MILL CREEK GEOGRAPHIC INITIATIVE

MILL CREEK WATERSHED
LOGAN, UNION, DELAWARE COUNTIES
and
MARYSVILLE, OHIO AREA

US EPA ID: OHGI000000003

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TABLE OF CONTENTS

APPENDIXES

MILL CREEK GEOGRAPHIC INITIATIVE

SITE: Mill Creek US EPA ID: OHGI000000003

Location: Northwest-Central Ohio (Marysville, OH)

Counties: Logan, Union, and Delaware

Site Reconnaissance: March 17, 19, 1997; June 16, 1997

Dates of sampling/investigation: August 26, 27, 1997

USGS Topographic Maps: Peoria, West Mansfield, East Liberty, Marysville, Magnetic Springs, Shawnee Hills, Ostrander

1.0 PHYSICAL GEOGRAPHY

The following descriptions of the study area physical geography are excerpted from: Ohio EPA, 1997; US Department of Agriculture, 1975; and Ohio Department of Natural Resources, 1983.

Mill Creek drains an area covering approximately 178 square miles and flows in a southeasterly direction from its headwaters in Logan County, through Union County, to its confluence with the Scioto River in Delaware County (Figure 1). The stream flows through a primarily rural/agricultural setting, with the major urbanized area of flow in the city of Marysville.

Mill Creek and its tributaries lie within the Central Lowlands physiographic region. The topography of this drainage area strongly reflects glacial deposition. The Wisconsin Age continental glacier, moving over the pre-existing topography composed of sedimentary bedrock, filled in valleys (buried valleys) with till and drift deposits and formed various surface features during deposition of the sediments entrained in the glacier. Ground moraines are characterized by nearly level or gently sloping terrain, while the end moraines present steeper slopes and hummocky terrains. Glacial lake beds are represented by flat lying areas. Meltwater incised the present stream patterns down through the till and drift deposits.

The bedrock underlying the study area is limestone and dolomite. Glacial movement over this base produced the calcareous tills now found in the substrates of the Mill Creek system. Soils found in this drainage basin are formed from high lime glacial drift, till and lake sediments. The texture and slope of the parent glacial materials strongly influences drainage, permeability and erosion potential, which can vary greatly from site to site. There are soils with high erosion potential and soils of very slow permeability within the study area. These characteristics present limitations for cultivation, construction and septic treatment, which, if exceeded, may impact surface water.

In the study area, cultivation and planting take place between April and mid-June, the period of highest average monthly precipitation. Yearly precipitation averages about 36 inches per year. As cultivation dominates the landscape, the potential for soil loss and runoff into surface waters exists. During October, the month with the lowest average precipitation, groundwater may contribute more to Mill Creek's flow. Many reaches of the Mill Creek watershed consist of narrowly forested riparian corridors. Dominant tree species include cottonwood, silver and red maple, sycamore, box elder, buckeye, hackberry, willow and green ash.

Agricultural uses dominate near the creek headwaters, and to the north and east of Marysville. To the northwest of Marysville, the hilly terrain has limited agricultural use and large-lot residential properties predominate. Outside of Marysville, treed riparian zones are present along significant reach lengths. Some portions do experience limited riparian zones, especially in areas where farming activities border the creek. In Marysville, the stream has been influenced by urban activities including low head dams, channelization, and riparian modifications.

2.0 POTENTIAL SOURCES

The following potential sources have been identified in the Mill Creek basin. Based on historical sampling data, these sources may be contributing contamination to Mill Creek, which ultimately may impact water quality and biodiversity in the Mill Creek watershed (from Ohio EPA, 1997). Figure 1 provides locations of these entities and also provides a summary of various regulated entities in the Mill Creek area.

Marysville WWTP: The Marysville Wastewater Treatment Plant (WWTP) discharges four million gallons of wastewater into Mill Creek (RM 18.26) per day. Sediment, surface water and fish tissue sampling data indicate that chemical and biological in-stream toxicity exists in Mill Creek due to the WWTP. Increased levels of ammonia, nitrate, phosphorus, and fecal coliform combined with dissolved oxygen decreases were identified downstream of the WWTP. As a result, biological and water quality conditions have been impaired downstream.

The Scotts Company: The Scotts Company and Subsidiaries (Scotts Company) consists of the main plant, where lawn and garden fertilizers, herbicides and pesticides are formulated, along with waste treatment and storage areas, research laboratories and product test fields. Disposal practices from this company have contributed to the pesticide and herbicide contamination, nutrification (ammonia/nitrate) and biological degradation of Crosses Run, a tributary of Mill Creek (RM 11.8).

Eljer Plumbingware: Eljer Plumbingware (Eljer facility) is a closed RCRA regulated facility that borders Town Run (RM 0.90) on the south side of Marysville. Town Run joins Mill Creek around RM 19. This company formerly manufactured various plumbing fixtures. Currently, a waste pile at the facility is undergoing RCRA closure and corrective actions. Metals and organic contamination have been documented to have migrated to Town Run from the waste pile.

Ray Lewis & Sons, Inc.: Ray Lewis & Sons, Inc. (Ray Lewis plating facility) is a metal-plating facility that manufactures various types of plumbing fixtures from aluminum, chromium, copper, magnesium, nickel and zinc. The company discharges cooling water into Mill Creek (RM 18.4) via a storm sewer. Pretreatment and sanitary wastewater have been directed to the Marysville WWTP since 1989. Process wastewater is treated on-site, some of the waste streams are recycled into product operations, and treatment sludge is hauled off-site.

Other NPDES Point Sources: Appendix A provides a summary of the National Pollution Discharge Elimination System (NPDES) permit holders with permit violations documented between 1990 to 1995:

Nestle R&D Center, Inc.- Non-contact cooling water and storm water is discharged to a storm sewer that flows into Mill Creek downstream of the Maple Street bridge (RM 18.9).

Union County Home- This WWTP is designed to treat 24,000 gallons per day (gpd). Treated wastewater is discharged to Infirmary Ditch, which enters Mill Creek at RM 17.9, northeast of Marysville. A proposed sanitary trunk line may terminate the need for the WWTP.

General Industries Co.- This company manufactures molded plastic products and generates approximately 648,000 gpd of wastewater. Discharges to an unnamed tributary of Beech Ditch ceased between 1993 and 1996 when the company connected to the Marysville sanitary sewer and installed a cooling tower to handle process waters. The company was often in violation for oil and grease levels in past monitoring at their outfall.

Mill Creek Estates- This WWTP services a residential development east of Marysville. The plant has a designed flow capacity of 105,000 gpd with the final effluent discharged to Mill Creek at RM 12.57. DSW has documented numerous violations for fecal coliform and total residual chlorine. Improvement plans by installation of a UV disinfection system were scheduled for early 1996.

Goodyear Tire and Rubber Company- Discharges averaging approximately 16,000 gpd are limited to non-contact cooling water, storm water, and sanitary wastewater. Treated water is discharged to Crosses Run at RM 2.05. Crosses Run enters Mill Creek at RM 11.83. The facility is expected to tie into the recent expansion of the Marysville sanitary sewer.

BMY Wheeled Vehicle Division- This company closed in 1995 and formerly made military vehicles and school buses. The company discharged approximately 17,000 gpd of treated sanitary and industrial wastewater to an unnamed tributary that enters Mill Creek at RM 9.3. Recent expansion of the Marysville sanitary sewer line is available to accept any wastewater should the facility reopen.

Ohio Department of Transportation (ODOT) Rest Area- This WWTP is operated by ODOT on US Route 33 and treats about 15,000 to 30,000 gpd of wastewater from a highway rest stop.

Discharges are directed to the same tributary as the former BMY facility (Mill Creek at RM 9.3).

Ostrander WWTP- This village WWTP was designed to handle 90,000 gpd of wastewater. The discharge to Mill Creek is located at RM 4.05 and is immediately upstream of Blues Creek. Historically, low pH was a problem but has since been rectified.

Northwood Stone and Asphalt Co.- This quarry produces both limestone products and asphalt. Discharges consist of stormwater runoff from a settling pond with an average flow of 288,000 gpd. An unnamed tributary receives the discharge and enters Mill Creek at RM 2.62.

Non-Point Sources: Significant agricultural activities occur throughout the Mill Creek watershed, with greater numbers of farms near the headwaters and north/northeast of Marysville. Significant riparian zones do exist along the stream bed and may assist in reduction of non-point source impacts outside of Marysville. Cultivation in close proximity to the stream could cause the increase of erosion and sediment load to the stream and also the possible increase of nutrient and farm chemical runoff. In addition, the conduits provided by field tiles that drain into the creek could also cause increased nutrient and farm chemical loading into the stream.

The only significant urban area in the Mill Creek watershed is the city of Marysville. As with most cities, street, lawn, and parking lot runoff are likely a source of contamination to Mill Creek via storm sewers, Town Run, and overland flows. Less significant riparian zones and stream bank channelization due to urbanization also increase the likelihood for contaminant migration to the stream.

3.0 PREVIOUS SAMPLING

In 1995, the Ohio EPA, Division of Surface Water (DSW) conducted a sampling survey of Mill Creek that included 27 chemical, physical and biological sampling locations along a 38 mile stretch of Mill Creek and in four small tributaries of Mill Creek: Town Run, the Crosses Run sub-basin, Blues Creek and Otter Creek. Details including the objectives of this study, sampling results and recommendations can be found in the Mill Creek technical support document (TSD) entitled, Biological and Water Quality Survey of Mill Creek (Scioto River Basin) and Selected Tributaries, June 30, 1997. Sampling results from this study indicated elevated levels of inorganics and the presence of various organic compounds in surface water and sediment of the Mill Creek watershed. Significant compounds identified in Mill Creek surface water and sediment included: chromium, copper, cyanide, lead, nickel, polynuclear aromatic hydrocarbons (PAHs), methoxychlor, 4,4-DDD, heptachlor epoxide, mirex and hexachlorobenzene. Town Run sediments and surface water compounds identified included: copper, lead, zinc, dieldrin, DDE, methoxychlor, mirex, and PAHs. Surface water and sediments in Crosses Run were contaminated with compounds that included: copper, chromium, PAHs, aldrin, a-& d-BHC, dieldrin, 4,4 DDT, 4,4 DDD, endosulfan I & II, endosulfan sulfate, endrin, heptachlor, heptachlor epoxide, and methoxychlor.

The Ohio EPA, Division of Emergency and Remedial Response (DERR) also conducted an investigation of Mill Creek in 1995. Sampling results for this study, which focused on the portion of the creek located in the city of Marysville, are summarized in the report entitled, Mill Creek Mini-Remedial Action Plan Findings, January 1996 (Appendix D). Elevated metals and organic compounds identified during this study were similar to the 1995 DSW results. Mill Creek surface water and sediment contaminants included: copper, nickel, cyanide, acetone, d&g-BHC, and 2,4-D. Compounds found in Town Run surface water and sediment included: cadmium, chromium, copper, lead, nickel, silver, zinc, chlorinated volatile organic compounds (VOCs), PAHs, aldrin, 4,4-DDE, and 4,4-DDD. Crosses Run was not evaluated for this study.

4.0 GEOGRAPHIC INITIATIVE SAMPLE LOCATIONS

On August 26 and 27, 1997, Ohio EPA, DERR completed field sampling activities in Mill Creek and selected tributaries. All sampling was completed in compliance with the work plan approved by US EPA on August 18, 1997. Twelve samples were collected from the mainstem of Mill Creek at locations MC-1 to 12. Sample locations are presented on Figure 2. Table 4.1 provides a description of the sample locations. For consistency with past sampling activities by the Ohio EPA, DSW, the present study will utilize a consistent sample location designation scheme. Locations are designated by the river mile (RM) upstream from the Scioto River. Tributary locations are designated by the RM upstream from its confluence with Mill Creek.

TABLE 4.1 - MILL CREEK SAMPLE LOCATIONS

Location	River Mile	Latitude	Longitude	Description
MC-1	RM 1.6	40° 14' 54"	83° 10' 26"	Downstream Mill Rd. bridge, near USGS gaging sta.
MC-2	~RM 10.0	40° 12' 57"	83° 15' 56"	North of Watkins Rd/Beecher-Gamble Rd. intersect.
MC-3	RM 11.9	40° 13' 27"	83° 17' 50"	Downstream of Crosses Run
MC-4	RM 12.1	40° 13' 26"	83° 17' 54"	Upstream of Crosses Run
MC-5	RM 18.2	40° 14' 34"	83° 21' 24"	~200 yards downstream of WWTP outfall
MC-6	RM 18.25	40° 14' 36"	83° 21' 23"	Below the discharge pipe of WWTP outfall
MC-7	RM 18.3	40° 14' 28"	83° 21' 26"	~100 yards upstream of WWTP outfall
MC-8	RM 18.4	no reading	no reading	~100 yards upstream of Ray Lewis Ditch
MC-9	RM 18.9	40° 14' 19"	83° 21' 53"	Downstream of Town Run
MC-10	RM 19.0	40° 14' 23"	83° 21' 59"	Upstream Town Run, east of Main St. bridge
MC-11	RM 24.7	40° 17' 22"	83° 24' 09"	Upstream of Cotton Slash Rd. bridge
MC-12	~RM 36.0	40° 21' 23"	83° 30' 53"	Upstream of Lunda Rd. bridge

To evaluate potential sources within the watershed, five tributaries to Mill Creek were targeted for sample collection: Crosses Run (CR), "Hinton-Mill Ditch" (HM), Beech Ditch (BD), "Ray Lewis Ditch" (RL), and Town Run (TR). These tributaries were selected based on knowledge of current potential sources identified along these water bodies. Crosses Run receives discharges from the Scotts Company, a manufacturer of fertilizers and lawn products. "Hinton-Mill Ditch" is an unnamed tributary that drains a turf plot north of US Route 33. Beech Ditch drains the southeast portion of Marysville and has received various spills in the past. "Ray Lewis Ditch" is a short tributary that receives discharges from a city storm sewer and non-contact cooling water discharged from the Ray Lewis plating facility. Town Run is a highly urbanized stream that flows through downtown Marysville and accepts urban runoff, septic tank discharges, possible illegal sanitary wastes, and runoff from the former Eljer facility. Figure 2 provides a map of sample locations, while Table 4.2 provides a description of the those locations.

TABLE 4.2 - MILL CREEK TRIBUTARY SAMPLE LOCATIONS

Location	River Mile	Latitude	Longitude	Description
CR-1	~RM 0.1	40° 13' 22"	83° 17' 49"	Crosses Run, upstream of confluence with Mill Cr.
CR-2	~RM 1.0	40° 12' 44"	83° 18' 13"	Crosses Run, downstream of Rt. 33
HM-1	~RM 0.4	40° 13' 43"	83° 18' 24"	Hinton-Mill Ditch, w. of Hinton-Mill Rd.
BD-1	~RM 0.3	40° 14' 13"	83° 18' 24"	Beech Ditch, west of Jolly Rd.
RL-1	~RM 0.01	40° 14' 25"	83° 21' 27"	Ray Lewis Ditch, at confluence w/ Mill Creek
RL-2	~RM 0.1	83° 21' 53"	83° 21'25"	Ray Lewis Ditch, below storm sewer discharge pipe
TR-1	~RM 0.01	40° 14' 16"	83° 21' 55"	Town Run, just upstrm of confl., near RR bridge
TR-2	~RM 0.2	40° 14' 13"	83° 21' 52"	Town Run, between Fourth and Fifth Streets
TR-U	~RM 0.25	No reading	No reading	Town Run, in culvert beneath Fifth St.
TR-3	~RM 0.4	40° 14' 02"	83° 22' 03"	Town Run, s. of 7th St., 30 yd upstream of culvert
TR-4	~RM 0.6	40° 13' 55"	83° 22' 01"	Town Run, s. of 9th St. near hospital, downstr. Eljer
TR-5	~RM 1.0	40° 13' 37"	83° 21' 53"	Town Run, e. of Walnut St., upstream of Eljer

5.0 SAMPLE ANALYSES

All sediment samples were analyzed for total organic carbon (TOC) to determine the percentage of organic matter present in the sediments. In addition, each sample received a sieve analysis to determine grain size. In conjunction with previous sampling events, selected analytes were chosen for Mill Creek and the various tributaries. All samples were submitted for analysis under the US EPA Contract Laboratory Program (CLP) to ensure the highest level of data quality.

Significant data collection from previous DSW and DERR studies exists for the media of Mill

Creek. A major data gap identified was the lack of a longitudinal profile of pesticides in Mill Creek. Therefore, a series of sediment and surface water samples were collected for pesticide/PCB analysis. Due to the generally low solubilities of semivolatile compounds (SVOCs) and based on historical sampling data, only sediments were analyzed for SVOCs. Sediment and surface water from selected locations were analyzed for metals and cyanide to confirm previous sampling results.

Analytes selected for Mill Creek tributaries were selected based on a general knowledge of the potential source areas. Due to documentation of pesticide contamination related to the Scotts Company, the Crosses Run and Hinton-Mill Ditch samples of sediment and surface water were only analyzed for pesticides/PCB. Due to the unknown nature of contamination in Beech Ditch, sediment and surface water samples were analyzed for pesticides/PCBs, VOCs, SVOCs, and inorganic compounds including cyanide. Due to the known waste streams from the plating company, Ray Lewis Ditch sediment and surface water samples were analyzed for inorganic compounds and cyanide. To expand on previous sampling in Town Run, surface water samples were analyzed for VOCs, cyanide, and pesticides/PCBs. Sediment samples from Town Run was analyzed for SVOCs, pesticide/PCBs, inorganic compounds and cyanide.

6.0 <u>ANALYTICAL RESULTS</u>

6.1 MILL CREEK

6.1.1 *Total Organic Carbon and Grain Size*

Total organic carbon varied from 1.7 % to > 3.5 % in Mill Creek sediment samples (Table 1). Samples were primarily clay, silt and fine sands except at locations MC-6, MC-9, and MC-11 where greater percentages of medium/coarse sands and gravels were encountered. No sediment samples were collected at MC-6 due to the lack of fine grained, clay/silt sediment. MC-9 sample concentrations could be biased low due to the lack of adequate fine-grained (clay/silt) components where certain contaminants tend to concentrate. MC-11 was predominantly a fine/medium sand (54%) and was representative of the local sediment. There should be enough fine grained material to produce reasonably good analytical data.

6.1.2 *Inorganic Compounds in Mill Creek Sediment*

Table 2 provides a summary of the analytical results for the inorganic compounds in sediment samples collected from nine locations on the Mill Creek mainstem. Of the 24 inorganic compounds analyzed only three compounds were not detected in any sediments: antimony, mercury, and selenium. To determine potential impacts to the environment and ecological receptors, all concentrations were compared to the Lowest Effect Levels (LEL) and Severe Effect Levels (SEL) published by Ontario, Canada (Persuad et al. 1993). These low and severe toxicity benchmark concentrations provide a screening tool to determine if adverse biological effects can be expected from the compounds detected in sampled sediments. Concentrations below the LEL are less likely to have adverse impacts. When the LEL concentration is exceeded there is a potential for adverse effects on biological populations. When the SEL concentration is exceeded, severe adverse affects are likely (SEL). LEL exceedances were determined for arsenic, cadmium, copper, lead, nickel, and zinc. Therefore, these compounds could be posing some degradation that may be lowering biological populations and the overall quality of the stream environment at the affected reach. No SEL exceedances were observed for inorganic compounds in Mill Creek. In summary the following inorganic compounds were identified above the LEL at the specified location:

Compound	Conc. Range	Bkgd	LEL	SEL	# LELExceedances/Location
arsenic	3.8 - 10.7 mg/kg	3.8	6	33	7 - all except MC-12, MC-8
cadmium	0.2 - 0.9	0.4	0.6	10	1 - MC-8
copper	14.6 - 95.6	20.8	16	110	8 - all except MC-9
lead	12.4 - 151	12.4	31	250	3 - MC-10, MC-8, MC-7
nickel	9.7 - 38.3	18	16	75	8 - all except MC-9
zinc	45.8 - 148	45.8	120	820	3 - MC-10, MC-8, MC-7

Arsenic was found throughout the entire Mill Creek watershed. Direct correlation to point sources may be difficult due to naturally occurring concentrations in central Ohio soils (generally 10-30 mg/kg). Further correlation of arsenic to biological community impacts from specific sources is also hampered by its prevalence in the watershed.

Cadmium was also prevalent at low concentrations throughout the watershed but only one LEL exceedance was found at MC-8. Likely sources are urban effects in Marysville and possible discharges from Town Run.

Copper was detected in every sample collected from Mill Creek. Concentrations in the Marysville area (MC-10, MC-8, MC-7, and MC-5) were the highest and over twice the background concentration at MC-12. These levels may be attributable to urban runoff, Town Run, and Ray Lewis Ditch. Impacts to biological communities may be expected through the entire watershed, but the greatest impacts can be expected in the Marysville area where the highest concentrations were detected. The prevalence of copper in the watershed further suggest that it may be naturally occurring.

All LEL exceedances for lead were observed in samples taken in the Marysville area (MC-10, MC-8, MC-7) and correlate to urban runoff and Town Run. As a result, potential biological impacts may be occurring in the Marysville stem of Mill Creek.

Nickel was found in all samples from Mill Creek and the LEL was exceeded in 8 of 9 samples. (The representativeness of the sample at MC-9 is in question due to the coarse grained nature of the sample collected and, therefore, it had the lowest concentration). Direct correlation to point sources may be difficult, although potential sources of nickel contamination may be attributed to non-point sources in Marysville and sources along Ray Lewis Ditch and Town Run. Potential impacts to biological communities may be expected based on the levels found. Elevated nickel levels throughout the watershed also suggests that it may be naturally elevated.

Three exceedances of the LEL for zinc were observed in the Marysville stem of Mill Creek and may be attributed to urban runoff, Town Run, and Ray Lewis Ditch. Detrimental impacts to biological populations can be expected in the Marysville area.

6.1.3 *Inorganic Compounds in Mill Creek Surface Water*

Table 3 provides a summary of the analytical results for inorganic compounds in Mill Creek surface water. The following inorganic compounds were elevated relative to the background sample taken at MC-12:

Compound	Bkgd	AWQC	Concentration	Location bkgd exceeded
cadmium	<0.3 ug/l	1.0 ug/l	1.2 ug/l	at MC-8
chromium	<0.6	180	0.7, 0.7, 2.3, 1.4	at MC 10, MC-9, MC-8, MC-7
copper	3.2	11	24.3, 36.8	at MC-8, MC-7
nickel	<3.6	160	4.2	at MC-7
cyanide	<2.3	5.2	15.8	at MC-7

AWQC= US EPA ambient water quality criteria (Eco Update 1996).
< = less than specified detection limit

Primary impacts to surface water are apparent at MC-7, which is downstream of the Ray Lewis Ditch which receives non-contact cooling water discharges from the Ray Lewis plating facility. The presence of cadmium, chromium, and copper further upstream in Mill Creek suggests potential urban impacts and discharges from Town Run. Potential affects from urban runoff were also displayed in the elevated levels of aluminum, iron and sodium, which were found to be about twice the concentration of the background sample of MC-12. Concentrations of cadmium, copper, and cyanide exceeded ambient water quality criteria (AWQC) screening values and suggest potential detrimental impacts to stream quality; further evaluation may be appropriate.

6.1.4 *Semivolatile Organic Compounds in Mill Creek Sediment*

Table 4 provides a summary of the analytical results for SVOCs in Mill Creek sediment samples. The SVOCs found were primarily PAHs, which are typically formed from the incomplete burning of coal, oil, gas and garbage. They are found in a variety of products such as crude oil, coal, tar pitch, creosote, road tar, and roofing tar. PAH compounds are fairly common and persistent in the environment. PAH compounds were first detected in Mill Creek sediment in Marysville, suggesting that urban affects and runoff are the likely sources of these compounds. An upstream, background sample at MC-12 (RM 36.0), did not contain any SVOCs and is not impacted by urban sources.

The most significant PAH compounds were detected at MC-10 and MC-9 (up and downstream of Town Run, respectively). PAH compounds totaling 12.36 mg/kg, were found at MC-10, located in Marysville and downstream of storm sewer outfalls that transmit various urban non-point source and street runoff contaminants. Published LEL concentrations were exceeded for phenanthrene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(k)fluroanthene, benzo(a)pyrene, indeno(1,2,3,cd)pyrene, and benzo(g,h,i)perylene. At MC-9, downstream of Town Run, LEL concentrations were exceeded for phenanthrene and pyrene. These LEL exceedances suggest some potential biological degradation may be expected in the Marysville reach of Mill Creek. Due to the persistence of PAH compounds, they appear to be transported downstream, since they were detected in all downstream samples from Marysville to the Scioto River. Since the downstream PAH concentrations were below LELs, adverse impacts to biological communities are less likely to occur.

6.1.5 *Pesticides/PCBs in Mill Creek Sediment*

Table 5 provides a summary of the concentrations of pesticides and PCBs in Mill Creek sediments. Detections of pesticide compounds were found in all 10 of the sediment samples collected from the Mill Creek mainstem. Pesticides detected include: d-BHC, lindane, heptachlor, aldrin, heptachlor epoxide, endosulfan I, dieldrin, 4,4-DDE, endrin, 4,4-DDD, endosulfan sulfate, 4,4 DDT, endrin ketone, and a&g-chlordane.

Based on screening levels the following LEL/SEL exceedances were identified in Mill Creek:

Compound	Conc. Range	LEL	SEL	Location exceeding SEL/LEL
dieldrin	BDL - 4.6 ug/kg	2	2730	MC-7, MC-5, MC-4
endrin	BDL - 7.5	3	3900	MC-3
4,4 DDT	BDL - 21	7	360	MC-3
chlordane	BDL - 120	7	180	MC-10, MC-3, MC-2, MC-1
lindane	BDL - 160	3	30	MC-2

BDL= below detection limit

Pesticide compounds are present in Mill Creek sediments from Marysville to the Scioto River at low concentrations (BDL to 160 ug/kg). Due to potential impacts of pesticides to biological communities, even at low concentrations, potential degradation of stream life is possible. Potential impacts appear to be present downstream of Crosses Run, which accepts discharges from the Scotts Company. In addition, upstream impacts from unknown sources and runoff appear to be occurring in the Marysville reach of Mill Creek.

No PCBs were detected in any sediment samples.

6.1.6 *Pesticides/PCBs in Mill Creek Surface Water*

Although pesticides were persistent in sediment samples at low concentrations, surface water did not contain any pesticides except at and downstream of the WWTP outfall (Table 6). The compounds d-BHC, lindane, and aldrin were all detected at low levels in the water column. Pesticide compounds typically have low solubilities and an affinity to attach to fine grained sediments. Their presence in the water column suggest current discharges from an existing waste stream to the Marysville WWTP. Another possibility is the incorporation of landfill leachate from the Marysville Landfill site into the WWTP discharge. (Portions of the Marysville WWTP are located on or adjacent to an old landfill.)

6.2 TOWN RUN

6.2.1 *Total Organic Carbon and Grain Size*

Total Organic Carbon ranged from 1.9% to > 2.5% in sediment samples collected from Town Run (Table 1). Sediments downstream of TR-4 tend to be composed of fine to coarse sands with 50% or less clay to silt size particles in the samples. The culverted portion of Town Run may have a larger content of fine materials since significant organic and fine-grained material was observed at TR-U, beneath Fifth Street. As the stream becomes less urbanized, upstream of Ninth Street, sediments increase in the quantity of clay and silt particles present (>65%).

6.2.2 *Inorganic Compounds in Town Run Sediment*

Table 7 provides a summary of the analytical data for inorganic compounds in Town Run sediment. Concentrations identified were compared to the Ontario sediment screening levels. LEL exceedances were identified for: arsenic, cadmium, chromium, copper, iron, lead, manganese, nickel, and zinc. In addition, SEL exceedances were found for both copper and lead.

Compound	Conc. Range	(TR-5) Bkgd.	LEL	SEL	LEL/SEL exceedances/Location
arsenic	6.1 - 15.1 mg/kg	15.1	6	33	LEL - at all 6 locations
cadmium	0.6 - 2.3	0.6	0.6	10	LEL - TR-4, TR-3, TR-U, TR-1
chromium	12.2 - 66.8	12.7	26	110	LEL - TR-U
copper	38.4 - 332	38.4	16	110	LEL - TR-5, SEL - TR-4 to TR-1
lead	36.8 - 386	36.6	31	250	LEL - all 6 locations, SEL - TR-U
nickel	20.7 - 34.1	28	16	75	LEL - at all 6 locations
zinc	90.2 - 673	90.2	120	820	LEL - TR-4 to TR-1

Arsenic exceeds the LEL at all sampling locations in Town Run. The upstream sample was actually the highest arsenic concentration observed. As in Mill Creek, the elevated arsenic levels are likely a result of naturally occurring levels in central Ohio soils (10-30 mg/kg).

Cadmium exceeded background and the LEL in all downstream samples of the former Eljer facility, except at TR-2. Correlation to a specific source may be difficult, since the background level (0.60 mg/kg) is similar to the downstream samples. Typical urban runoff sources could also be contributing to the presence of this contaminant. Previous sampling (DERR, 1995) indicated cadmium was present at concentrations of up to 2.1 mg/kg in samples collected adjacent to the former Eljer facility.

Chromium only had one LEL exceedance at TR-U located on the north end of the culverted portion of Town Run. This compound was detected in all 7 samples, but was not significantly detected above the background sample except at TR-U. DERR (1995) detected chromium up to 76.9 mg/kg at the former Eljer facility, adjacent to Town Run, but concentrations reduced to near background levels immediately downstream from the former facility. Therefore, significant migration of this compound is not evident.

Copper exceeded the LEL in all 7 samples and the SEL was exceeded at TR-4 to TR-1, (all downgradient of the former Eljer facility), therefore, direct impacts and severe impairments to biological communities can be expected from the concentrations observed. This copper contamination may be attributed to the former Eljer facility. Previous sampling (DERR, 1995) indicated copper was present at concentrations of up to 5080 mg/kg in samples collected in Town Run adjacent to the former facility.

The lead LEL concentration was exceeded in all 7 samples, and the SEL was exceeded at TR-U. Potential impairments to biological communities may result from the presence of these lead levels in Town Run. Adjacent to the former Eljer facility, DERR (1995) found lead levels up to 799 mg/kg. Elevated lead concentrations, at varying levels, are persistent downstream; therefore, the former Eljer facility is a likely source of this contamination. Varying concentrations could be a result of differential sediment transport or a result of additional urban sources of contamination.

Nickel exceeded the LEL in all 7 samples. Due to elevated levels in the background sample at TR-5, correlation to a specific source is difficult and may indicate a naturally occurring phenomenon. The highest nickel levels observed in previous sampling (DERR, 1995) was 168 mg/kg adjacent to the former Eljer facility.

Zinc concentrations exceeded the LEL at sample locations TR-4 to TR-1, all located downstream of the former Eljer facility. Concentrations were also significantly higher than the background sample at TR-5 (90.2 mg/kg). Previous Town Run sampling (DERR, 1995) adjacent to the former Eljer facility, found zinc up to 5990 mg/kg. Much of the zinc contamination in Town can be attributed to the former Eljer facility.

Copper, lead, and zinc were elevated downstream of the former Eljer facility and may be correlated to site contaminants. The former Eljer facility may have contributed to the cadmium, chromium, and nickel contamination in Town Run, but there may be other urban runoff sources. Impacts and adverse effects to biological populations in Town Run can be expected based on the screening level exceedances observed for cadmium, copper, lead, nickel, and zinc.

6.2.3 *Inorganic Compounds in Town Run Surface Water*

Surface water samples from Town Run were only analyzed for cyanide during this investigation, since previous investigations (DERR, 1995 and DSW, 1997) have already characterized inorganic compounds. Table 8 provides a summary of the analysis for cyanide in surface water samples collected from Town Run. Cyanide was below detection limits in all samples. The previous investigation (DERR, 1995) determined elevated levels of copper (0.38 mg/l), nickel (0.037 mg/l), and zinc (0.65 mg/l) were present in Town Run surface water. These metal concentrations compare to AWQC of 0.10 mg/l, 0.16 mg/l, and 0.10 mg/l (unadjusted for hardness) (US EPA, 1996). These elevated concentrations were observed in the water column adjacent to the former Eljer facility.

6.2.4 *Semivolatile Organic Compounds in Town Run Sediment*

Table 9 provides a summary of the analytical results for SVOCs in Town Run sediments. As in Mill Creek, the primary SVOCs identified were PAHs. Concentrations of PAHs were significantly higher in Town Run than in Mill Creek, probably due to the highly urbanized nature of the stream and the acceptance of runoff from a wide variety of point and non-point sources in Marysville. Every sample location had LEL exceedances for PAH compounds, which included: fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chyrsene, benzo (k)fluoranthene, benzo(a)pyrene, indeno(1,2,3,cd)pyrene, and benzo(g,h,i)-perylene, and Total PAH. No compounds exceeded established screening levels.

Total PAH levels in Town Run sediment samples varied from 8.18 mg/kg to 137.9 mg/kg. Single PAH compounds ranged in concentration from below detection limits to 26 mg/kg. Source identification may be difficult due to the persistence and common occurrence of PAH compounds. Many PAH compounds are carcinogens, and depending on exposure pathways and uptake factors, can pose a risk to human health.

6.2.5 *Pesticides/PCBs in Town Run Sediment*

Table 10 provides a summary of analytical results for pesticides and PCBs in Town Run sediments. Pesticide compounds found in Town Run sediments include: heptachlor, aldrin, heptachlor epoxide, endosulfan I, dieldrin, 4,4-DDE, endrin, endosulfan II, 4,4-DDD, endosulfan sulfate, 4,4-DDT, endrin ketone, and a-&g-chlordane. Pesticides were identified in all five samples from Town Run, but were mainly found in TR-1, TR-2, and TR-3. This indicates a possible source near the downtown area or non-point source urban runoff. The following pesticide compounds exceeded LELs:

Compound	No. of Samples	Conc. Range	LEL
aldrin	4	4.2 - 14 ug/kg	2
hept. epoxide	4	5.3 - 9.5	5
dieldrin	2	6 - 11	2
4,4-DDE	3	12 - 63	5
endrin	3	7.2 - 27	3
4,4-DDD	3	7.8 - 370	8
4,4-DDT	4	11 - 6000	7
a-chlordane	6	7 - 120	7
g-chlordane	5	19 - 120	7

At TR-2, 4,4-DDT (6000 ug/kg) and 4,4-DDD (370 ug/kg) exceeded the SELs of 360 ug/kg and 180 ug/kg, respectively. The significantly high concentration of 4,4-DDT at 6000 ug/kg suggests possible disposal and/or illegal application of this banned pesticide. No PCBs were detected in Town Run sediment samples.

Based on the elevated levels of pesticides, detrimental effects to the biological populations would be expected in most of Town Run, especially downstream of TR-4 (north of 9th Street).

6.2.6 *Pesticides/PCBs in Town Run Surface Water*

Table 6 provides a summary of the analytical results for pesticides and PCBs in Town Run surface water. Pesticide and PCB concentrations were below detection limits in all but one surface water sample in Town Run. The duplicate sample at TR-1 (near the Mill Creek confluence) identified endosulfan I, a-chlordane, and g-chlordane in the water column between 0.015 and 0.034 ug/l. The presence of pesticides in only the duplicate sample may indicate a problem with sample technique. Or more likely, the presence of suspended solids in the sample. Due to the low solubility of pesticides, they are less likely to be identified in water samples. Pesticides typically attach to fine particles and therefore are more likely to be identified in relation to suspended solids in the water.

6.2.7 *Volatile Organic Compounds in Town Run Surface Water*

Table 6 provides a summary of analytical results for VOCs in Town Run surface water. The most upstream sample (TR-5) was below detection limits for all VOCs. At TR-4, downstream of the Eljer facility, trichloroethene (TCE) was found at 1 ug/l. Chloroform (at 1 to 4 ug/l) was detected in TR-3, TR-2, and TR-1. As a residual for drinking water treatment, the chloroform suggests possible discharges from sanitary and/or septic systems to the stream. Xylene was also detected at 2 ug/l at TR-1.

Previous sampling at the former Eljer facility discharge indicated chlorinated compounds (TCE, 1,1,1-trichloroethane, 1,1-dichloroethane, 1,2-dichloroethane) were present at concentrations between 12 and 140 ug/l in surface water. The TR-4 sample appears to confirm additional downstream contaminant migration from the site.

6.3 RAY LEWIS DITCH

Ray Lewis Ditch transmits storm sewer water to Mill Creek. The primary flow in this sewer discharge is non-contact cooling water from the Ray Lewis plating facility.

6.3.1 *Total Organic Carbon and Grain Size*

Total organic carbon ranged from 1.8% to > 2.2% in sediment samples collected from Ray Lewis Ditch (Table 1). Sediments composed of silt and clay were not abundant in the Ray Lewis Ditch (<50%), but were generally fine to medium grained sand. Sediment sample concentrations could potentially be biased low due to the lack of fine particles to which many contaminant compounds may attach.

6.3.2 *Inorganic Compounds in Ray Lewis Ditch Sediment*

Table 11 provides a summary of metals and cyanide analysis of samples collected from the Ray Lewis Ditch. The following compounds exceeded LEL screening values: arsenic, chromium, copper, iron, lead, manganese, nickel, and zinc. An SEL exceedance was also observed for copper. In summary:

Compound	Conc. Range	LEL	SEL
copper	165 - 188 mg/kg	16	110
chromium	26.2 - 28.6	26	110
lead	43.1 - 169	31	250
zinc	120 - 144	120	820
cyanide	4.2 - 6.5	--	--

Discharges from the storm sewer and the Ray Lewis plating facility appear to have impacted the sediments of the receiving ditch that flows into Mill Creek. Elevated levels of copper, chromium, lead, zinc, and cyanide may be attributed to the plating facility, and could be an indication of past discharges (prior to sanitary sewer disposal after 1989) or current discharges potentially containing metals and cyanide.

6.3.3 *Inorganic Compounds in Ray Lewis Ditch Surface Water*

Table 8 provides a summary of analytical results for inorganic compounds in Ray Lewis Ditch. U.S. EPA maximum contaminant levels (MCLs) for public water supplies were exceeded for lead and cyanide in Ray Lewis Ditch. Compared to background concentrations in Mill Creek (MC-12), elevated levels were observed for chromium, copper, lead, nickel, zinc, and cyanide. In summary:

Compound	Conc. Range	MCL	AWQC	Mill Creek Bckgrd (MC-12)
chromium	5.1 - 13.2 ug/l	100 ug/l	180 ug/l	~ BDL
copper	140 - 552	1300	11	~ 3.3
lead	1.7 - 20.9	15	2.5	~ 3.0
nickel	9.0 - 23.4	100	160	~ BDL
zinc	51.7 - 81.5	---	100	~ BDL
cyanide	52.7 - 346	200	5.2	~ BDL

AWQC = US EPA water quality criteria, Ecotox Thresholds (1996)

Surface water samples are a direct indication of current flow and discharges through the storm sewer. Based on the detected metal and cyanide concentrations and AWQC exceedances, it appears that the Ray Lewis plating facility may be directly discharging contaminants into the storm sewer outfall. The current discharge permit only allows for clean, non-contact cooling water. Further evaluation of the discharge and a compliance investigation may be appropriate.

6.4 BEECH DITCH

All samples were collected from one sample location upstream of the confluence between Beech Ditch and Mill Creek.

6.4.1. *Total Organic Carbon and Grain Size*

Total organic carbon equaled 1.9% from the single sample location of Beech Ditch sediment (Table 1). The sediment collected was primarily clay and silt (up to 55%) with additional fine to coarse sands in the sediment matrix.

6.4.2 *Inorganic Compounds in Beech Ditch Sediment*

Table 11 provides a summary of inorganic compound analytical results for sediment in Beech Ditch. The following compounds exceeded the LEL in the Beech Ditch sediment sample:

Compound	Concentration	LEL	Mill Creek Background (MC-12)
arsenic	16.1 mg/kg	6 mg/kg	~ 4 mg/kg
copper	29	16	~ 20
manganese	608	460	~ 334
nickel	37.9	16	~ 18

Compared to background, the inorganic compounds found in Beech Ditch appear to be slightly elevated. Sources of contamination are likely due to urban runoff from southeastern Marysville, potential septic system discharges from the rural housing units that occupy the ditch drainage area, and residual spill contamination from the former Terra International fertilizer company. Some low level impacts to biological communities may occur as a result of LEL screening value exceedances.

6.4.3 *Inorganic Compounds in Beech Ditch Surface Water*

Table 8 provides a summary of analytical results for inorganic compounds in Beech Ditch surface water. Lead, detected at a concentration of 19.6 ug/l, exceeded the MCL of 15 ug/l. Elevated levels of copper (27.8 ug/l) and lead (19.6 ug/l) were present in Beech Ditch surface water. Background concentrations for copper and lead were 3.2 ug/l and 3 ug/l, respectively. Unknown urban and septic tank discharges are likely sources.

6.4.4 *Semivolatile Organic Compounds in Beech Ditch Sediment and Surface Water*

Table 9 and Table 6 provide summaries of analytical results for SVOCs in Beech Ditch sediments and surface water, respectively. Small concentrations of PAH compounds were detected in the sediment. Single compound and Total PAHs (0.488 mg/kg) did not exceed LELs. The presence of PAHs are inherent to urban runoff discharges. The low levels may not pose significant impacts to biological communities based on LEL comparisons.

No SVOCs were identified in the surface water sample collected from Beech Ditch.

6.4.5 *Pesticides/PCBs in Beech Ditch Sediment and Surface Water*

Tables 12 and Table 6 provide a summaries of analytical results for pesticides/PCBs in sediment and surface water, respectively. Three pesticide compounds were detected: lindane, dieldrin, and a-chlordane. Dieldrin (2.8 ug/kg) exceeded the LEL of 2 ug/kg. PCBs were not detected in Beech Ditch sediments. The source of pesticide contamination is unknown, but could be related to residential uses or the former Terra International facility. The levels of pesticides were very low and may have only minimal impacts to biological communities in Beech Ditch. No pesticides or PCBs were detected in the surface water sample.

6.5 HINTON-MILL DITCH

6.5.1 *Total Organic Carbon and Grain Size*

Total organic carbon was determined to be 0.98% at the single sample location in "Hinton-Mill" Ditch (Table 1). The sediment sample was composed primarily of clay and silt (up to 60%) and fine to medium sand (32%).

6.5.2 *Pesticides and PCBs in Sediment and Surface Water*

Table 12 and Table 6 provide summaries of pesticide and PCBs for Hinton-Mill Ditch sediment and surface water, respectively. No pesticides or PCBs were detected in the sediment and surface water samples, therefore, no impacts have been found relating to runoff from turf plots.

6.6 CROSSES RUN

6.6.1 *Total Organic Carbon and Grain Size*

Total organic carbon ranged from 0.93% to 1.3% in sediments collected from Crosses Run (Table 1). Sediments were composed primarily of clay and silt, which accounted for 55-60% of the sediment matrix.

6.6.2 *Pesticides and PCBs in Crosses Run Sediment*

Table 12 provides a summary of analytical results for pesticides and PCBs in Crosses Run sediments. At locations CR-2, CR-2 duplicate, and CR-1, the sample results determined the following pesticides to be present in sediment in Crosses Run downstream of the Scotts Company and U.S. Route 33: lindane, heptachlor, heptachlor epoxide, 4,4-DDE, endrin, 4,4-DDD, endosulfan sulfate, 4,4-DDT, endrin aldehyde, a-chlordane, and g-chlordane. The following compounds exceed published LEL and SEL screening values for biological impacts:

Compound	Conc. Range	LEL	SEL
lindane	ND - 24 ug/kg	3 ug/kg	30 ug/kg
hept. epoxide	ND - 88	5	150
endrin	ND - 440	3	3900
4,4-DDE	ND - 270	5	570
4,4-DDD	16 - 220	8	180
4,4-DDT	29 - 1900	7	360
a-chlordane	180 - 9700	7	180
g-chlordane	160 - 11000	7	180

LEL exceedances were observed at CR-1 for: heptachlor epoxide, endrin, 4,4 DDE, 4,4-DDE, 4,4-DDT, a-chlordane, g- chlordane. Heptachlor epoxide exceeded the LEL at CR-2. SEL exceedances were observed at CR-2 for: 4,4-DDD, 4,4-DDT, a-chlordane, g-chlordane.

The detection of elevated levels of pesticides confirms previous sampling completed in 1994 by Ohio EPA, DERR (Appendix E). Both sample locations (CR-1 and CR-2) are downgradient from the Scotts Company operations and wastewater discharge outfalls. In addition, on-site landfills are documented sources of the pesticide contamination found in the sediment. Furthermore, CR-2 is in and adjacent to a former landfill located north of and beneath U.S. Route 33. The numerous exceedances of LEL/SEL screening values suggests that significant degradation to biological populations will result from the level of contaminants found in Crosses Run sediments. No PCBs were detected in Crosses Run sediment.

6.6.3 *Pesticides and PCBs in Crosses Run Surface Water*

Table 6 provides a summary of analytical results for pesticides and PCBs in surface water samples collected from Crosses Run. The duplicate water sample collected at CR-2 failed to correlate with the original sample. Between the two samples the following pesticides were detected in the surface water at CR-2: d-BHC, aldrin, endosulfan I, 4,4-DDE, endosulfan sulfate, 4,4-DDT, a-chlordane, g-chlordane. No pesticides were detected in the water column at CR-1.

The detection of pesticides in the duplicate sample is likely explained by the fact that these pesticides are very insoluble. The presence of these compounds in the water column is likely to occur from their detection on suspended solids where the contaminant is likely to attach for transport. As a result, pesticide contaminant movement is most likely to occur during high water levels and storm events when fine particles are likely to be stirred into suspension for mobilization downstream. No PCBs were detected in the surface water of Crosses Run.

7.0 ECOLOGICAL ASSESSMENT

The Ohio EPA, (DSW, 1997) completed data collection for its most recent watershed study in 1995. Similar studies were conducted in 1978, 1986, and 1990. Mill Creek has been designated as a Warm Water Habitat (WWH) for its entire length. Appendix B provides a summary of the aquatic life use attainment status for various locations in Mill Creek and its tributaries. The most significant source of impact on chemical water quality and biological community performance was determined to be the Marysville WWTP. Partial and non-attainment of the WWH designation was determined from the WWTP to two miles downstream. Non-attainment was attributed to consistently low dissolved oxygen concentrations, elevated levels of ammonia-N, total phosphorus, and fecal coliform bacteria. Organic enrichment was encountered within the WWTP mixing zone. Despite these impacts, the water quality downstream of the WWTP has improved from previous studies, and recent WWTP modifications since 1995 are expected to further improve water quality.

Partial attainment status of the WWH designation was also observed between Maple St. (RM 19.1) and the WWTP (RM 18.2), the most urbanized reach of Mill Creek in Marysville. Partial attainment status was also found downstream of the confluence of Crosses Run with Mill Creek.

Overall, water quality in Mill Creek has steadily improved through time. The river segment from RM 24.8 to the mouth had 18.3 river miles that were in full attainment in 1995 compared to only 3.4 in 1990, 7.5 in 1986, and 1.7 in 1978. Further improvements in stream quality were also observed in the lower 5 miles of Mill Creek, which improved from *marginally good* to *exceptional* in performance.

Two tributaries, Blues Creek and Otter Creek, both met full attainment of their WWH designated use. Both Town Run and Crosses Run failed to meet their WWH designated use. Low scores in the various indices indicate significant impacts to biological communities from expected occurrences.

The DSW study provided an important discovery regarding fish tissue in Mill Creek. Chlordane exceeded U.S. Food and Drug Administration (FDA) action levels in a fish tissue sample collected immediately down stream of Crosses Run. This finding documents the uptake of pesticides in the food chain from sediment contamination in Crosses Run and Mill Creek.

The DSW study has provided data on the biological communities in the Mill Creek watershed. Results of this GI correlate to the river segment degradation observed by DSW. Reduced use attainments in Mill Creek in the urbanized portion of Marysville and downstream of Crosses Run correlated to the presence of sediment and water quality contamination observed in the August 1997 sampling. High concentrations of metals and PAHs, and the presence of pesticides in Town Run sediment correlate to the non-attainment status observed by DSW. Pesticides found in Crosses Run sediments further correlate to the non-attainment status observed by DSW. Therefore, it can be concluded that the contamination observed in the Mill Creek basin has caused a decline in water quality and biological communities in small portions of Mill Creek and especially in Crosses Run and Town Run. Despite this contamination, impacts appear to be localized. Significant improvements have been documented by DSW in the overall quality of Mill Creek as is indicated by the number of stream miles meeting attainment standards. By addressing these local concerns, improvements can be expected in Mill Creek. Due to the very poor quality of Town Run and Crosses Run, any remedial or source containment actions should result in significant improvements to Town Run and Crosses Run biological communities.

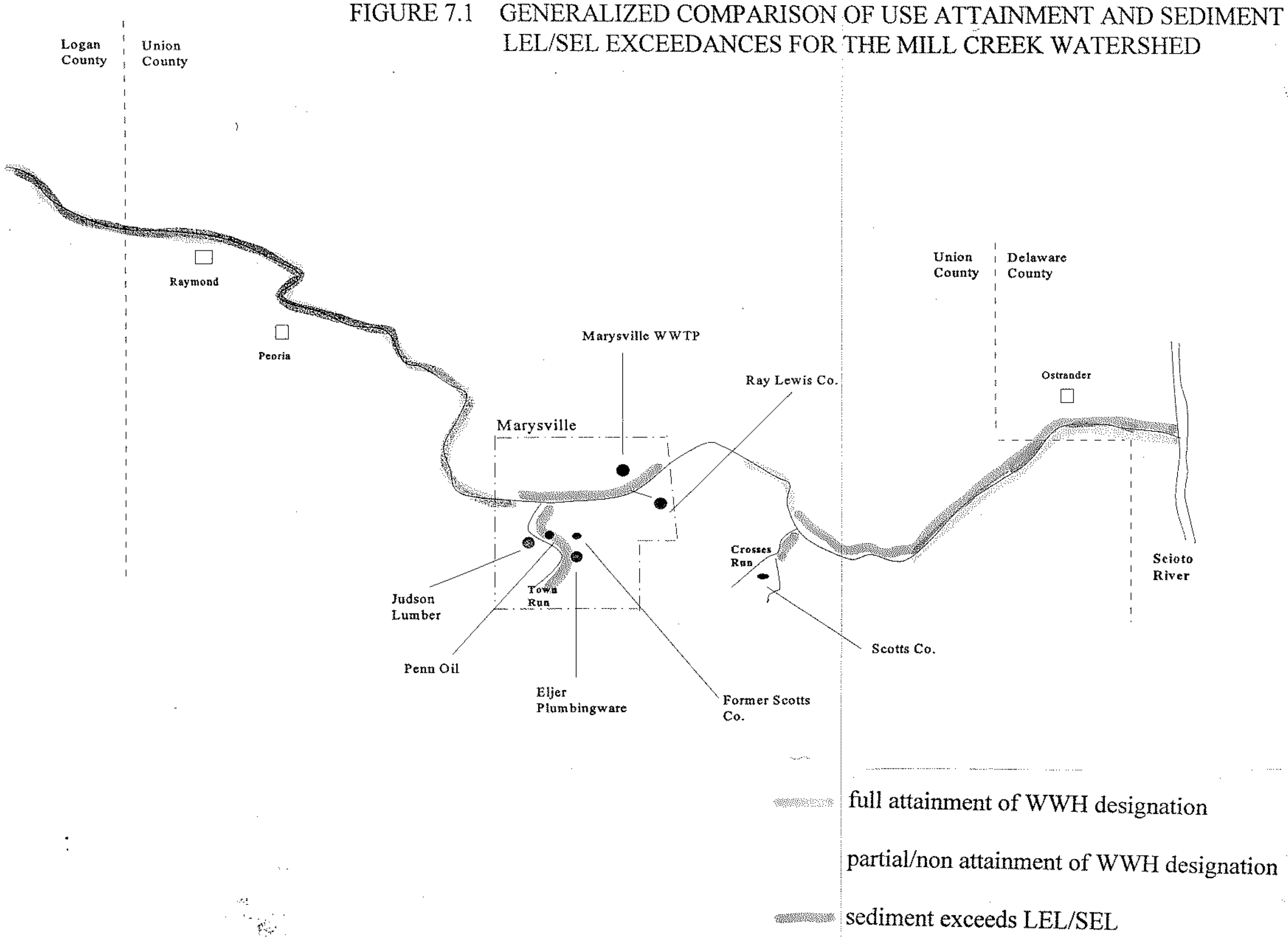
Figure 7.1 provides a comparison of use attainment based on DSW ecological studies to the chemical sampling results and LEL/SEL exceedances. Where biological communities fail to support expected uses, the chemical data indicates elevated levels of contamination. The only instance where this correlation is not observed is well downstream of Crosses Run in the lower reaches of Mill Creek (RM 1.6). Biological communities reflected exceptional quality despite low level pesticide contamination that exceeded LEL screening values. Contamination persistence and further migration from upstream sources would be of greater concern in this portion of Mill Creek.

In March 1998, the U.S. Fish and Wildlife Service (1998) completed an ecological assessment of the analytical results collected for this study and included as Appendix A. Based on screening benchmarks, numerous metals, SVOCs, VOCs, and pesticides were found to be contaminants of concern. Lead in sediment may pose an acute risk to piscivorous birds in Town Run and Beech Ditch. Crosses Run sediment contaminated with pesticides display acute hazards to evaluated species. Total PAH concentrations in Town Run could result in potential adverse effects and an imminent hazard to the aquatic environment. To determine protective concentrations of contaminants, toxicity testing may be appropriate.

8.0 POTENTIAL SOURCES OF CONTAMINATION

As previously discussed, a variety of contaminant sources have contributed to the degradation of Town Run and Crosses Run. In addition, these impacted streams provide further degradation to Mill Creek downstream of their confluences. This latest sampling has verified previous sources

FIGURE 7.1 GENERALIZED COMPARISON OF USE ATTAINMENT AND SEDIMENT LEL/SEL EXCEEDANCES FOR THE MILL CREEK WATERSHED



and identified additional areas of concern, especially along Town Run. Metals contamination from the former Eljer facility was confirmed in Town Run. Pesticide contamination from the Scotts Company was confirmed in Crosses Run. Metals and cyanide contamination was identified in Ray Lewis Ditch indicating a possibility that contaminants are migrating from the Ray Lewis plating facility. Sampling did not directly focus on the Marysville WWTP because significant historical documentation and the DSW 1997 report indicate significant impacts from this facility to Mill Creek. Concerns were raised regarding the presence of PAH and pesticide compounds in Town Run. Additional investigations are necessary to define the extent and sources of this contamination.

8.1 CONTAMINANT SOURCES TO MILL CREEK TRIBUTARIES

8.1.1 *Town Run*

Town Run has been bordered by numerous small commercial properties and residential areas since the founding of Marysville. Today, viable potentially responsible parties may be difficult to obtain. To provide additional information and a historical perspective of Town Run, a review of historical documents at the Marysville Public Library was completed. In summary, the following major industrial/commercial entities that utilized various compounds were located along Town Run:

In the late 1800's, an electric power generating plant was operated by the Marysville Light and Water Company on South Plum Street where the current Penn Oil Company is located. After various aquisitions, the electric properties of Marysville were acquired by the Dayton Power and Light Company. The type of electric production utilized at the Plum Street site is unknown. Correlation to PAH compounds is possible if coal/coal gasification was associated with the site.

Since 1875, a lumber company has operated at South Main and Eighth Street. It was founded as the Rice, Fleck and Company, Planing Mill and Lumber Yard. In 1892 it was operated as the Plate and Fry Lumber Co. Since 1906, it was known as the Marysville Lumber Yard. Currently, the site is vacant with lumber storage-type buildings still present. Correlation with insecticides and PAHs relating to wood preserving is possible.

In 1937, the O.M. Scott & Sons Company constructed office facilities at the corner of Sixth and Plum Streets. This office was located adjacent to the original seed elevator. Eventually the elevator was converted to office space as the company grew. Currently, Marysville City Hall and a parking lot occupy the site. In the 1950s, the Scotts Company built a seed processing plant along the Conrail tracks and west of North Maple Street. This facility now lies vacant. In 1957, the current Scott plant southeast of Marysville was constructed. Significant production activities at the former Sixth Street site, probably predate the 1950s. Correlation to insecticide and pesticides contamination may be possible if fertilizers and pesticides were produced.

The Penn Oil site is located near the corner of South Plum and Ninth Streets. This company distributes various petroleum products. The main building for the company burned down on August 12, 1997. Some runoff during fire fighting activities entered the stream, although a majority was contained behind dikes. Releases of petroleum products to site soils and any migration to Town Run from surface water runoff could correlate to PAH compounds identified in the stream.

From 1948 to 1987, Eljer Plumbingware operated a manufacturing facility at 425 East Ninth Street that produced brass plumbing fixtures. Eljer purchased an existing brass fixture manufacturer called the H.B. Salter Manufacturing Company. Foundry sand associated with production was disposed of in waste piles behind the facility. Various inorganic and VOCs have been identified in the foundry sands and ditch sediments at the facility and include: cadmium, chromium, lead, selenium, silver, trichloroethene, trichloroethane and their degradation products. Similar compounds have been identified in the stream in 1995 by DERR and in this GI investigation. The facility was recently transferred to an environmental cleanup/land reuse company who has initiated some sediment removal in Town Run (near the former ditch outfall), limited removal of the waste piles, chlorinated contaminated soil removal, building demolition, site regrading and runoff controls. The company plans to cap the waste piles and operate an outdoor park facility for Marysville on the surface of the site.

Non-point sources of contamination may include urban runoff from streets of downtown Marysville, illegal discharges to storm sewers, and septic tank discharges.

8.1.2 *Ray Lewis Ditch*

Ray Lewis & Son, Inc. has operated a plating facility on Delaware Avenue since 1951. The presence of metals and cyanide in surface water and sediment of Ray Lewis Ditch indicate direct impacts to the environment from this company. The DSW has initiated additional sampling at the facility, and is currently working with the facility to identify the source of the contamination and find a solution to eliminate this discharge to the environment.

8.1.3 *Crosses Run*

The Scotts Company has caused direct impacts to the surface water and sediment quality of Crosses Run. The Ohio EPA has documented a variety of NPDES violations and sources of soil contamination on the property. Ohio EPA and the Scotts Company are currently negotiating a multi-media consent order for RCRA Corrective Actions and to resolve NPDES issues. Additional sources of discharges to this water body include an upstream cattle farm and the Goodyear Tire Company outfall.

8.1.4 *Urban Runoff*

Significant impacts from urban runoff are evident, especially in Town Run. PAH compounds common to used oil and street runoff is persistent in Town Run where storm sewer discharge points are numerous. The presence of pesticide compounds could also be related to residual contamination from past applications in surrounding buildings. A large portion of Town Run flows through covered culverts with various commercial and residential buildings overlying it.

8.2 CONTAMINANT SOURCES TO MILL CREEK

Less significant observations of elevated compounds were identified directly in Mill Creek. Noted impacts were observed when the stream flows through Marysville as a result of receiving urban runoff, discharges from Town Run, Ray Lewis Ditch, and the Marysville WWTP. Impacts were also observed downstream of Crosses Run. The point sources identified would contribute to Mill Creek biological degradation in conjunction with the contaminant transport and migration via their respective tributaries. The major identified point source directly discharging to Mill Creek is the Marysville WWTP. Impacts have been documented although improvements are expected based on plant upgrades since 1995. The Mill Creek Estates WWTP may also be contributing to the impairment of Mill Creek.

8.3 SOURCE SUMMARY

The following tables provide a summary of the sources and potential sources of contamination identified in the Mill Creek watershed. Primary point source impacts have been identified mainly in Marysville and along Crosses Run. Additional sampling data was collected in a Phase II investigation conducted in June 1998 to evaluate potential sources along Town Run. Local agencies and education programs will be important to evaluate and control various non-point sources of contamination that can be a detriment to the watershed.

Table 8.1 Primary identified sources of contamination to Mill Creek and its tributaries:

Source	Stream	Regulatory Authority
Eljer Plumbingware	via Town Run	RCRA Closure/voluntary action
Marysville WWTP	to Mill Creek	NPDES permit
Mill Creek Estates	to Mill Creek	NPDES permit
Scotts Company	via Crosses Run	NPDES/RCRA corrective action order pending
Ray Lewis & Son, Inc.	via Ray Lewis Ditch	NPDES permit

Table 8.2 Potential sources of contamination to Mill Creek:

Potential Source	Stream	Comment
Former Electric Co./Penn Oil site	via Town Run	Sampled under Phase II GI - 6/98
Former Marysville Lumber Co.	via Town Run	Sampled under Phase II GI - 6/98
Former Scott Seed Co.	via Town Run	Sampled under Phase II GI - 6/98
Marysville Landfill	via Infirmary Ditch	DERR 1995 sampling
NPDES Permit Dischargers	Mill Creek and tribs.	Ensure compliance with permit.
Potential storm sewer discharges	Mill Creek and tribs	Local awareness
Septic tank discharges	various tributaries	Health Dept. and local awareness
Agricultural Runoff	Mill Creek and tribs.	Local awareness, conservation districts
Urban runoff	Mill Creek and tribs	Local awareness

9.0 RECOMMENDATIONS

DERR will continue to evaluate and summarize the Phase II sampling data collected in June 1998. This information will provide further insight regarding potential sources along Town Run. Based on the findings of this investigation, DERR believes that the primary sources of contamination in the Mill Creek watershed are: 1) former Eljer Plumingware, 2) Marysville WWTP, 3) Ray Lewis & Sons, Inc., and 4) the Scotts Company. All of these facilities are currently regulated and problems can be reduced or eliminated through various adminstrative or enforcement actions.

Recommendations

- Eljer Plumbingware- The extent of metals contamination from this facility to Town Run has been documented. Ohio EPA, Division of Hazardous Waste Management (DHWM) oversight of RCRA closure activities should continue to ensure that all remedial actions are protective of human health and the environment.

- Marysville WWTP- Based on Ohio EPA, DSW documentation, significant impairments to Mill Creek has occurred downstream of the WWTP. Ohio EPA should ensure that the facility meets their NPDES permit requirements and assist the facility in correcting deficiencies. With the recent expansions of the Marysville's sewer system, NPDES compliance must be maintained.

- Ray Lewis & Sons - Ohio EPA, DSW has initiated an investigation into the sources of contamination to their discharge outfall. DSW must ensure that the metals discharges cease and compliance with the NPDES permit is maintained.

- The Scotts Company- Ohio EPA, DSW and DHWM are currently negotiating a consent order with the facility to rectify NPDES compliance issues and conduct RCRA corrective actions to address waste disposal areas at the facility. Most surface water discharge issues have been addressed through the facility's recent connection to the sanitary sewer system.

Cooperation by the above facilities to address their problems should cause significant improvements to the environmental quality of the Mill Creek watershed. Other smaller potential sources that are currently regulated (i.e. NPDES permit, RCRA generators) should be evaluated by the Ohio EPA to ensure all facilities are in compliance. DERR will continue to evaluate additional potential sources in the Marysville/Town Run area and make additional recommendations in an addendum report. Many non-point source issues will remain and can only be addressed through education and local efforts.

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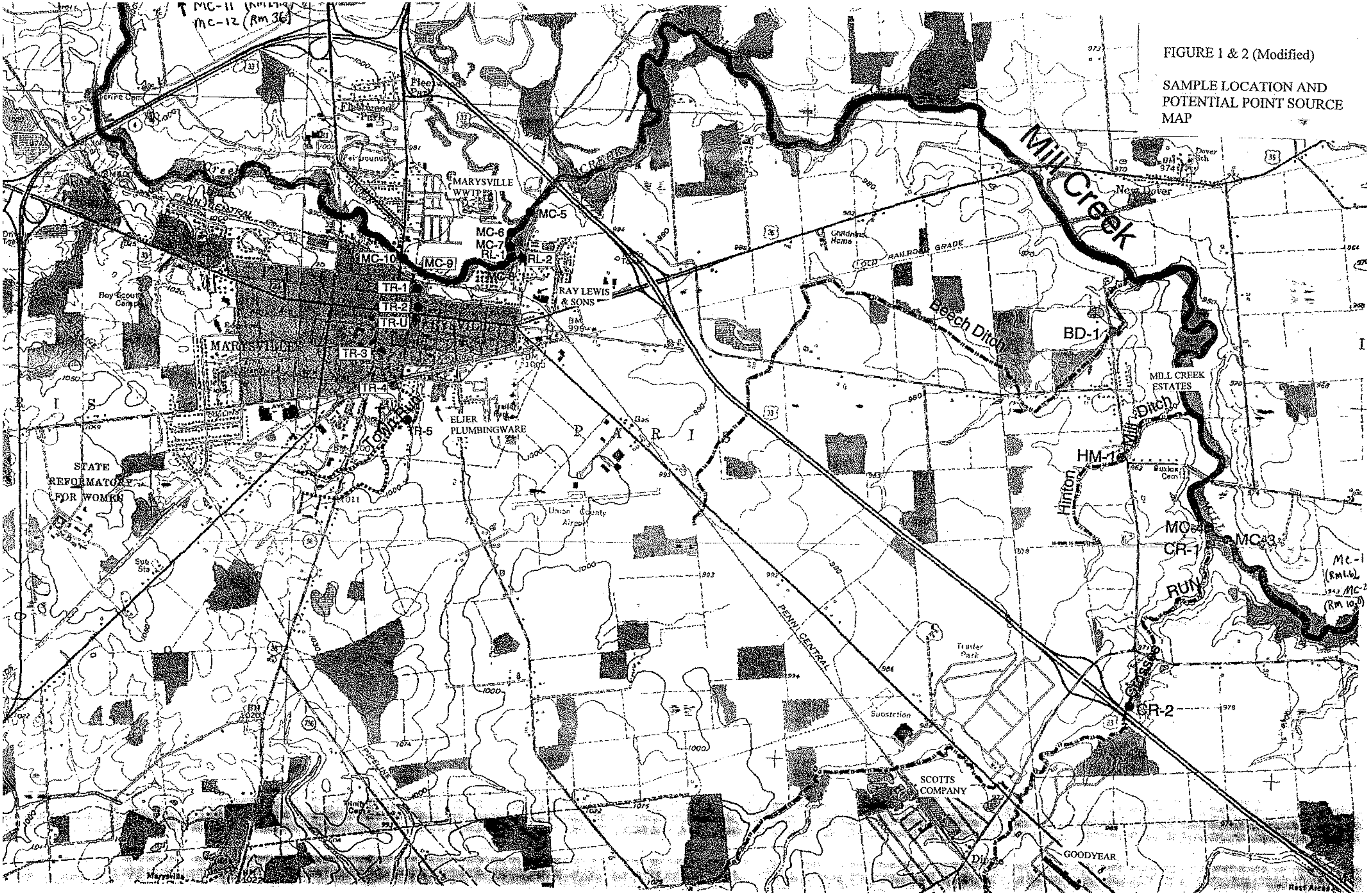


FIGURE 1 & 2 (Modified)

SAMPLE LOCATION AND POTENTIAL POINT SOURCE MAP

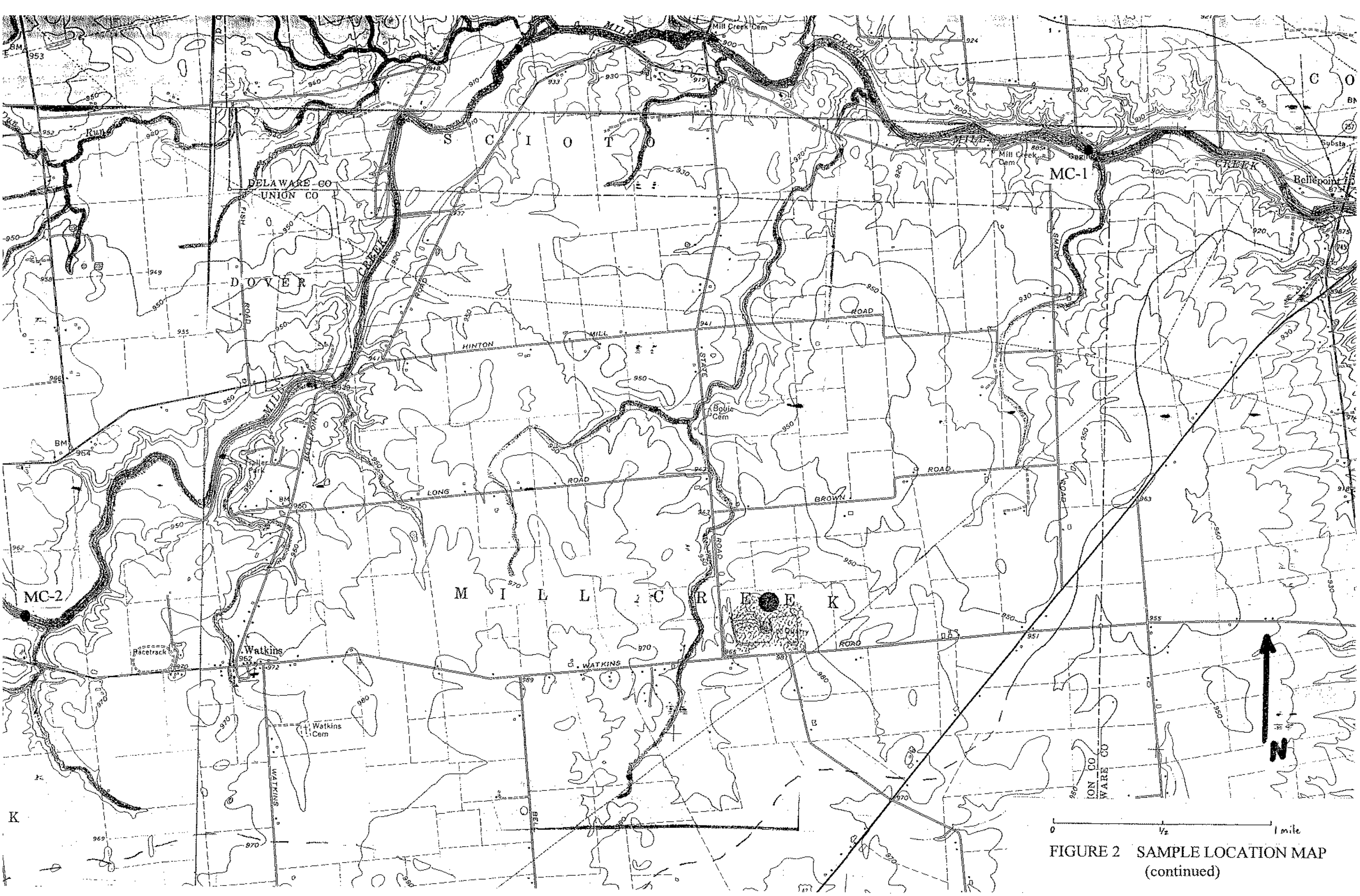


FIGURE 2 SAMPLE LOCATION MAP
(continued)

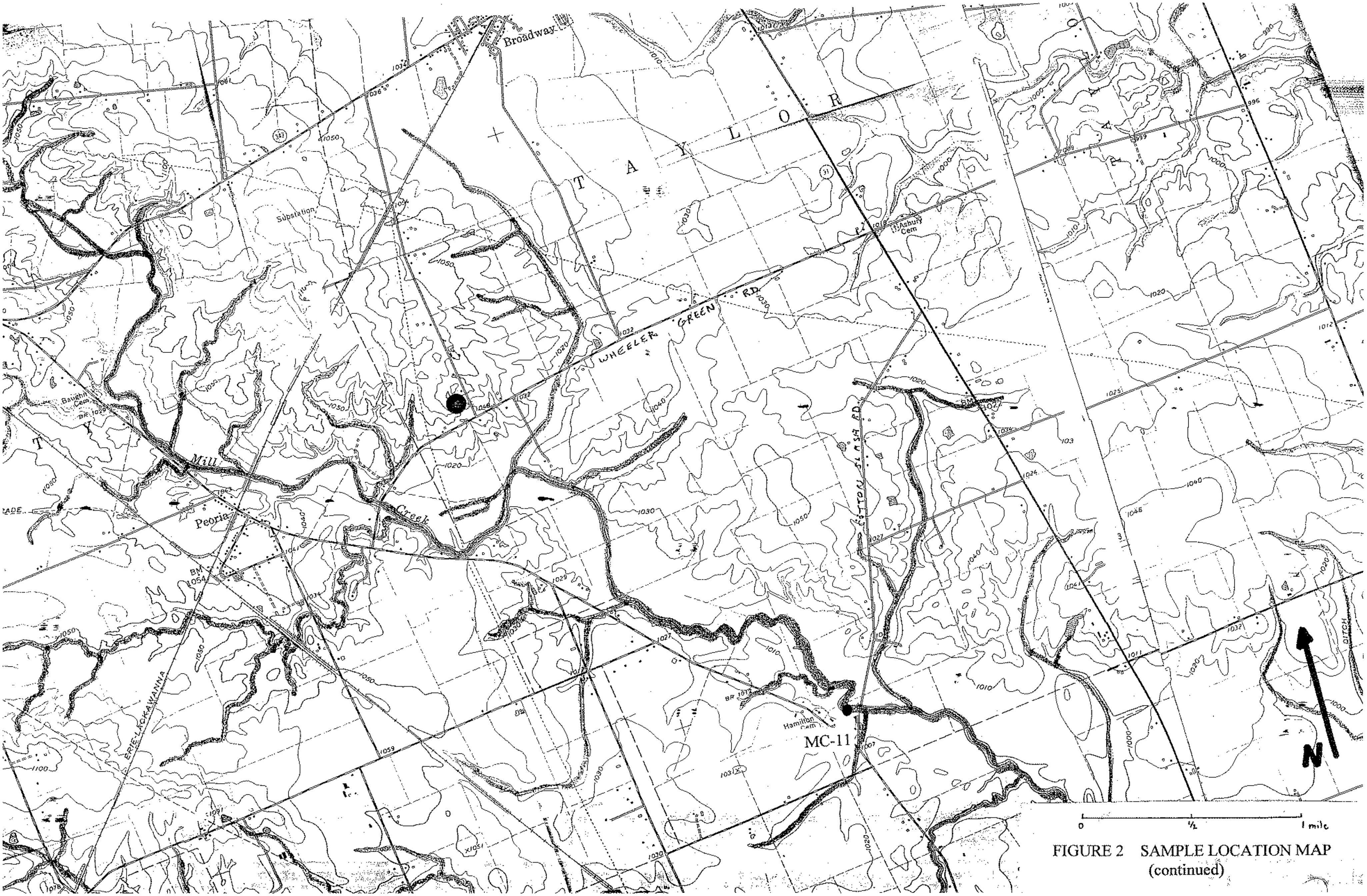


FIGURE 2 SAMPLE LOCATION MAP
(continued)

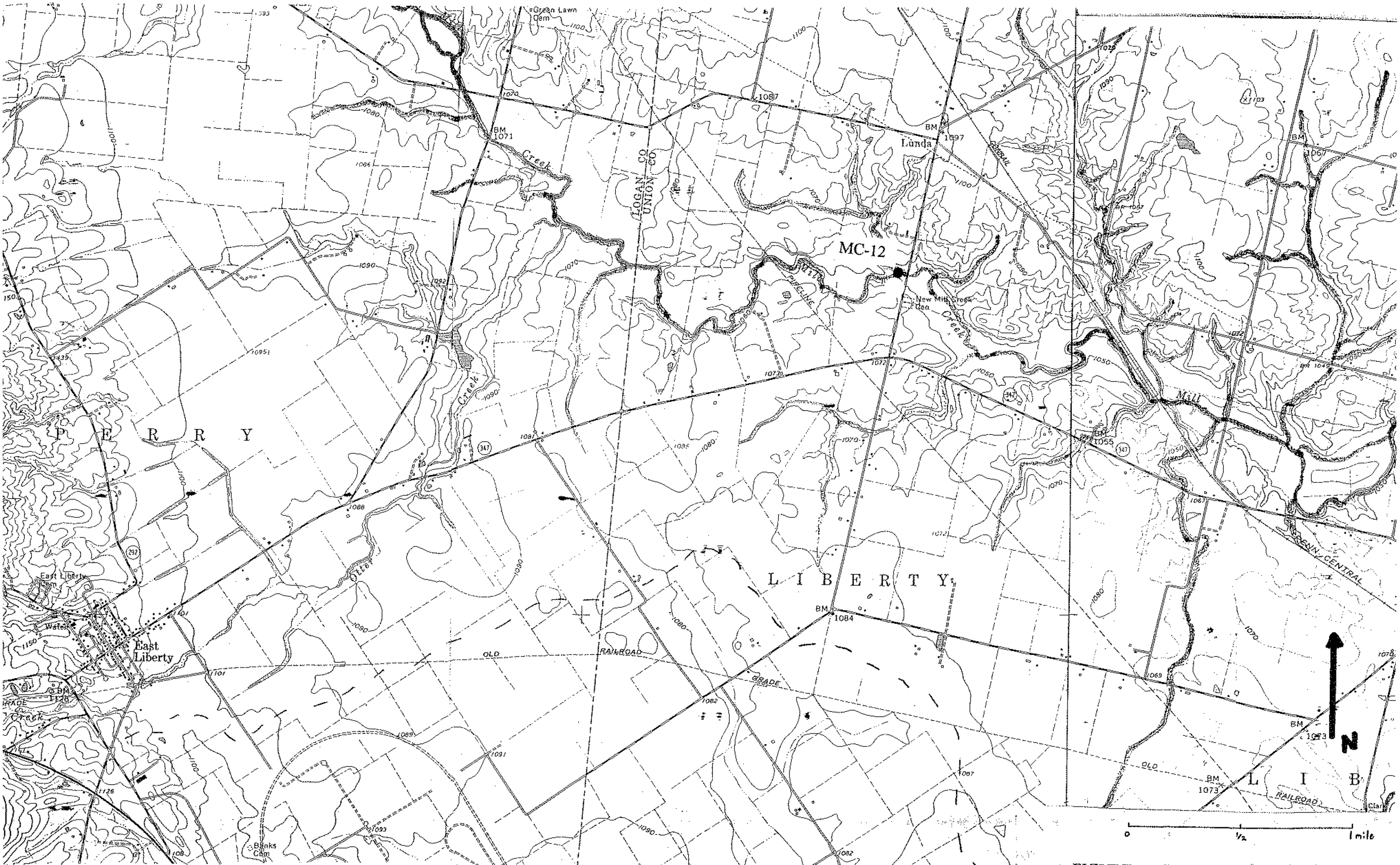


FIGURE 2 SAMPLE LOCATION MAP
(continued)

TABLES

TABLE 1

MILL CREEK GEOGRAPHIC INITIATIVE

Total Organic Carbon (TOC) and Grain Size

	TOC ug/g	Grain Size*		
		< #200	#200-#16	> #16
MC-1	17,100	92.5	1.0	6.5
MC-2	19,900	67.1	25.8	7.1
MC-3	25,400	54.6	23.3	22.1
MC-4	>35,300	62.7	27.4	9.9
MC-5	>27,100	44.1	28.8	27.1
MC-6	>22,400	24.7	5.7	69.6
MC-7	>28,500	48.5	41.4	10.1
MC-8	>22,800	45.8	45.1	9.1
MC-9	>25,100	23.8	38.7	37.5
MC-10		68.7	25.6	5.7
MC-11	>21,700	32.0	54.3	13.7
MC-12	19,900	62.7	33.7	3.6
CR-1	13,000	59.9	38.3	1.8
CR-2	9,280	56.8	35.5	7.7
HM-1	9,840	60.5	32.4	7.1
BD-1	19,000	55.1	31.6	13.3
RL-1	>18,600	46.6	40.6	12.8
RL-2	>22,100	24.5	65.2	10.3
TR-1	>23,200	37.2	48.1	14.7
TR-2	>19,600	23.4	51.9	24.7
TR-U	>24,200	--	--	--
TR-3	>25,200	50.5	35.5	14.0
TR-4	19,800	72.0	21.1	6.9
TR-5	>25,500	67.6	23.5	8.9

* US Standard Sieve Numbers

< #200 = clay/silt

#200-#16 = fine/medium sand

> #16 = course sand and gravel

TABLE 2 MILL CREEK GEOGRAPHIC INITIATIVE

MILL CREEK - METALS IN SEDIMENT - mg/kg

	LEL	SEL	MC-12	MC-10	MC-9	MC-8	MC-7	MC-5	MC-4	MC-3	MC-1
aluminum			5690 J	7050 J	2880 J	4060 J	5890 J	3760 J	6270 J	6300 J	11700 J
antimony			<1.8	<1.6	<1.2	<1.6	<1.6	<1.9	<1.9	<1.5	<2
arsenic	6	33	3.8 J	**10.7**	**7.4**	4.4	**8.9**	**7.7**	**6.1**	**6.8**	**8.8**
barium			46.2	92.6	58.5	96.3	80.6	60.4	60.6	44.9	83.5
beryllium			0.4	0.5	0.2	0.3	0.4	0.2 J	0.4	0.4	0.6
cadmium	0.6	10	0.4	0.6	0.2 J	**0.9**	0.4	0.3	0.4	0.5	0.3 J
calcium			33400	61800	139000	69100	59800	104000	24800	26200	12400
chromium	26	110	8.5	17.1	5.1	10.6	13.5	22.8	13	11.5	14.8
cobalt			8.2	9	4.6	6.2	7.8	6.3	8.1	8.3	9.6
copper	16	110	**20.8** J	**52.1** J	14.6 J	**65.7** J	**95.6** J	**53.8** J	**34** J	**48.2** J	**28.2** J
iron	20000	40000	14500	18200	9450	12100	15800	13700	16200	17100	**23000**
lead	31	250	12.4 J	**81.8** J	13.9 J	**151** J	**91** J	29.4 J	20.7 J	20.4 J	22.3 J
magnesium			12600	25100	66200	26900	22300	51000	11000	11800	6350
manganese	460	1100	334 J	339 J	360 J	241 J	345 J	210 J	428 J	363 J	384 J
mercury	0.2	2	<0.09	<0.08	<0.06	<0.08	<0.08	<0.1	<0.1	<0.08	<0.1
nickel	16	75	**18**	**21.7**	9.7	**15.2**	**21.3**	**38.3**	**27.1**	**21.8**	**25.3**
potassium			954	1060	703	698	963	718	962	949	1440
selenium			<0.9	<0.8	<0.6	<0.8	<0.8	<1	<1	<0.8	<1
silver			0.4	0.6	<0.2	0.3	0.4	1.4	0.6	0.6	0.7
sodium			239	344	324	290	316	593	404	359	335
thallium			<1.3	1.3 J	<0.8	<1.1	<1.1	<1.4	<1.4	<1.1	1.5 J
vanadium			13.7	17.3	8.7	11.1	14	9.4	14	14	21.7
zinc	120	820	45.8	**148**	44.8	**125**	**135**	102	69.5	70	76.2
cyanide			n/a	<0.2	0.4 J	<0.2	<0.2	<0.2	n/a	n/a	n/a

n/a - not analyzed
LEL - Lowest Effect Level in sediment, Ontario **bold - exceed LEL**
SEL - Severe Effect Level in sediment, Ontario

TABLE 3 **MILL CREEK GEOGRAPHIC INITIATIVE**

MILL CREEK - METALS IN SURFACE WATER - ug/l

	MCL	MC-12	MC-10	MC-9	MC-8	MC-7	MC-6	MC-5
aluminum		208	342	426	463	510	n/a	n/a
antimony	6	<4.7	<4.7	<4.7	<4.7	<4.7	n/a	n/a
arsenic	50	4.6 J	2.6 J	2 J	5.1 J	3.1 J	n/a	n/a
barium	2000	67.2	54.2	57.7	59.5	57.7	n/a	n/a
beryllium	4	<0.1	<0.1	<0.1	<0.1	<0.1	n/a	n/a
cadmium	5	<0.3	<0.3	<0.3	1.2	<0.3	n/a	n/a
calcium		73300	56900	61100	60300	70900	n/a	n/a
chromium	100	<0.6	0.7	0.7	2.3	1.4	n/a	n/a
cobalt		<1.4	<1.4	<1.4	<1.4	<1.4	n/a	n/a
copper	1300	3.2 J	3.3 J	4.3 J	24.3	36.8 J	n/a	n/a
iron		302	608	769	850	991	n/a	n/a
lead	15	3 J	1.6 J	2.6 J	6.6 J	2.3 J	n/a	n/a
magnesium		35100	25900	26100	24900	29800	n/a	n/a
manganese		25.4 J	24.5 J	42.8 J	48.6	52.9 J	n/a	n/a
mercury	2	<0.1	<0.1	<0.1	<0.1	<0.1	n/a	n/a
nickel	100	<3.6	<3.6	<3.6	<3.6	4.2	n/a	n/a
potassium		4880	5990	6040	5790	5950	n/a	n/a
selenium	50	<2.4	<2.4	<2.4	<2.4	<2.4	n/a	n/a
silver		<0.8	<0.8	<0.8	<0.8	<0.8	n/a	n/a
sodium		17800	43400	47700	41700	41700	n/a	n/a
thallium	2	<3.4	<3.4	<3.4	<3.4	<3.4	n/a	n/a
vanadium		<1.5	<1.5	<1.5	1.6	1.5	n/a	n/a
zinc		<16.8	<16.8	<16.8	<16.8	<16.8	n/a	n/a
cyanide	200	n/a	<2.3	<2.3	<2.3	15.8 J	<15.3	<16.3

n/a - not analyzed
MCL = Maximum Contaminant Level in Drinking Water

TABLE 4 **MILL CREEK GEOGRAPHIC INITIATIVE**

MILL CREEK - SEMIVOLATILES IN SEDIMENT - mg/kg

	LEL	*SEL*	MC-12	MC-10	MC-09	MC-04	MC-03	MC-02	MC-01
methylphenol,4			BD	0.08 J	BD	BD	BD	BD	BD
naphthalene			BD	0.042 J	BD	BD	BD	BD	BD
methylnaphthalene-2			BD	0.064 J	BD	BD	BD	BD	BD
acenaphthylene*			BD	0.087 J	0.045 J	BD	BD	BD	BD
acenaphthene*			BD	0.05 J	0.024 J	BD	BD	BD	BD
dibenzofuran			BD	0.053 J	0.027 J	BD	BD	BD	BD
fluorene*	0.19	4.8	BD	0.074 J	0.065 J	BD	BD	BD	BD
phenanthrene*	0.2	28.5	BD	**0.96**	**0.48**	0.058 J	0.12 J	0.04 J	0.047 J
anthracene*	0.22	11.5	BD	0.22 J	0.13 J	BD	0.031 J	BD	BD
carbazole			BD	0.17 J	0.042 J	BD	BD	BD	BD
fluoranthene*	0.75	30.6	BD	**2.3**	0.61	0.17 J	0.31 J	0.13 J	0.072 J
pyrene*	0.49	25.5	BD	**1.6**	**0.54**	0.14 J	0.26 J	0.15 J	0.057 J
butylbenzlyphthalate			BD	0.034 J	BD	BD	BD	BD	BD
benzo(a)anthracene*	0.32	44.4	BD	**0.89**	0.25 J	0.061 J	0.13 J	0.056 J	0.037 J
chrysene*	0.34	13.8	BD	**1.3**	0.27 J	0.079 J	0.15 J	0.062 J	0.039 J
bis2ethylhexylphthalate			BD	0.63	BD	BD	BD	BD	BD
di-n-octylphthalate			BD	0.068 J	BD	BD	BD	BD	BD
benzo(b)fluoranthene*			BD	1.5	0.32 J	0.085 J	0.17 J	0.09 J	0.054 J
benzo(k)fluoranthene	0.24	40.2	BD	**0.37** J	0.1 J	0.027 J	0.075 J	BD	BD
benzo(a)pyrene*	0.37	43.2	BD	**0.97**	0.2 J	0.057 J	0.13 J	0.05 J	BD
indeno(1,2,3cd)pyrene	0.2	9.6	BD	**0.94**	0.11 J	0.041 J	0.1 J	0.036 J	BD
dibenz(a,h)anthracene	0.06	3.9	BD	BD	0.04 J	BD	BD	BD	BD
benzo(g,h,i)perylene*	0.17	9.6	BD	**1.1**	0.039 J	0.046 J	0.048 J	0.042 J	BD
Total PAH	4	300	0	**12.361**	3.093	0.764	1.542	0.656	0.306

*PAH compound

LEL- Lowest Effect Level in sediment , Ontario

SEL- Severe Effect Level in sediment, Ontario; based on 3% TOC

BD= Below Detection limits which ranged from 0.460 to 1.6 mg/kg

Bold - exceeds LEL

TABLE 5 MILL CREEK GEOGRAPHIC INITIATIVE

MILL CREEK- PEST/PCB IN SEDIMENT -ug/kg

	LEL	*SEL*	MC-12	MC-11	MC-10	MC-9	MC-7	MC-5	MC-4	MC-3	MC-2	MC-1
a-BHC	6	300	<2.8	<2.2	<13	<2	<12	<2.6	<2.4	<15	<17	<3
b-BHC	5	630	<2.8	<2.2	<13	<2	<12	<2.6	<2.4	<15	<17	<3
d-BHC			<2.8	<2.2	<13	<2	1.2 J	<2.6	<2.4	<15	<17	<3
lindane	3	30	<2.8	1.9 J	<13	<2	<12	2.2 J	1.3 J	<15	***160*** J	<3
heptachlor			2.2 J	<2.2	<13	<2	<12	0.83 J	<2.4	<15	5 J	9 J
aldrin	2	240	<2.8	<2.2	<13	<2	2.8 J	<2.6	<2.4	<15	<17	<3
hept. epoxide	5	150	<2.8	<2.2	<13	<2	0.7 J	<2.6	<2.4	<15	<17	<3
endosulfan I			6.6 J	<2.2	15	2.8 J	<12	<2.6	<2.4	120	41 J	60
dieldrin	2	2730	<5.4	<4.3	<26	<3.8	**4.6** J	**2.8** J	**2.7** J	<29	<32	1.8 J
DDE- 4,4	5	570	<5.4	<4.3	3.2 J	<3.8	3.3 J	<5	<4.6	<29	<32	<5.9
endrin	3	3900	<5.4	<4.3	<26	<3.8	<24	<5	<4.6	**7.5** J	<32	2.1 J
endosulfan II			<5.4	<4.3	<26	<3.8	<24	<5	<4.6	<29	<32	<5.9
DDD-4,4	8	180	<5.4	<4.3	<26	<3.8	4.6 J	3 J	1.4 J	<29	<32	<5.9
endosulfan sulfate			<5.4	<4.3	<26	1.4 J	1.9 J	<5	<4.6	<29	<32	6.4
DDT-4,4	7	360	1.8 J	<4.3	<26	2.7 J	2.4 J	<5	2.2 J	**21** J	<32	5.2 J
methoxychlor			<28	<22	<130	<20	<120	<26	<24	<150	<170	<30
endrin ketone			<5.4	<4.3	<26	1.2 J	1.8 J	<5	<4.6	<29	<32	<5.9
endrin aldehyde			<5.4	<4.3	<26	<3.8	<24	<5	<4.6	<29	<32	<5.9
a-chlordane	7	180	5.9 J	<2.2	**14**	2.7 J	<12	5.7 J	1.4 J	**120**	**36** J	**54**
g-chlordane	7	180	4.7 J	<2.2	**9.5** J	1.5 J	6.3 J	4.9 J	0.92 J	**100**	**30** J	**44** J
toxophene			<280	<220	<1300	<200	<1200	<260	<240	<1500	<1700	<300
PCBs			<54	<43	<260	<38	<240	<50	<46	<290	<320	<59

LEL - Lowest Effect Level in sediment, Ontario
SEL - Severe Effect Level in sediment, Ontario; based on 3% TOC
Bold - exceeds LEL
Bold italics - exceeds SEL

TABLE 6 MILL CREEK GEOGRAPHIC INITIATIVE

SURFACE WATER ORGANICS DATA

Mill Creek surface water - ug/l

	MC-12	MC-10	MC-9	MC-6	MC-5	MC-4	MC-3	MC-2	MC-1
Pesticides	BDL (1)	BDL	BDL			BDL	BDL	BDL	BDL
PCBs	BDL (2)	BDL	BDL			BDL	BDL	BDL	BDL
d-BHC				0.054	0.048 J				
lindane				0.18 J	0.027 J				
aldrin				0.026 J	BDL				

Crosses Run surface water - ug/l

	CR-2	CR-2 (dup)	CR-1
Pesticides			BDL
d-BHC	BDL	0.037 J	
aldrin	BDL	0.05 J	
endosulfan I	0.066 J	BDL	
DDD, 4,4	0.046 J	BDL	
endosulfan sulfate	0.14 J	BDL	
DDT-4,4	0.28 J	BDL	
a-chlordane	0.056 J	BDL	
g-chlordane	0.026 J	BDL	

Hinton Mill Ditch surface water - ug/l

	HM-1
Pesticides	BDL
PCBs	BDL

Beech Ditch surface water - ug/l

	BD-1
VOCs	BDL
SVOCs	BDL
Pesticides	BDL

Town Run surface water - ug/l

	TR-5	TR-4	TR-3	TR-2	TR-1	TR-1 (dupl.)
VOCs	BDL (3)					
chloroform		BDL	1 J	4 J	1 J	1 J
trichloroethene		1 J	BDL	BDL	BDL	BDL
xylene		BDL	BDL	BDL	2 J	2 J
Pesticides	BDL	BDL	BDL	BDL	BDL	
endosulfan I						0.034 J
a-chlordane						0.032 J
g-chlordane						0.015 J
PCBs	BDL	BDL	BDL	BDL	BDL	BDL

BDL (1) - detection limits range from 0.05 to 0.5 ug/l for pesticides
BDL (2) - detection limits range from 1.0 to 2.0 ug/l for PCBs
BDL (3) - the detection limit was 10 ug/l for VOCs

TABLE 7

MILL CREEK GEOGRAPHIC INITIATIVE

TOWN RUN - METALS IN SEDIMENT - mg/kg

	LEL	SEL	TR-5	TR-4	TR-3	TR-3 (dup)	TR-U	TR-2	TR-1
aluminum			8270 J	8520 J	5310 J	5690 J	5220 J	2680 J	4270 J
antimony			<1.6	<1.9	<1.6	<1.5	3.7 J	<1.2	<1.3
arsenic	6	33	**15.1**	**9.4**	**8.4**	**8.3**	**10.6**	**6.1**	**10.5**
barium			72.4	71	57	61.1	78.7	55	113
beryllium			0.7	0.5	0.4	0.5	0.4	0.3	0.4
cadmium	0.6	10	0.6	**0.7**	**0.7**	**1.8**	**2.3**	0.6	**0.7**
calcium			38600	51400	48700	44800	64000	96300	71600
chromium	26	110	12.7	18.3	16.9	18.3	**66.8**	12.2	16.8
cobalt			15.6	11.2	8.8	9.5	9	6.3	7.5
copper	16	110	**38.4** J	***250*** J	***290*** J	***332*** J	***319*** J	***134*** J	***166*** J
iron	20000	40000	**24400**	**22400**	16200	18700	**20300**	16900	19200
lead	31	250	**36.6** J	**58.8** J	**124** J	**144** J	***381*** J	**128** J	**145** J
magnesium			11500	15200	15900	15000	21600	25900	23600
manganese	460	1100	**473** J	**502** J	309 J	310 J	289 J	368 J	336 J
mercury	0.2	2	<0.08	<0.1	<0.08	0.1 J	<0.1	<0.06	<0.06
nickel	16	75	**28**	**34.1**	**26.6**	**30.7**	**30.3**	**20.7**	**22.6**
potassium			1190	1240	923	980	982	458	839
selenium			<0.8	<1	<0.8	<0.8	<1.2	<0.6	<0.6
silver			0.7	0.8	0.5	0.5	0.9	0.3	0.6
sodium			334	367	325	285	434	241	340
thallium			1.2 J	<1.4	<1.1	<1.1	<1.7	1.2 J	<0.9
vanadium			24.4	18	14.1	16.9	15.9	9.4	13.3
zinc	120	820	90.2	**394**	**486**	**626**	**673**	**533**	**478**
cyanide			<0.2	<0.2	<0.2	<0.2	<0.3	<0.1	<0.2

n/a - not analyzed
LEL - Lowest Effect Level in sediment, Ontario
SEL - Severe Effect Level in sediment, Ontario

bold - exceed LEL
italics bold - exceeds SEL

TABLE 8 MILL CREEK GEOGRAPHIC INITIATIVE

RAY LEWIS DITCH/BEECH DITCH - METALS IN SURFACE WATER - ug/l

		Ray Lewis Ditch			Beech Ditch
	MCL	**RL-2**	**RL-1**	(MC-7)	**BD-1**
aluminum		155	72.7 J		208
antimony	6	<4.7	<4.7		<4.7
arsenic	50	4.4 J	3 J		4.5 J
barium	2000	13.1	14.1		47.4
beryllium	4	<0.1	<0.1		<0.1
cadmium	5	<0.3	<0.3		<0.3
calcium		161000	159000		124000
chromium	100	13.2	5.1		<0.6
cobalt		<1.4	<1.4		<1.4
copper	1300	552 J	140 J	36.8 J	27.8 J
iron		646	575		229
lead	15	**20.9** J	1.7 J		**19.6** J
magnesium		75900	74600		60300
manganese		19.9 J	27.1 J		35.9 J
mercury	2	<0.1	<0.1		<0.1
nickel	100	23.4	9	4.2	<3.6
potassium		6230	4480		4090
selenium	50	<2.4	<2.4		<2.4
silver		<0.8	<0.8		<0.8
sodium		44700	41800		52300
thallium	2	<3.4	<3.4		<3.4
vanadium		<1.5	<1.5		<1.5
zinc		81.5	51.7	<16.8	<16.8
cyanide	200	**346**	52.7	15.8 J	<2.3

TOWN RUN - CYANIDE IN SURFACE WATER - ug/l

	MCL	TR-5	TR-4	TR-3	TR-2	TR-1
cyanide	200	<2.3	<2.3	<2.3	<2.3	<2.3

MCL = Maximum Contaminant Level in Drinking Water

TABLE 9

MILL CREEK GEOGRAPHIC INITIATIVE

TOWN RUN - SEMIVOLATILES IN SEDIMENT - mg/kg

	LEL	*SEL*	TR-5	TR-4	TR-3	TR-U	TR-2	TR-1	Beech Ditch BD-1
methylphenol,4			BD	0.042 J	BD	BD	0.024 J	0.041 J	BD
naphthalene			0.17 J	0.1 J	0.38 J	0.91 J	BD	0.34 J	BD
methylnaphthalene-2			0.18 J	0.067 J	0.32 J	0.58 J	0.021 J	0.29 J	BD
acenaphthylene*			0.13 J	0.09 J	BD	0.59 J	0.11 J	0.41 J	BD
acenaphthene*			1.1	0.66	3.4 J	1.8 J	0.056 J	1.2	BD
dibenzofuran			0.76	0.36 J	1.9 J	1.2 J	0.052 J	0.95	BD
fluorene*	0.19	4.8	**1.6**	**0.54**	**3.4 J**	**1.8** J	0.093 J	**1.6**	BD
phenanthrene*	0.2	28.5	**11**	**7.4**	**25**	**18**	**0.88**	**13**	0.056 J
anthracene*	0.22	11.1	**3.4**	**1.1**	7.4	**2.5** J	**0.23 J**	**3.2**	BD
carbazole			2	1.2	3.9 J	2.2 J	0.081 J	2.3	BD
di-n-butylphthalate			BD	0.033 J	BD	BD	0.024 J	0.091 J	BD
fluoranthene*	0.75	30.6	**12**	**8.3**	**26**	**26**	**1.7**	**14**	0.1 J
pyrene*	0.49	25.5	**12**	**9**	**22**	**25**	**1.2**	**15**	0.087 J
butylbenzlyphthalate			0.035 J	BD	BD	BD	BD	0.44 J	BD
benzo(a)anthracene*	0.32	44.4	**7.4**	**4.3**	**12**	**11**	**0.66**	**8.8**	0.036 J
chrysene*	0.34	13.8	**7.3**	**5**	**9.8**	**11**	**0.72**	**9.5**	0.057 J
bis2ethylhexylphthalate			BD	0.5 J	BD	BD	BD	0.59	BD
di-n-octylphthalate			0.034 J	0.1 J	BD	BD	BD	BD	BD
benzo(b)fluoranthene*			8.3	6.1	13	14	0.99	7.9	0.055 J
benzo(k)fluoranthene*	0.24	40.2	**2.6**	**2**	**3.3 J**	**4.5** J	0.24 J	**2.6**	BD
benzo(a)pyrene*	0.37	43.2	**6.4**	**4.6**	**9.7**	**10**	**0.66**	**6.4**	0.033 J
indeno(1,2,3cd)pyrene	0.2	9.6	**4.5**	**3.5**	**5**	**6.4**	**0.41**	**4.8**	0.026 J
benzo(g,h,i)perylene*	0.17	9.6	**4.8**	**3.8**	**5.3**	**6.8**	**0.47**	**5.1**	0.038 J
Total PAH	4	300	**79.13**	**55.29**	**137.9**	**136.89**	**8.189**	**88.71**	0.488

*PAH compound
LEL- Lowest Effect Level in sediment , Ontario
SEL- Severe Effect Level in sediment, Ontario; based on 3% TOC
BD = Below Detection limit which ranged from 0.410 to 13 mg/kg
Bold - exceeds LEL

TABLE 10 MILL CREEK GEOGRAPHIC INITIATIVE

TOWN RUN - PEST/PCB IN SEDIMENT - ug/kg

			Town Run			TR-3			
	LEL	***SEL***	**TR-5**	**TR-4**	**TR-3**	**dupl**	**TR-U**	**TR-2**	**TR-1**
a-BHC	6	300	<13	<14	<22	<12	<14	<42	<14
b-BHC	5	630	<13	<14	<22	<12	<14	<42	<14
d-BHC			<13	<14	<22	<12	<14	<42	<14
lindane	3	30	<13	<14	<22	<12	<14	<42	<14
heptachlor			<13	<14	14 J	14 J	4.2 J	<42	7.2 J
aldrin	2	240	<13	<14	<22	<12	**8.2** J	<42	**5.6** J
hept. epoxide	5	150	<13	<14	**8.4** J	**9.3** J	**5.3** J	<42	**7.8** J
endosulfan I			<13	<14	110 J	130	49 J	33 J	64 J
dieldrin	2	2730	<25	<27	<43	**6** J	<27	<81	**11** J
DDE- 4,4	5	570	<25	<27	<43	<24	**12** J	**63** J	**17** J
endrin	3	3900	<25	**8.6** J	**27** J	**7.2** J	<27	<81	<28
endosulfan II			<25	<27	<43	<24	<27	<81	5 J
DDD-4,4	8	180	<25	<27	<43	<24	**11** J	***370*** J	**7.8** J
endosulfan sulfate			<25	<27	<43	<24	7.3 J	<81	9.5 J
DDT-4,4	7	360	<25	<27	<43	**26** J	**11** J	***6000*** J	**40**
methoxychlor			<130	<140	<220	<120	<140	<420	<140
endrin ketone			<25	<27	26 J	<24	22 J	<81	<28
endrin aldehyde			<25	<27	<43	<24	<27	<81	16 J
a-chlordane	7	180	7 J	<14	**100**	**120**	**46** J	**30** J	**60** J
g-chlordane	7	180	<13	<14	**96** J	**120**	**33** J	**19** J	**59** J
toxophene			<1300	<1400	<2200	<1200	<1400	<4200	<1400
PCBs			<250	<270	<430	<240	<270	<810	<280

LEL - Lowest Effect Level, Ontario
SEL - Severe Effect Level in sediment, Ontario; based on 3% TOC
Bold - exceeds LEL
Bold italics - exceeds SEL

TABLE 11 MILL CREEK GEOGRAPHIC INITIATIVE

RAY LEWIS DITCH/BEECH DITCH - METALS IN SEDIMENT - mg/kg

			Ray Lewis			Beech Ditch
	LEL	**SEL**	**RL-2**	**RL-1**	**RL-1 (dup)**	**BD-1**
aluminum			3770 J	7030 J	6740 J	8880 J
antimony			<1.3	<1.3	<1.4	<1.9
arsenic	6	33	**6.4**	5	**12.5**	**16.1**
barium			51.2	70.5	91.4	67.7
beryllium			0.3	0.5	0.4	0.6
cadmium	0.6	10	0.6	**1.1**	0.4 J	0.3 J
calcium			90000	77900	97200	33200
chromium	26	110	**28.6**	**26.8**	**26.2**	11.8
cobalt			6.6	11.8	10.3	19.1
copper	16	110	***165*** J	***188*** J	***176*** J	**29** J
iron	20000	40000	15000	**21700**	19800	26100
lead	31	250	**169** J	**43.1** J	**48.3** J	22.5 J
magnesium			27700	26800	32600	11000
manganese	460	1100	263 J	**502** J	**504** J	**608** J
mercury	0.2	2	<0.07	<0.07	<0.07	<0.1
nickel	16	75	**22.6**	**33.8**	**30.8**	**37.9**
potassium			716	892	1130	1680
selenium			<0.7	<0.7	<0.7	<1
silver			0.3	0.4	0.3	0.8
sodium			273	237	314	390
thallium			<0.9	1.7 J	1.8 J	<1.4
vanadium			11.3	16.9	16.1	20.8
zinc	120	820	**144**	**134**	**120**	72.9
cyanide			4.9	6.5	4.2	<0.2

LEL - Lowest Effect Level in sediment, Ontario
SEL - Severe Effect Level in sediment, Ontario
bold - exceeds LEL
italics bold - exceeds SEL

TABLE 12 MILL CREEK GEOGRAPHIC INITIATIVE

BEECH DITCH, HINTON MILL, CROSSES RUN - PEST/PCB IN SEDIMENT - ug/kg

	LEL	*SEL*	Beech Ditch BD-1	Hinton Mill HM-1	Crosses Run CR-2	CR-2 (dup)	CR-1
a-BHC	6	300	<2.5	<2.6	<130	<120	<21
b-BHC	5	630	<2.5	<2.6	<130	<120	<21
d-BHC			<2.5	<2.6	<130	<120	<21
lindane	3	30	1.2 J	<2.6	<130	**24** J	<21
heptachlor			<2.5	<2.6	4500 J	5100 J	<21
aldrin			<2.5	<2.6	<130	<120	<21
hept. epoxide	5	150	<2.5	<2.6	**88** J	**77** J	**7.5** J
endosulfan I			<2.5	<2.6	<130	<120	200
dieldrin	2	2730	**2.8** J	<5.0	<250	<240	<41
DDE- 4,4	5	570	<4.8	<5.0	<250	270 J	<41
endrin	3	3900	<4.8	<5.0	<250	440 J	**12** J
endosulfan II			<4.8	<5.0	<250	<240	<41
DDD-4,4	8	180	<4.8	<5.0	***220*** J	***220*** J	**16** J
endosulfan sulfate			<4.8	<5.0	480 J	600 J	<41
DDT-4,4	7	360	<4.8	<5.0	***850*** J	***1900*** J	**29** J
methoxychlor			<25	<26	<1300	<1200	<210
endrin ketone			<4.8	<5.0	<250	<240	<41
endrin aldehyde			<4.8	<5.0	<250	16 J	4.9 J
a-chlordane	7	180	4.1 J	<2.6	***9700***	***8800*** J	**180**
g-chlordane	7	180	<2.5	<2.6	***9800*** J	***11000*** J	**160**
toxophene			<250	<260	<13000	<2400	<2100
PCBs			<48	<50	<2500	<2400	<410

LEL - Lowest Effect Level, Ontario
SEL - Severe Effect Level in sediment, Ontario; based on 3% TOC
Bold - exceeds LEL
Bold italics - exceeds SEL

APPENDIX A

Table 5. Number of NPDES permit violations documented at Mill Creek basin dischargers from 1990-1995. Data evaluated was contained in monthly operating reports submitted to the Ohio EPA by those entities.

Facility	Outfall	Parameter	Number of Violations	Total Violations (%)
Nestle R & D Center	001	pH	2	
		Water Temperature	6	8 (0.9%)
Marysville WTP	001	Suspended Solids	3	
		pH	1	4 (0.5%)
Marysville WWTP	001	Suspended Solids	5	
		BOD_5/cBOD_5	13	
		Ammonia	25	
		Lead	7	
		Mercury	12	
		Hex. Chromium	1	
		Fecal coliform	4	
		Antimony	2	
		Cadmium	4	73 (8.5%)
Union County Home	001	Suspended Solids	85	
		BOD_5/cBOD_5	31	
		Dissolved Oxygen	72	
		Ammonia	4	192 (22.5%)
General Industries	001	Oil & Grease	16	
	002	Fecal coliform	5	
		BOD_5/cBOD_5	9	
		Suspended Solids	6	
		Ammonia	11	47 (5.5%)
Mill Creek Estates	001	Suspended Solids	19	
		BOD_5/cBOD_5	8	
		Fecal coliform	43	
		Dissolved Oxygen	4	
		Residual Chlorine	23	97 (11.3%)
The Scotts Company	001	Suspended Solids	15	
		Residual Chlorine	4	
		pH	3	
		Ammonia	54	
		Dissolved Oxygen	2	
		Fecal coliform	7	
		BOD_5/cBOD_5	4	

Table 5. continued.

Facility	Outfall	Parameter	Number of Violations	Total Violations (%)
The Scotts Company (continued)	002	BOD_5/$cBOD_5$	2	
		Suspended Solids	1	
		Ammonia	21	
		Residual Chlorine	1	
	003	Suspended Solids	2	
		Residual Chlorine	1	
		Ammonia	19	
	004	Fecal coliform	2	
		Ammonia	2	
		Residual Chlorine	5	
	005	Suspended Solids	18	
		Fecal coliform	2	
		Residual Chlorine	4	
		Ammonia	8	
		BOD_5/$cBOD_5$	2	
	006	Water Temperature	6	
	008	pH	4	189 (22.1%)
Goodyear	001	Suspended Solids	6	
		Dissolved Oxygen	4	
		Fecal coliform	5	15 (1.8%)
BMY Corporation	001	BOD_5/$cBOD_5$	19	
		Suspended Solids	55	
		Ammonia	72	
		pH	4	
		Dissolved Oxygen	1	151 (17.7%)
ODOT (U.S. 33 Rest Area)	001	Suspended Solids	6	
		pH	1	
		BOD_5/$cBOD_5$	2	
		Dissolved Oxygen	2	
		Ammonia	1	12 (1.4%)
Ostrander WWTP	001	pH	36	
		Suspended Solids	15	
		Dissolved Oxygen	6	
		Fecal coliform	5	62 (7.3%)
Northwood Stone	001	Suspended Solids	5	5 (0.6%)
Total Violations (all dischargers)				855

APPENDIX B

Table 1. Aquatic life use attainment status for stations sampled in the Mill Creek basin based on data collected July-September, 1995. The Index of Biotic Integrity (IBI), Modified Index of well being (MIwb), and Invertebrate Community Index (ICI) scores are based on the performance of fish and macroinvertebrate communities. The Qualitative Habitat Evaluation Index (QHEI) is a measure of the ability of the physical habitat to support biological communities. All sites were evaluated using the "wading method" IBI metrics unless indicated otherwise.

RIVER MILE Fish/Invert.	IBI	Modified Iwb	ICI[a]	QHEI[b]	WWH Attain-ment Status[c]	Comments
Mill Creek						
Eastern Corn Belt Plains WWH Use Designation (Existing)						
39.1/39.4	43	8.1ns	28/MG[d]	61.5	FULL	Ust. Otter Creek
36.1/36.0	46	8.2ns	40	64.0	FULL	Dst. Otter Creek
28.2/28.2	51	8.8	42	71.0	FULL	Wheeler-Green Rd.
24.8/24.8	49	8.7	40	73.0	FULL	Cotton Slash Rd.
19.3/19.3	41	8.5	40	74.5	FULL	Maple St.
19.1/19.0	45	7.7*	42	70.5	PARTIAL	Main St.
18.4/18.6	44	7.5*	40	77.0	PARTIAL	Dst. Town Run
18.2/18.2	*37*	*6.4*	*16*	*NA*	*NA*	*Marysville WWTP Mixing Zone*
18.1/18.1	39ns	6.6*	18*	71.0	PARTIAL	Cherry St.
16.2/16.9	36ns	<u>5.2</u>*	20*	63.0	NON	Adj. Waldo Rd
14.6/14.6	42	8.5	44	68.0	FULL	U.S. 36
12.0/12.1	37	8.3	42	78.5	FULL	Ust. Crosses Run
11.6/11.7	34*	8.0ns	40	74.5	PARTIAL	Dst. Crosses Run
6.9/6.9	38ns	8.6	G	74.5	FULL	Bellpoint/Hinton Mill Rd.
4.4/4.4	49	9.7	44	88.5	FULL	Ust. Ostrander WTP
3.7/3.7	54	9.4	44	81.0	FULL	Dst. WWTP & Blues Cr.
1.7/1.6	51	9.6	50	91.0	FULL	Near mouth
Otter Creek						
Eastern Corn Belt Plains WWH Use Designation (Existing)						
0.7H/0.7	45	NA	G	70.5	FULL	Dst. U.S. 33 Construction
Town Run						
Eastern Corn Belt Plains WWH Use Designation (Recommended)						
0.9H/0.8	<u>26</u>*	NA	F*	45.5	NON	Ust. Eljer Plumbingware

Table 1. (continued).

RIVER MILE Fish/Invert.	IBI	Modified Iwb	ICI[a]	QHEI[b]	WWH Attainment Status[c]	Comments
Town Run (continued)						
0.7H/0.7	30*	NA	F*	53.5	NON	Dst. Eljer Plumbingware
0.1H/0.1	28*	NA	P*	60.5	NON	Dst. Marysville urban
Crosses Run						
	Eastern Corn Belt Plains WWH Use Designation (Existing)					
2.8H/2.8	12*	NA	P*	28.0	NON	@ Dairy Farm
-- /2.4	NA	NA	4*	NA	(NON)	Ust. Trib./Water Dam
2.1H/2.0	12*	NA	0*	42.5	NON	Dst. Scotts Company
0.9H/0.6	12*	NA	6*	73.5	NON	Dst. N. Fk. Crosses Run
North Branch Crosses Run						
	Eastern Corn Belt Plains Undesignated (WWH Use Recommended)					
1.0H/1.0	12*	NA	P*	45.0	NON	Ust. Scotts Company
0.2H/0.1	14*	NA	0*	30.5	NON	Dst. Scotts Company
Unnamed Tributary to Crosses Run at RM 2.24						
	Eastern Corn Belt Plains Undesignated (No Recommended Use)					
-- /0.1	NA	NA	VP*	NA	(NON)	@ mouth
Blues Creek						
	Eastern Corn Belt Plains WWH Use Designation (Existing)					
0.7/0.6	42	8.4	G	71.5	FULL	Near mouth

* Significant departure from ecoregion biocriterion; *poor* and *very poor* results are underlined.

ns Nonsignificant departure from ecoregion biocriterion (≤4 IBI or ICI units; ≤0.5 MIwb units).

a A narrative evaluation based on the qualitative sample (G-*good*, MG-*marginally good*, F-*fair*, P-*poor*) is used in lieu of the ICI when artificial substrate data are not available.

b All Qualitative Habitat Evaluation Index (QHEI) values are based on the most recent version (Rankin 1989).

c Use attainment status based on one organism group is parenthetically expressed.

d The quantitative (artificial substrate) sample was affected by nondetectable current speed; a *marginally good* narrative evaluation was substituted after further analysis of the data.

W Wading site type

Table 1. (continued).

H Headwater site type

Biocriteria: Eastern Corn Belt Plains (ECBP)
(OAC Chapter 3745-1-07, Table 7-17)

INDEX -	Site Type	WWH	EWH	MWH[e]
IBI -	Headwater/Wading	40	50	24
Mod. Iwb -	Wading	8.3	9.4	5.8
ICI		36	46	22

e - Modified Warmwater Habitat for channelized habitats

APPENDIX C

APPENDIX C

Due to its size, the CLP Data Package was not included in the scanned image of this report. If interested in the CLP Data Package, please contact the Division of Emergency and Remedial Response, Central District Office.

APPENDIX D

MILL CREEK

MINI-REMEDIAL ACTION PLAN

FINDINGS

MILL CREEK STUDY AREA
MARYSVILLE, OHIO
UNION COUNTY

PREPARED BY:

DAN TJOELKER
SAMIR YEBAILE
LIN KRAUSE

OHIO EPA
DIVISION OF EMERGENCY & REMEDIAL RESPONSE
CENTRAL DISTRICT OFFICE

JANUARY, 1996

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

1.0 Introduction

A study of the Mill Creek area in Marysville, Ohio was completed between April 4 to April 6, 1995 by the Division of Emergency & Remedial Response.. A total of 41 sediment, surface water, soil, and quality control samples were collected from Mill Creek, Town Run, McCarthy Park, the Marysville Landfill, and the Ray Lewis Landfill. The purpose of this study was to identify and investigate possible sources of potential contamination in the Mill Creek area in Marysville, Ohio. Potential contaminant source areas identified include: the former Eljer Plumbingware facility, the Marysville Wastewater Treatment Plant (WWTP), the Marysville and Ray Lewis Landfills, and unknown discharges into Town Run and McCarthy Park storm sewers.

2.0 Site Location/Description

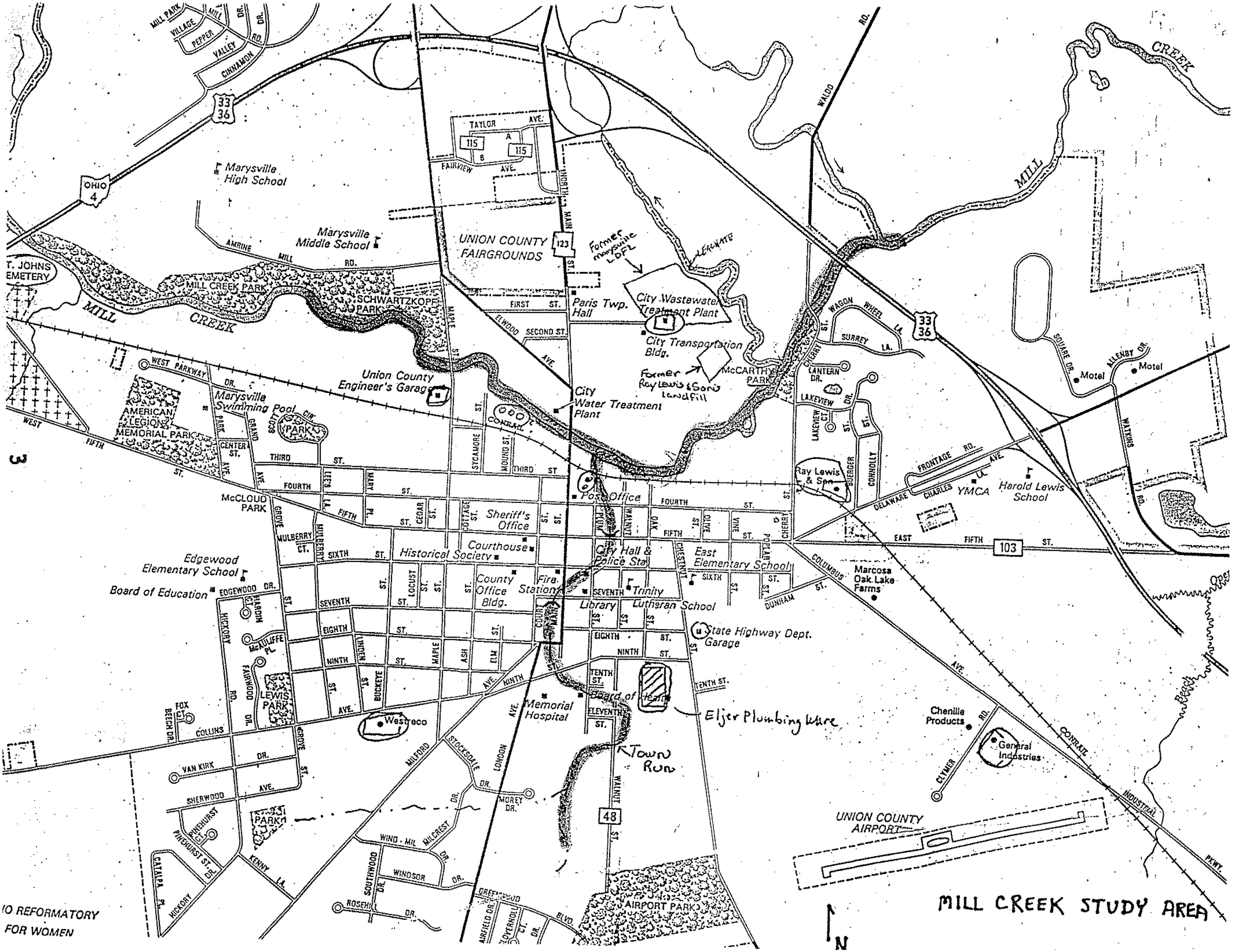
The sampling area focused on a portion of the Mill Creek watershed located in Marysville, Union County, Ohio (Figure 1). Town Run, a tributary to Mill Creek, was also included in the study. Town Run is an urban stream that accepts storm water discharges from city streets and is partially culverted through the downtown area of Marysville. Samples were also collected at the Marysville and Ray Lewis Landfills and at the confluence of two storm sewer discharges at McCarthy Park.

Mill Creek displays slight meander patterns in the study area, but primarily flows through relatively straight river reaches. Generally, the stream is lined with trees and its banks are typically 5 to 10+ feet in height. Significant fill and cement material have been deposited on the stream banks for stabilization and erosion control. Typically, Mill Creek is about 25-50+ feet wide and about 2-3 feet deep. Two dam structures are located within the study area, one is located upstream of Maple Street and the second is a weir located upstream of the WWTP. These dams could affect sediment transport and potential contaminant migration within Mill Creek by forming depositional areas upstream of these structures.

Town Run is an urban stream about 5-15+ feet wide and 6 to 18 inches deep. Locally, the stream displays a very broad meander pattern. Significant channelization has occurred to control its flow and reduce erosion. Numerous bricks and cement materials lie in the stream bed and along the banks. The stream banks of Town Run are typically 3 to 5+ feet in height.

3.0 Sampling

All sampling was completed utilizing the approved 3/20/95 Mill Creek Mini-Remedial Action Plan (RAP). All Division of Emergency & Remedial Response (DERR) sampling procedures were followed as specified in the DERR Sampling Guidance-Field Standard Operating Procedures. Locations where samples were collected are displayed in Figure 2. Appropriate sample volumes were collected based on the method for sample analysis. Samples were analyzed for metals (US EPA Method 6010, 7470), volatile organics (VOC) (8240), semi-volatile organics (SVOC) (8270), pesticides and PCBs (8080), and herbicides (8150). Two surface water and three sediment duplicate samples were collected as quality control samples. A


MILL CREEK STUDY AREA
N
MILL CREEK
Marysville High School
Marysville Middle School
UNION COUNTY FAIRGROUNDS
Former Marysville LDFL
Leachate
City Wastewater Treatment Plant
City Transportation Bldg.
Former Ray Lewis & Sons landfill
McCARTHY PARK
Paris Twp. Hall
City Water Treatment Plant
Union County Engineer's Garage
MILL CREEK PARK
SCHWARTZKOPF PARK
ST. JOHNS CEMETERY
AMERICAN LEGION MEMORIAL PARK
Marysville Swimming Pool
SCOTT PARK
McCLOUD PARK
Post Office
Sheriff's Office
Courthouse
Historical Society
City Hall & Police Sta.
Fire Station
County Office Bldg.
Library
Trinity Lutheran School
East Elementary School
State Highway Dept. Garage
Board of Health
Eljer Plumbing Ware
Town Run
Memorial Hospital
Westreco
Edgewood Elementary School
Board of Education
LEWIS PARK
Ray Lewis & Son
YMCA
Harold Lewis School
Marcosa Oak Lake Farms
Chenille Products
General Industries
UNION COUNTY AIRPORT
AIRPORT PARK
Motel
Motel
OHIO REFORMATORY FOR WOMEN
CONRAIL
33 36
OHIO 4
123
103
48

trip blank was also utilized to determine the potential for VOC contamination during sample shipment and storage.

On April 4, 1995, surface water (SW) samples were collected from the study area. Samples were collected by emersion of the appropriate laboratory provided glass container into the stream. Sample SW-2, at a field tile/storm sewer just south of Eljer Plumbingware, was collected after intercepting the sample with a clean stainless steel bucket from the outfall prior to the filling of sample containers.

On April 5, 1995, sediment (SE) samples were collected from the study area. Sediment samples were collected with clean stainless steel scoops and spoons from the stream bed and placed in laboratory provided glass containers with teflon lined lids. Sample depths were focused on the 0 to 3 inch depth and fine-grained sediment whenever possible. Sample collection proceeded from downstream to upstream.

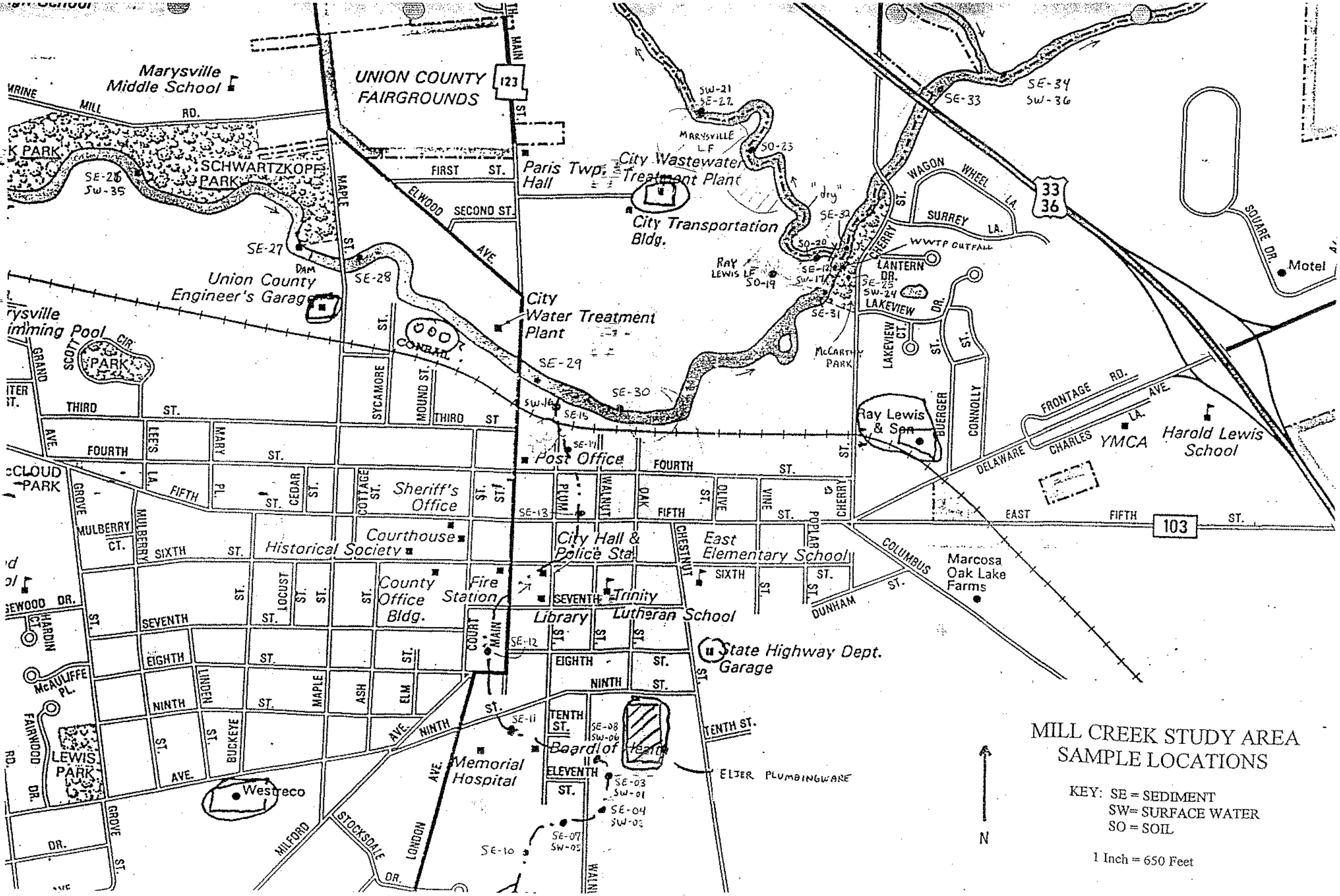
On April 6, 1995, the remaining soil, sediment, and surface water samples were collected from the Marysville and Ray Lewis Landfill areas.

4.0 Mill Creek Analytical Results

Sample Locations/Descriptions: sediment (SE), surface water (SW), (see also Figure 2).

*SE-34, **SW-36 - Downstream of former Mill Creek channel, north of US Rt. 33 bridge.
*SE-33 - Upstream of former Mill Creek channel, just north of US Rt. 33 bridge.
*SE-32 - Downstream of WWTP outfall.
*SE-18, **SW-17 - At WWTP outfall.
*SE-31 - Upstream of WWTP outfall, above weir.
*SE-30 - Downstream of Town Run confluence.
*SE-29 - Upstream of Town Run confluence, east of Main St. bridge.
*SE-28 - East of Maple St. bridge.
*SE-27 - Upstream of dam at Schwartzkopf Park (background).
*SE-26, **SW-35 - South of Marysville High School and Amarine Road, at Mill Creek Park (background).
**SW-24 - McCarthy Park at confluence of two storm sewer outfalls.
**SW-21 - North of Marysville Landfill in former Mill Creek channel.

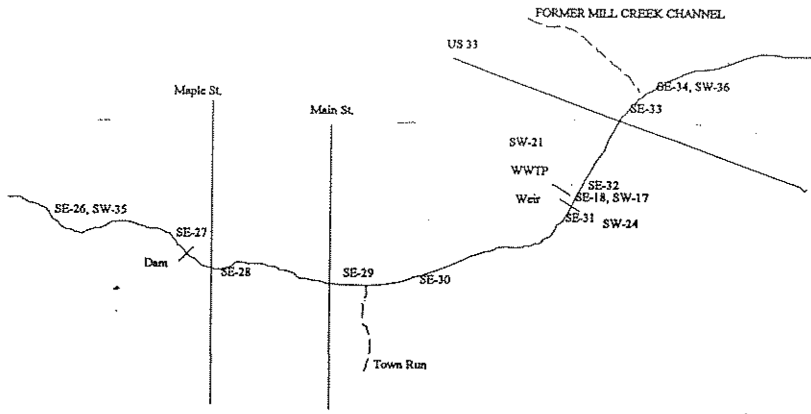
* analyzed for metals only
** analyzed for metals, VOC, SVOC, PCB/Pesticides, Herbicides



MILL CREEK STUDY AREA
SAMPLE LOCATIONS

KEY: SE = SEDIMENT
SW = SURFACE WATER
SO = SOIL

1 Inch = 650 Feet



4.1 Mill Creek Sediment

Table 1 is a summary of the sediment sample results for Mill Creek. Upstream Samples SE-26 and SE-27 were chosen to represent potential background samples for the downstream samples. Since there are only two samples to determine background, complex statistical evaluations for determining background values for downstream comparison are not appropriate. For relative comparisons, downstream samples were compared to a value that was obtained by taking the average (mean) of the two background samples multiplied by 2 to account for potential natural variations (see Table 1). Any downstream samples exceeding this value would be considered potentially elevated.

Based on this relative comparison, the presence of elevated levels of contamination to Mill Creek appear to be minimal. Copper was elevated above background in Samples SE-31 and SE-18. Three samples, SE-33, SE-34, and SE-29, exceeded background lead concentrations. All downstream samples exceeded the background value for magnesium. Sodium was elevated in Samples SE-30, SE-18, SE-32, and SE-33. Zinc exceeded background in Sample SE-31.

Sediment screening levels have been established by the National Oceanic and Atmospheric Administration (NOAA) (1990) and by Ontario, Canada (1993). These sources provide screening concentration levels at which low environmental response would be expected (i.e. environmental response noted in less than 5% of the observations). The lead values at SE-33 and SE-34 exceed both the NOAA and Ontario screening levels (35 ppm and 31 ppm, respectively). Levels of copper in Samples SE-30, SE-31, and SE-18 exceed the Ontario

TABLE 1 MILL CREEK STUDY
MARYSVILLE, OH

MILL CREEK- SEDIMENT

				WWTP					Background		Mean x 2
Metals (ppm):	**SE-34**	**SE-33**	**SE-32**	**SE-18**	**SE-31**	**SE-30**	**SE-29**	**SE-28**	**SE-27**	**SE-26**	***Bkgd***
Aluminum	2140	1170	2510	3660	2390	2220	2920	1320	1950	4550	*6500*
Arsenic	<20	<20	<20	<20	<40	<40	<40	<20	<20	<20	*<20*
Barium	31.6	22.7	28.8	31.3	24	21.2	61.4	11	19.2	44.1	*63.3*
Beryllium	<.20	<.40	0.28	0.22	<.40	<.40	0.4	0.27	0.2	0.29	*0.49*
Cadmium	<.50	<1.0	<.50	<.5	<1.0	<1.0	<1.0	<.50	<.50	<.50	*<.50*
Chromium	7.4	4.5	5.1	6.9	9.8	4.6	4.2	3.2	3.7	7.4	*14.8*
Cobalt	3	2.5	4.5	3.6	4.2	3.5	3.8	3.6	3.1	6.1	*9.2*
Copper	15.8	10	9.7	***20.5***	***24.2***	16.5	14.4	8.1	5.6	11.1	*16.7*
Iron	6620	5750	10100	11100	9700	8260	9710	5970	6040	11900	*17940*
Lead	***60.5***	***84.6***	8.5	10.7	14	16	***28***	5.4	6	10.9	*16.9*
Magnesium	***12800***	***28000***	***21500***	***17100***	***28600***	***36400***	***19400***	***9670***	4370	2520	*6890*
Manganese	180	125	257	221	231	301	217	145	117	319	*436*
Nickel	11	9.2	14.4	15.8	10.3	7.3	8.5	6.8	8.7	14	*22.7*
Potassium	296	216	358	485	390	367	431	223	293	507	*800*
Selenium	<10	<20	<10	<10	<20	<20	<20	<10	<10	<10	*<10*
Silver	<1.0	<2.0	<1.0	<1.0	<2.0	<2.0	<2.0	<1.0	<1.0	<1.0	*<1.0*
Sodium	120	***140***	***188***	***244***	115	***149***	127	85	68	66	*134*
Thallium	<40	<80	<40	<40	<80	<80	<80	<40	<40	<40	*<40*
Vanadium	4.9	3.9	6.8	7.8	7	6.4	6.6	4.2	4.7	9.8	*14.5*
Zinc	4.9	41.7	34.7	48.7	***78***	48	53	19.6	26.8	38.1	*65*
Mercury	<.08	<.08	<.08	<.08	<.08	<.08	<.08	<.08	<.08	<.08	*<.08*

VOCs (ppb): acetone				75	
SVOCs (ppb):				ND	
PCB/Pesticides (ppb):				ND	
Herbicides (ppb): D-2,4				120	

140 exceeds background value

Sampled: 4/5/95

screening level of 16 ppm (the NOAA value is 70 ppm).

The volatile organic compound (VOC), acetone, and the herbicide, 2,4 D, were detected in sediment in Sample SE-18, collected at the WWTP outfall.

4.2 Mill Creek Surface Water

Table 2 is a summary of the water sample results for Mill Creek and water samples taken from McCarthy Park and near Marysville Landfill. Upstream Sample SW-35 was designated as the background sample. For sample comparisons, this background sample was multiplied by 2 to account for potential natural variations. Any downstream samples exeeding this value would be considered potentially elevated.

Chromium was elevated in Sample SW-36 (north of US Rt. 33 bridge). At the WWTP outfall, (SW-17), manganese, nickel, potassium, and sodium all exceeded background. In addition, acetone (18 ppb), gamma-BHC (0.19 ppb) and delta-BHC (0.12 ppb) were observed in this surface water sample at the WWTP outfall. Gamma-BHC was present in the downstream sample, SW-36 (0.06 ppb). At the McCarthy Park location (SW-24) sodium exceeded background for Mill Creek, in addition acetone and chloroform were identified at 12 and 11 ppb respectively. A surface water sample (SW-21) taken along the north side of Marysville Landfill near a possible leachate area was elevated with beryllium, iron, manganese, sodium, and zinc relative to Mill Creek background. Acetone (44 ppb) was also detected in Sample SW-21.

5.0 McCarthy Park, Marysville/Ray Lewis Landfills Analytical Results

Sample Locations/Description: (see Figure 2)

**SO-23 - Black sludge-like sample from former Mill Creek channel, northeast of Marysville Landfill.
**SE-22 - Sediment near "leachate" area in former Mill Creek channel, north of Marysville Landfill.
**SO-19 - Soil sample from Ray Lewis Landfill area.
**SO-20 - Soil sample from former Mill Creek channel, near WWTP outfall and Ray Lewis Landfill.
**SE-25 - Sediment sample at confluence of two storm sewer discharges in McCarthy Park.

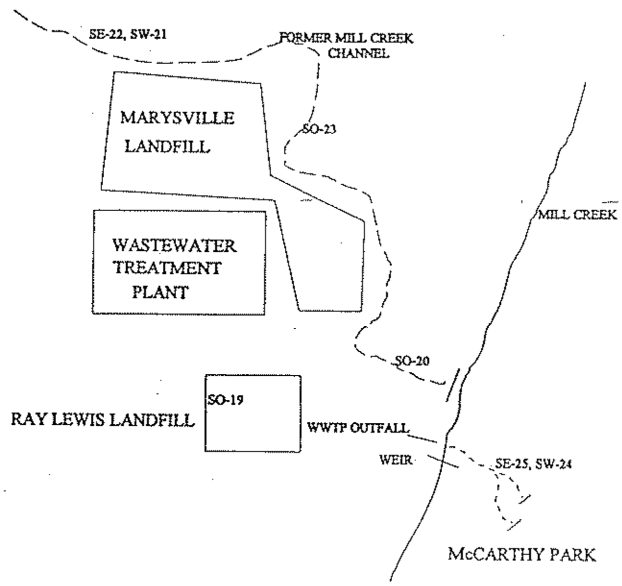
** analyzed for metals, VOC, SVOC, PCB/Pesticides, Herbicides

TABLE 2 MILL CREEK STUDY
MARYSVILLE, OH

MILL CREEK-SURFACE WATER	SW-36	(WWTP) SW-17	Background SW-35	*Bkgd x 2*	McCarthy Park SW-24	Marysville Landfill SW-21
Metals (ppm):						
Aluminum	0.27	0.11	0.49	*0.98*	<.10	0.48
Arsenic	<.20	<.20	<.20	*<.20*	<.20	<.20
Barium	0.0403	0.0068	0.0571	*0.114*	0.014	0.085
Beryllium	<.002	<.002	<.002	*<.002*	<.002	***0.0035***
Cadmium	<.005	<.005	<.005	*<.005*	<.005	<.005
Calcium	73.4	44.7	86.3	*172.6*	38.7	125
Chromium	***0.01***	<.01	<.01	*<.01*	<.010	<.01
Cobalt	<.01	<.01	<.01	*<.01*	<.01	<.01
Copper	<.02	<.02	<.02	*<.02*	<.02	0.03
Iron	0.6	0.37	0.92	*1.8*	<.10	***9.44***
Lead	<.05	<.05	<.05	*<.05*	<.05	<.05
Magnesium	32.5	22.4	39	*78*	21.6	37.4
Manganese	0.0701	***0.106***	0.0485	*0.097*	<.005	***0.339***
Nickel	<.02	***0.037***	<.02	*<.02*	<.02	<.02
Potassium	4.96	***12.8***	2.65	*5.3*	2.83	5.21
Selenium	<.10	<.10	<.10	*<.10*	<.10	<.10
Sodium	86.8	***233***	26.6	*53.2*	***95.1***	***58.4***
Vanadium	<.01	<.01	<.01	*<.01*	<.01	<.01
Zinc	0.033	0.043	0.022	*0.044*	<.02	***0.095***
Mercury	<.0002	<.0002	<.0002	*<.002*	<.0002	<.002
Cyanide	NA	0.026	NA		NA	NA
VOCs (ppb)	ND		ND			
acetone		18			12	44
Chloroform		ND			11	
Semi-VOCs (ppb)	ND	ND	ND		ND	ND
PCB/Pest. (ppb)			ND		ND	ND
gamma-BHC	0.06	0.19				
delta-BHC	ND	0.12				

12.8 concentration exceeds background value

Sampled: 4/4/95



5.1 McCarthy, Marysville/Ray Lewis Landfills Sediment and Soil Results

Table 3 provides a summary of the sediment and soil sample results taken at McCarthy Park and the Marysville and Ray Lewis Landfills. Relative to the Mill Creek background levels, sediment from a McCarthy Park sample (SE-25) exceeded background levels for copper, lead, nickel, sodium, and zinc. In addition, significant concentrations of polynuclear aromatic hydrocarbons (PAHs) were identified in the McCarthy Park sample. Sample SE-22, taken north of the Marysville Landfill, did not show any elevated metals relative to Mill Creek background; although, small concentrations of acetone (110 ppb) and 2 butanone (21 ppb) were detected. A soil/sludge sample (SO-23) taken from the old channel adjacent to the Marysville Landfill, appears to represent sewage sludge in its color and consistency. Elevated levels of barium, cadmium, chromium, copper, lead, nickel, silver, zinc, and mercury were detected relative to Mill Creek sediment. Small quantities of pesticides were also detected in this sample.

6.0 Town Run Analytical Results

Sample Locations/Descriptions: (see Figure 2)

**SE-15, **SW-16 - Upstream of confluence with Mill Creek.
*SE-14 - North of Fourth St.
*SE-13 - South of Fifth St.

TABLE 3 MILL CREEK STUDY
MARYSVILLE, OH

SEDIMENT (SE)/SOIL (SO)

	McCarthy Park	Marysville LF		Ray Lewis LF	
Metals (ppm):	SE-25	SE-22	SO-23	S0-19	SO-20
Aluminum	4250	377	2380	4520	4910
Arsenic	<20	<20	<20	<20	<20
Barium	34.6	15.9	596	42.4	45.3
Beryllium	0.37	<.20	<.20	0.42	0.46
Cadmium	<.50	<.5	2.51	<.50	<.50
Chromium	14.2	1.4	480	7.9	8.8
Cobalt	6.6	<1.0	1.9	5.8	6
Copper	***29.5***	5.8	538	14.1	16.8
Iron	13100	6510	6800	11600	14100
Lead	***28***	8.2	97.2	9.3	14
Magnesium	15700	432	1140	9010	5140
Manganese	364	96.9	313	101	187
Nickel	***27.3***	<2.0	86.6	15.3	15.6
Potassium	541	94.7	194	506	657
Selenium	<10	<10	<10	<10	<10
Silver	<1.0	<1.0	13.2	<1.0	1.2
Sodium	***136***	90	93.9	62	104
Thallium	<40	<40	<40	<40	<40
Vanadium	10.5	1.2	3.2	10.9	11.6
Zinc	***92.8***	51	447	40.5	39.3
Mercury	<.08	<.08	1.48	<.08	<.08

* sediment compared to Mill Creek background

VOCs (ppb):					ND
acetone	ND	110	24	12	
butanone,2-	ND	21	ND	ND	
methylene chloride	6.4	ND	ND	ND	
chloroform	19	ND	ND	ND	

Semi-VOCs (ppb):		ND		ND	ND
bis(2-ethylhexyl)phthalate			1400		
naphthalene	580				
methylnapthalene, 2-	380				
acenapthene	520				
dibenzofuran	610				
fluroene	890				
phenanthrene	5700				
anthracene	1400				
fluoranthene	7000				
pyrene	4200				
benzo(a)anthracene	3000				
chrysene	3100				
benzo(b)fluoranthene	2400				
benzo(k)fluroanthene	1700				
benzo(a)pyrene	2100				

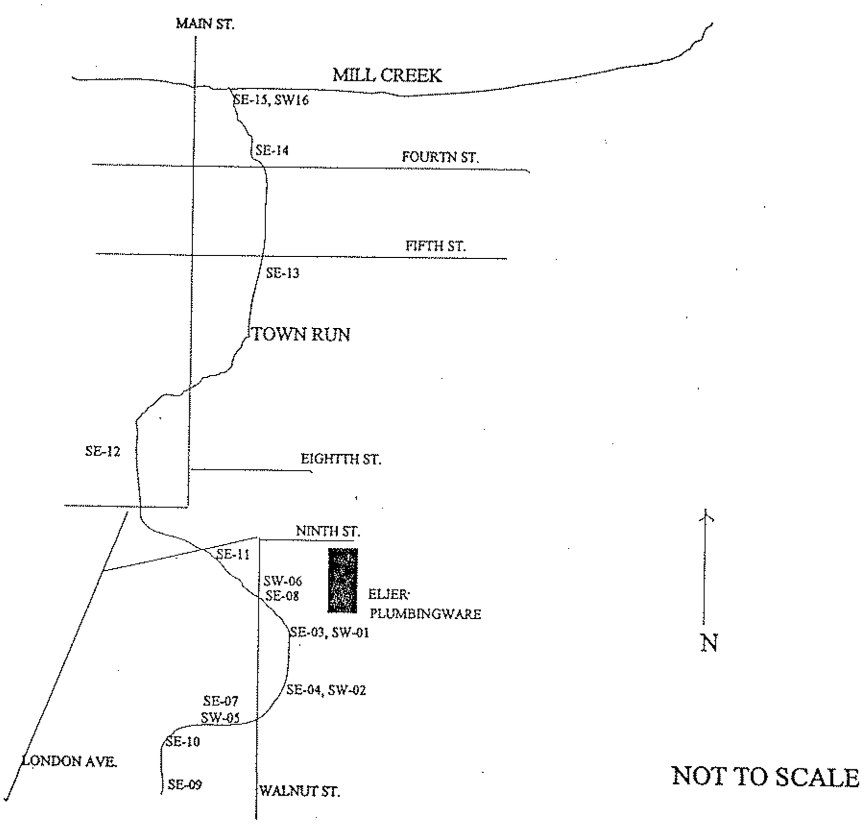
TABLE 3 (cont.)

	McCarthy Park	Marysville LF		Ray Lewis LF	
	SE-25	SE-22	SO-23	S0-19	SO-20
indeno(1,2,3-cd)pyrene	1400				
benzo(g,h,i)perylene	1000				
PCB/Pesticides (ppb)	ND	ND			ND
gamma-BHC			ND	4.9	
beta-BHC			5.6	ND	
heptachlor epoxide			14	ND	
endosulfan I			19	ND	
endrin			ND	1.8	
DDD, 4,4'			4.1	ND	
endrin aldehyde			6.1	ND	

Sampled: 4/5/95 - 4/6/95

*SE-12 - West of Main, north of Eighth St.
*SE-11 - South of Ninth St.
*SE-08, *SW-06 - South of Tenth, west of Walnut St.
*SE-03, **SW-01 - At Eljer Plumbingware discharge.
*SE-04, **SW-02 - Discharge pipe, south of Eljer Plumbingware.
*SE-07, *SW-05 - South of Eleventh St., west of Walnut St.
*SE-10 - Upstream background.
*SE-09 - Upstream background.

* analyzed for metals only
** analyzed for metals, VOC, SVOC, PCB/Pesticides, Herbicides



6.1 Town Run Sediment

Table 4 summarizes the results of sediment samples taken from Town Run. Numerous metal compounds exceeded background in Town Run. Sediment Samples SE-09 and SE-10 were designated as background samples. A background comparison value was derived by multiplying the mean of SE-09 and SE-10 by 2 to account for potential natural variations.

TABLE 4 MILL CREEK STUDY
MARYSVILLE, OH

TOWN RUN - SEDIMENT

Metals (ppm):	(Mill Cr. conflu.) SE-15	duplicate	SE-14	SE-13	SE-12	SE-11	SE-08	(Eljer outfall) SE-03	duplicate	SE-04	SE-07	Background SE-09	Background SE-10	***Bkgd Value (mean x 2)***
Aluminum	1470	2140	2270	1370	1900	4780	3470	2240	3370	3590	2850	3370	3560	*6930*
Arsenic	<20	<40	<40	<40	<200	<20	<20	<20	<40	<20	22	<20	<20	*<20*
Barium	15.8	30	41.1	20.7	22.5	***136***	39.1	23	69.7	47.3	51.8	34.5	40	*74.5*
Beryllium	<.40	<.40	<.40	<.40	<2.0	0.39	0.24	0.25	0.42	0.44	0.3	0.34	0.3	*0.64*
Cadmium	<1.0	<1.0	<1.0	<1.0	<5.0	<.50	***0.83***	***1.41***	***2.1***	***0.56***	<.5	<.5	<.5	*<.5*
Chromium	7.4	***15.7***	11.6	***12.7***	<10.0	9.5	***13.3***	***76.9***	***66.8***	6.9	9.4	6.2	6.1	*12.3*
Cobalt	2.4	5	***13.1***	4.3	<10.0	***13.5***	5.5	4.6	***13.6***	7.9	12.6	5.6	7.4	*13*
Copper	***53.7***	***181***	***105***	***93.3***	***152***	***201***	***501***	***4110***	***5080***	***93.3***	***34.7***	19.4	14.8	*34.2*
Iron	6580	14300	15900	9420	11800	15400	10200	12200	24700	10700	17900	8930	10700	*19630*
Lead	***37***	***70***	***72***	***73***	<50.0	20.4	***123***	***620***	***799***	21.2	27.5	14.5	14.8	*29.3*
Magnesium	***25100***	***31400***	***33800***	***24500***	***28100***	2430	5810	2500	4660	8820	6670	3920	3880	*7800*
Manganese	174	336	628	218	332	***1060***	317	160	***824***	316	579	285	353	*638*
Nickel	9.5	***28.1***	20.8	11.4	<20.0	***24.6***	***25.2***	***103***	***168***	14.7	16.6	11.7	12.7	*24.4*
Potassium	228	340	388	232	306	647	547	292	337	533	518	538	549	*1087*
Selenium	<20	<20	<20	<20	<100	<10	<10	<10	<20	<10	<10	<10	<10	*<10*
Silver	<2.0	<2.0	<2.0	<2.0	<10	***1.4***	<1.0	***1.8***	***4***	<1.0	<1.0	<1.0	<1.0	*<1.0*
Sodium	131	142	140	169	<500	132	123	154	160	96	129	156	143	*299*
Thallium	<80	<80	<80	<80	<400	<40	<40	<40	<80	<40	<40	<40	<40	*<40*
Vanadium	5.8	8.1	9.7	5.8	<10	12.2	8.8	8.3	11.4	10.4	11	8.1	10.5	*18.6*
Zinc	***169***	***291***	***330***	***151***	***640***	***93.6***	***1180***	***5720***	***5990***	***104***	70.7	53.5	41.1	*94.6*
Mercury	<.08	<.08	<.08	<.08	<.08	<.08	<.08	<.08	<.08	<.08	***0.18***	<.08	<.08	*<.08*

181 concentration exceeds background value

Sampled: 4/5/95

TABLE 4 MILL CREEK STUDY
MARYSVILLE, OH

TOWN RUN - SEDIMENT

VOCs (ppb):	(Eljer outfall) SE-03	duplicate	SE-04	(Mill Cr. confluence SE-15
acetone	0	25	100	0
Carbon disulfide	7.3	0	0	0
Butanone-2	0	0	15	0
Dichloroethene 1,1	14	13	0	0
Dichloroethane 1,1	12	20	0	0
Dichloroethane 1,2	35	28	0	0
Trichloroethane 1,1,1	60	56	0	0
Carbon tetrachloride	12	0	0	0
Trichloroethene	160	120	0	0
Semi-VOCs (ppb):				
Naphthalene	0	520	500	0
Methylnaphthalene-2	0	340	0	0
Dibenzofuran	0	380	330	0
Fluorene	0	480	530	0
Phenanthrene	3300	2800	2300	2100
Anthracene	560	550	540	390
Fluoranthene	7000	5000	4400	2700
Pyrene	3300	2100	2300	2600
Benzo(a)anthracene	2400	1600	1600	1100
Bis(2-ethylhexyl)phthalate	680	870	0	0
Chrysene	2700	1900	1800	1300
Benzo(b)fluoranthene	2300	1800	1600	1100
Benzo(k)fluroanthene	1600	620	670	900
Benzo(a)pyrene	1300	840	1000	950
Indeno(1,2,3-cd)pyrene	740	740	800	890
Benzo(g,h,i)perylene	520	390	420	630
Pesticides/PCBs (ppb):	ND	ND	ND	
Aldrin				6.3
DDE-4,4'				3.6
DDD-4,4'				6.2

Sampled: 4/5/95

In summary the following compounds were elevated above background at the stated locations:

Barium	SE-11
Cadmium	SE-04, SE-03, SE-08
Chromium	SE-03, SE-08, SE-13, SE-15
Cobalt	SE-03, SE-11, SE-14
Copper	SE-07, SE-04, SE-03, SE-08, SE-11, SE-12, SE-13, SE-14, SE-15
Lead	SE-03, SE-08, SE-13, SE-14, SE-15
Magnesium	SE-12, SE-13, SE-14, SE-15
Manganese	SE-03, SE-11
Nickel	SE-03, SE-08, SE-11, SE-15
Silver	SE-03, SE-11
Zinc	SE-04, SE-03, SE-08, SE-11, SE-12, SE-13, SE-14, SE-15
Mercury	SE-07

The analytical results were also compared to the NOAA (1990) and Ontario (1993) lowest environmental effect screening levels. The cadmium concentrations in Samples SE-03, and SE-04 exceed the Ontario level of 0.6 ppm. The Ontario level for chromium (26 ppm) was exceeded in Sample SE-03. All the elevated copper concentrations exceeded the Ontario level of 16 ppm. The NOAA level for copper (70 ppm) was exceeded in Samples SE-03, SE-04, SE-08, SE-11, SE-12, SE-13, SE-14, and SE-15. All the elevated lead levels exceeded both the Ontario and NOAA screening levels (31 and 35 ppm, respectively). The Ontario screening standard for nickel (16 ppm) was exceeded in Samples SE-07, SE-03, SE-08, SE-11, SE-14, SE-15; the nickel standard by NOAA (30 ppm) was exceeded in Sample SE-03. The NOAA screening level for silver (1 ppm) was exceeded in Samples SE-03 and SE-11. The zinc screening level (120 ppm for both Ontario and NOAA) was exceeded in Samples SE-03, SE-08, SE-11, SE-12, SE-13, SE-14, and SE-15.

Volatile organic compounds were detected in Samples SE-03 and SE-04 ranging from below detection limits to 160 ppb. Volatile organic compounds detected include: acetone, carbon disulfide, 2-butanone, 1,1 dichloroethene, 1,1 dichloroethane, 1,2 dichloroethane, 1,1,1 trichloroethane, carbon tetrachloride, and trichloroethene.

Numerous PAHs were detected in Samples SE-03, SE-04, and SE-15. The PAH concentration levels appear to be elevated based on the NOAA and Ontario lowest effect level for total PAH of 4000 ppb.

Pesticides were only detected in Sample SE-15, located just before Town Run discharges to Mill Creek. Aldrin, 4,4'DDE, and 4,4'DDD were detected at 6.3, 3.6, and 6.2 ppb, respectively. DDE and DDD exceed the NOAA screening levels (2 and 1 ppb, respectively). Aldrin exceeds the Ontario screening level of 2 ppb.

6.2 Town Run Surface Water

Table 5 summarizes the results of surface water analyses for samples taken from Town Run. Sample SW-5 represents background for Town Run. For comparison purposes, the background sample was multiplied by 2 times background to account for potential natural variations.

Background was exceeded for copper in Samples SW-02, SW-01, and SW-06. Nickel and zinc both exceeded background at SW-01.

Volatile organic compounds were also identified in the surface water. Acetone was detected in Samples SW-16 and SW-01. The volatile organic compounds 1,1 dichloroethane, 1,2 dichlroethene, 1,1,1 trichloroethane, and trichloroethene were detected in Sample SW-01 from 12 to 140 ppb. Trichloroethene at 120 ppb exceeds the US EPA Maximum Contaminant Level (MCL) for drinking water of 5 ppb.

7.0 Discussion

Based on this study it appears that Town Run and Mill Creek have been and continue to be impacted by various sources. The former Eljer Plumbingware facility appears to be a major contributor to elevated contamination concentrations in Town Run with limited impacts to Mill Creek. Surface water and sediment samples were taken from a drainage ditch that drains the waste pile behind Eljer Plumbingware and at the base of a field tile (?) that runs parallel to the southern end of the waste pile. The elevated levels of cadmium, chromium, lead, and silver in Town Run have been analyzed and detected in the waste pile at Eljer Plumbingware (Geraghty & Miller, 1993). Copper, nickel, and zinc also appear to be attributable to Eljer Plumbingware 19based on the elevated concentrations found in Town Run samples at the outfalls from the facility. Elevated sample results downstream from Eljer Plumbingware document migration of these contaminants. Copper and zinc appear to have migrated from Town Run into Mill Creek as seen in elevated concentrations in Mill Creek downstream of Town Run. Lead, nickel and zinc appear to have migrated significant distances in Town Run, but do not appear to be elevated in Mill Creek near the Town Run confluence. Mixing and dilution effects could be occurring that could limit the impact of Town Run discharges on Mill Creek. Cadmium, chromium, and silver appear to be more prevalent near the Eljer Plumbingware outfall with less downstream migration.

Volatile organic compounds have also impacted Town Run sediment and surface water from Eljer Plumbingware discharges. The extent of contaminant migration is less documented since only limited samples were analyzed for VOCs (i.e. at the Eljer Plumbingware outfalls and just above the confluence of Town Run with Mill Creek). The VOCs identified in sediment and surface water have been documented in waste pile and ditch samples collected at the former Eljer Plumbingware facility (Geraghty & Miller, 1993). The fact that surface water is impacted by these compounds is significant and suggests higher concentrations at the source area at Eljer Plumbingware.

TABLE 5 MILL CREEK STUDY
MARYSVILLE, OH

TOWN RUN- SURFACE WATER

Metals (ppm):	SW-16	SW-06	(Eljer outfall) SW-01	duplicate	SW-02	Background SW-05	*Bkgd x 2*
Aluminum	0.25	0.42	<.10	<.10	0.11	0.42	*0.84*
Arsenic	<.10	<.20	<.20	<.20	<.20	<.20	*<.20*
Barium	0.0509	0.0538	0.0694	0.0684	0.054	0.419	*0.84*
Beryllium	<.002	<.002	<.002	<.002	<.002	<.002	*<.002*
Cadmium	<.005	<.005	<.005	<.005	<.005	<.005	*<.005*
Calcium	76.3	77.9	93.6	94.1	88.6	63.7	*127.4*
Chromium	<.01	<.01	<.01	<.01	<.01	<.01	*<.01*
Cobalt	<.01	<.01	<.01	<.01	<.01	<.01	*<.01*
Copper	<.02	***0.032***	***0.385***	***0.272***	***0.028***	<.02	*<.02*
Iron	0.58	0.65	0.56	0.12	0.13	0.58	*1.16*
Lead	<.05	<.05	<.05	<.05	<.05	<.05	*<.05*
Magnesium	29.4	28.1	22.2	22.6	34.5	22.5	*45*
Manganese	0.103	0.124	0.14	0.125	0.0096	0.0803	*0.16*
Nickel	<.02	<.02	***0.037***	***0.034***	<.02	<.02	*<.02*
Potassium	4.13	4.11	3.36	3.33	1.92	3.82	*7.64*
Selenium	<.10	<.10	<.10	<.10	<.10	<.10	*<.10*
Silver	<.01	<.01	<.01	<.01	<.01	<.01	*<.01*
Sodium	97	104	27.7	27.6	40.9	104	*208*
Vanadium	<.01	<.01	<.01	<.01	<.01	<.01	*<.01*
Zinc	0.0506	0.072	***0.652***	***0.57***	0.021	0.114	*0.228*
Mercury	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	*<.0002*

	SW-16	SW-06	SW-01	duplicate	SW-02	SW-05
VOCs (ppb):		NA			ND	NA
acetone	32		12	78		
dichloroethane 1,1	ND		24	28		
dichloroethene 1,2	ND		35	37		
trichloroethane 1,1,1	ND		140	110		
trichloroethene	ND		120	120		
Semi-VOCs (ppb):	ND	NA	ND	ND	ND	NA
PCB/Pest. (ppb):	ND	NA	ND	ND	ND	NA

0.385 concentration exceeds background value
NA=Not Analyzed

Sampled: 4/4/95

It appears that many of the metals contaminants are bound to sediment particles and migrating primarily through sediment transport in Town Run. This is evident in the surface water analytical results. The only contaminants that appear to be migrating as dissolved compounds in the water column are copper, nickel and zinc. The impacts of these dissolved metals appears to be limited to the Eljer Plumbingware outfall and immediately downstream, no elevated surface water results, relative to background, were observed near the confluence with Mill Creek.

Contamination impacts to Mill Creek are less significant than Town Run. Due to the larger flow volume and various weirs and dams along the creek, dilution and transport disruption is possible. Only copper, lead, sodium, and zinc appear to be elevated relative to background. Zinc and copper contamination in Mill Creek are most likely attributable to Eljer Plumbingware. Elevated levels of lead in three samples may be from Eljer Plumbingware, but could also be attributed to storm water discharges from McCarthy Park, migration from the Marysville Landfill, and any unknown point sources downstream of the WWTP outfall. Magnesium differences are evident in Mill Creek and Town Run and appear to be a result of geochemical differences in the water. Potential explanations for these geochemical differences could include: the impacts of surface water discharge from city storm sewers, the effects of the cement material that lines the streams in its more urban stretches, and possible changes in geology.

The WWTP appears to be impacting the surface water quality of Mill Creek relative to background. Manganese, nickel, potassium, and sodium were elevated above background at a water sample taken directly from the discharge at the outfall. In addition, acetone and gamma- and delta- BHC were identified in the surface water. Elevated levels of copper and sodium, relative to background, were detected in sediment at the WWTP outfall and could be a result of sewage plant or upstream discharges. Acetone and 2,4 D were detected in the sediment at the outfall and could be a result of sewage plant discharges. Pesticides/herbicides identified in soil and water samples at the WWTP outfall suggest the possibility that these compounds are being discharged from the WWTP. In addition, the sludge-like material found in the channel by the Marysville Landfill (SO-23, Table 3), also showed detectable levels of pesticides. This further suggests that pesticides may be discharging from the WWTP through the sewage treatment process.

The McCarthy Park storm water discharge may also be impacting Mill Creek. Elevated levels of copper, lead, nickel, sodium, and zinc were found in sediments relative to Mill Creek. In addition, signicant PAHs were also found. This contamination suggests an upgradient source, whether a point source or non-point source, that discharges to the storm sewers and could be impacting Mill Creek. Again, a dilution effect may reduce the impacts on Mill Creek, but it could be or may become a source of chronic impacts.

The Marysville Landfill is also a potential source area to contaminants in Mill Creek. Historical sampling by DERR (1992) and US EPA (1991, 1993) have shown elevated levels of metals, VOCs, PAHs, and some pesticides in site soils and sediment. The Marysville Landfill is bordered to the north and east by the former channel for Mill Creek. In the late 1800s, the stream was straightened and a levee was built, cutting off the former channel present today. This channel is generally dry, but does collect water during wet periods. This channel flows to the north where it eventually rejoins Mill Creek north of US Route 33 and Waldo Road. Elevated metals have been found in this former stream channel, a portion of this could be related to overflows from the sewage sludge settling area. Sediment sample data from current and past sampling indicate a decrease in concentration in the downstream direction of the former channel. Any contaminants migrating through the former channel would join Mill Creek, north of US Route 33. Due to the isolation of the landfill and topographic relief, overland migration of contaminants to Mill Creek, between the WWTP outfall and US Route 33, is unlikely. The ground water pathway has not been evaluated and it is unknown if any ground water contamination exists that could be impacting Mill Creek at this time.

8.0 Summary

Sediments and surface water in the Mill Creek study area appear to be impacted from both identified and unidentified potential source areas in Marysville. Impacts to Town Run are readily apparent from the former Eljer Plumbingware facility. Additionally, unidentified and non-point sources in Marysville could also contribute contamination from surface water runoff and storm sewer discharges to Town Run. Mill Creek appears to have been impacted by Town Run discharges, but at less significant or elevated levels than Town Run. The identification of pesticides and herbicides in the water and sediment at the WWTP outfall to Mill Creek is also of concern. These compounds may be a component of the waste stream of the WWTP and could be impacting Mill Creek. Further evaluation of the plants effluent, waste streams, and sludge may be desirable to further evaluate this concern. Non-point source discharges to Mill Creek may be causing impacts as is evident in the samples obtained from the McCarthy Park discharge. Impacts of the Marysville and Ray Lewis Landfills appear to be localized in extent and major impacts appear to be confined to the former Mill Creek channel that lies adjacent to the landfill.

9.0 References

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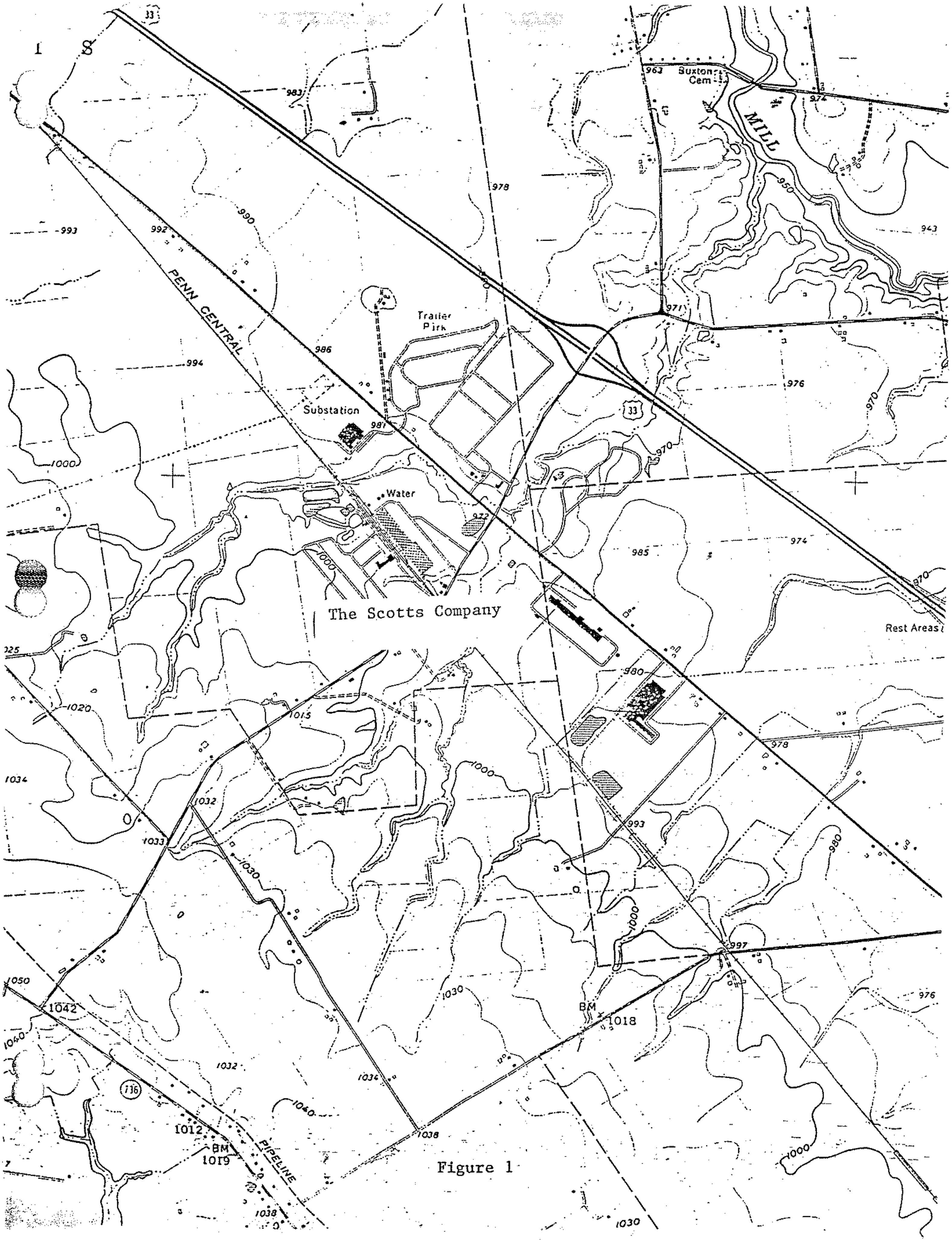
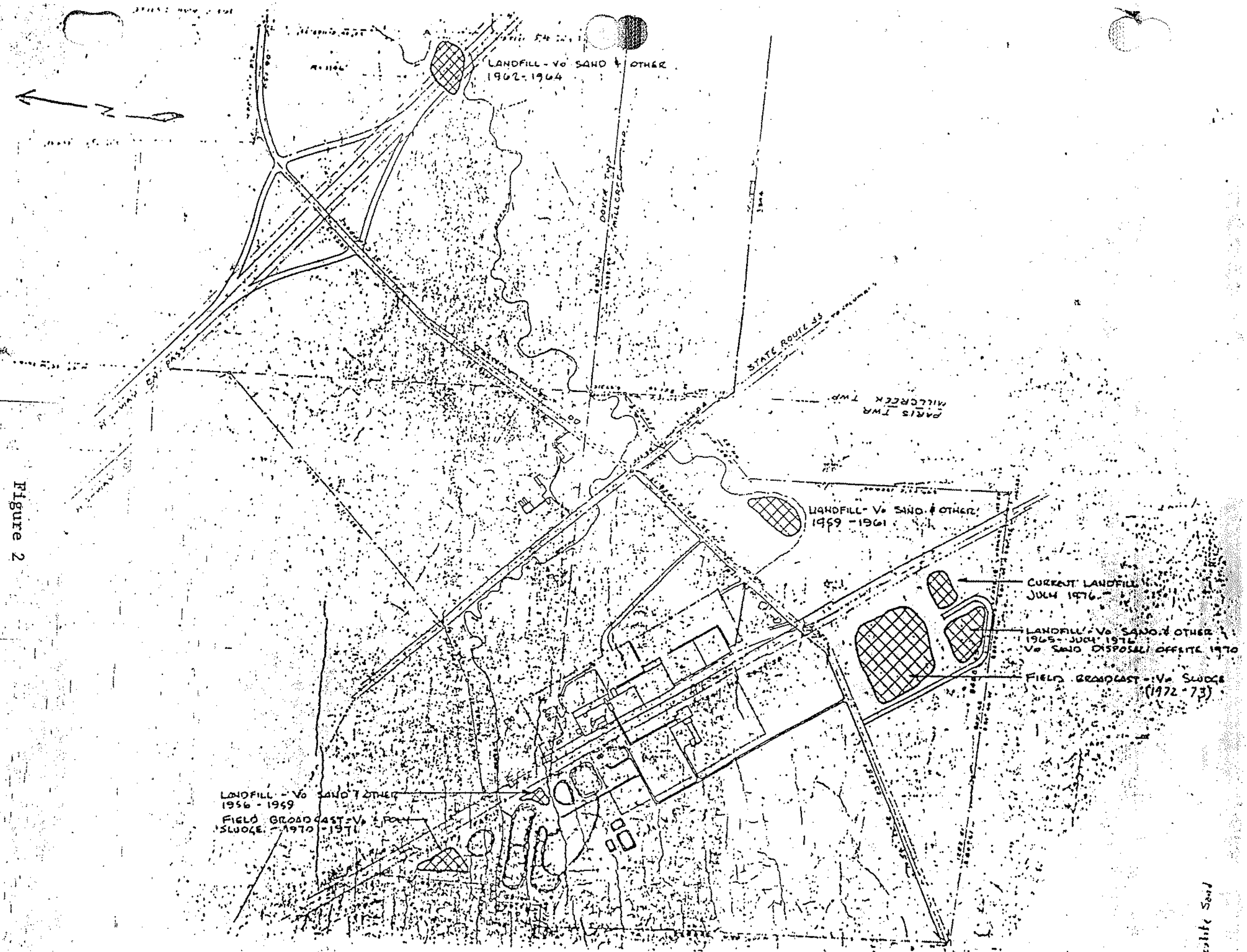
APPENDIX E



The Scotts Company
Trailer Park
Substation
Water
PENN CENTRAL
PIPELINE
MILL
Buxton Cem
Rest Areas
BM 1018
BM 1019

Figure 1



On-site Disposal Locations

Figure 2

Vermiculite Sand

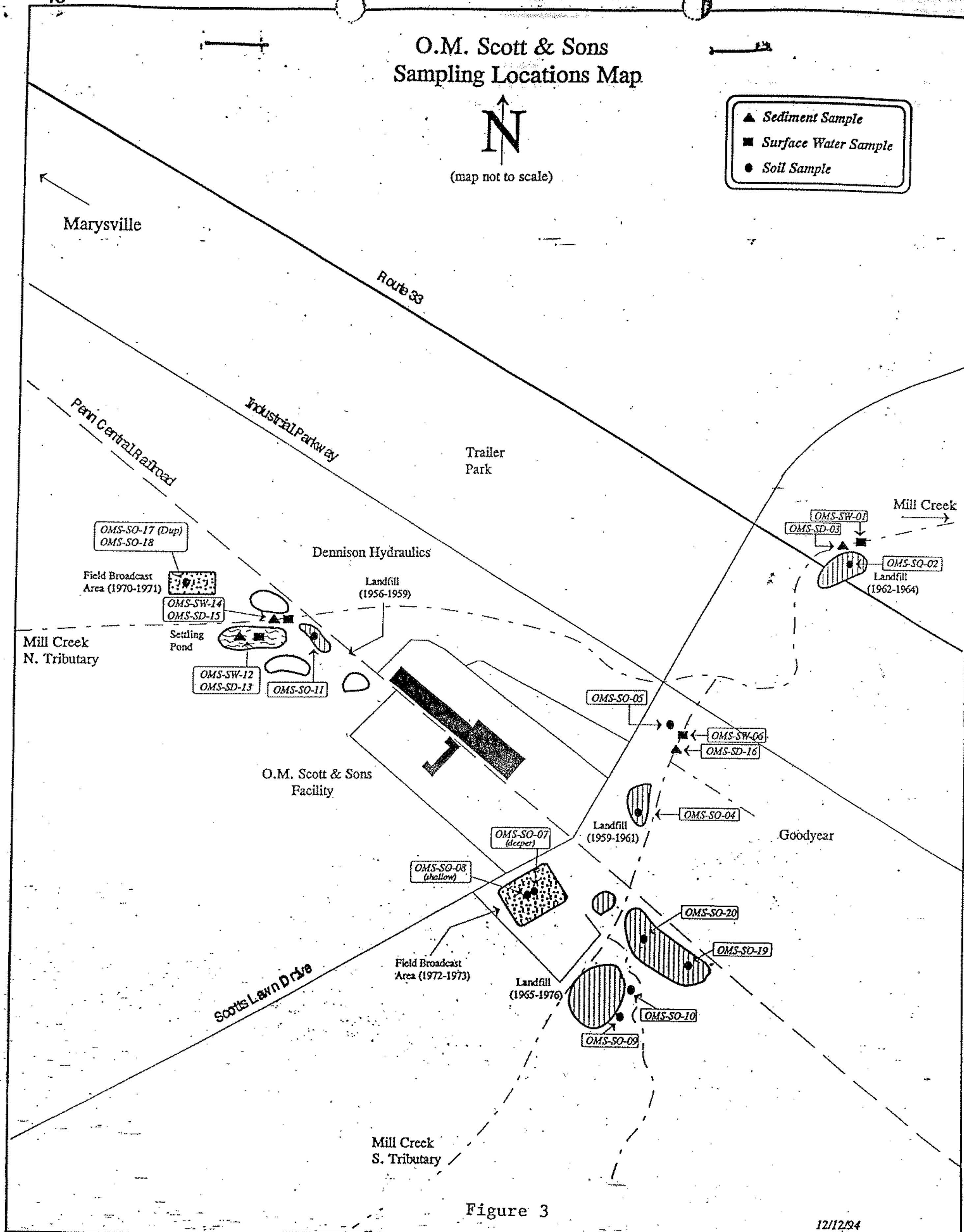

O.M. Scott & Sons
Sampling Locations Map
N
(map not to scale)
Sediment Sample
Surface Water Sample
Soil Sample
Marysville
Route 33
Industrial Parkway
Penn Central Railroad
Trailer Park
Mill Creek
OMS-SW-01
OMS-SD-03
OMS-SO-02
Landfill (1962-1964)
OMS-SO-17 (Dup)
OMS-SO-18
Field Broadcast Area (1970-1971)
Dennison Hydraulics
Landfill (1956-1959)
OMS-SW-14
OMS-SD-15
Settling Pond
Mill Creek N. Tributary
OMS-SW-12
OMS-SD-13
OMS-SO-11
OMS-SO-05
OMS-SW-06
OMS-SD-16
O.M. Scott & Sons Facility
OMS-SO-04
Landfill (1959-1961)
Goodyear
OMS-SO-07 (deeper)
OMS-SO-08 (shallow)
OMS-SO-20
OMS-SO-19
Field Broadcast Area (1972-1973)
Landfill (1965-1976)
OMS-SO-10
OMS-SO-09
Scotts Lawn Drive
Mill Creek S. Tributary
12/12/94

Figure 3

Table 1
O.M Scott & Sons Co.
Surface Water Sample Results
December 8, 1994

Sample I.D.	Test	Compound	Result
Water OMS-SW-01	VOCs	methylene chloride	1.8 J ppb
		acetone	14.0 ppb
		2-butanone	13.0 ppb
		toluene	6.1 ppb
		ethyl benzene	0.6 J ppb
		xylenes	2.3 J ppb
	SVOC	benzoic acid	2.0 J ppb
		4-chloro-3-methylphenol	3.0 J ppb
	Pest	heptachlor epoxide	0.07 ppb
		endrin	0.10 ppb
		endosulfan II	0.26 ppb
	Herb	2,4-D	62.0 ppb
Water OMS-SW-06	VOCs	methylene chloride	2.2 J ppb
		acetone	14.0 ppb
		chloroform	0.7 J ppb
		2-butanone	4.8 J ppb
		toluene	1.4 J ppb
	SVOC	bis(2-ethylhexyl)phthalate	8.0 J ppb
	Herb	2,4-D	4.6 ppb
Water OMS-SW-12	Metals	nickel	0.112 ppm
	VOCs	methylene chloride	1.7 J ppb
		acetone	12.0 ppb
		2-butanone	3.9 J ppb
	SVOC	benzoic acid	3.6 J ppb
		bis(2-ethylhexyl)phthalate	16.0 J ppb
	Pest	aldrin	0.07 ppb

Water OMS-SW-14	VOCs	methylene chloride	2.2 J ppb
		acetone	8.5 J ppb
		2-butanone	3.5 J ppb
		toluene	3.1 J ppb
	SVOC	benzoic acid	1.7 J ppb
		bis(2-ethylhexyl)phthalate	1.3 J ppb
	Pest	heptachlor	0.05 ppb
		heptachlor epoxide	0.05 ppb
		endosulfan II	0.06 J ppb
	Herb	2,4-D	15.0 ppb
Trip Blank	VOCs	acetone	5.9 J ppb

ppm - parts per million
ppb - parts per billion
J - The numerical value is an estimated quantity.

Table II
O.M. Scott & Sons Co.
Soil Sample Results
December 8, 1994

Sample I.D.	Test	Compound	Result
Soil OMS-SO-02		ammonia	990.0 ppm
		nitrate+nitrite	123.0 ppm
	Metals	beryllium	0.45 ppm
	VOCs	methylene chloride	4.5 J ppb
		acetone	38.0 ppb
		2-butanone	8.1 J ppb
		benzene	44.0 ppb
		4-methyl-2-pentanone	2.1 J ppb
		toluene	30.0 ppb
		chlorobenzene	26.0 ppb
		ethyl benzene	9.2 ppb
		styrene	0.9 J ppb
		xylenes	53.0 ppb
	SVOCs	1,2-dichlorobenzene	150.0 J ppb
		isophorone	98.0 J ppb
		2,4-dichlorophenol	74.0 J ppb
		naphthalene	180.0 J ppb
		hexachlorobutadiene	180.0 J ppb
		2-methylnaphthalene	180.0 J ppb
		acenaphthalene	230.0 J ppb
		dibenzofuran	84.0 J ppb
		fluorene	210.0 J ppb
		hexachlorobenzene	84.0 J ppb
		pentachlorophenol	230.0 J ppb
		phenenthrene	1800.0 ppb
		anthracene	380.0 ppb

		di-n-butylphthalate	150.0 J ppb
		fluoranthene	2000.0 ppb
		benzo(a)anthracene	860.0 ppb
		bis(2-ethylhexyl)phthalate	81.0 J ppb
		chrysene	930.0 ppb
		benzo(b)fluoranthene	1200.0 ppb
		benzo(k)fluoranthene	1000.0 ppb
		benzo(a)pyrene	960.0 ppb
		indeno(1,2,3-cd)pyrene	930.0 ppb
		dibenz(a,h)anthracene	390.0 ppb
		benzo(g,h,i)perylene	1000.0 ppb
	Pest	heptachlor	3500.0 J ppb
		4,4'-DDE	4400.0 J ppb
		4,4'-DDD	24000.0 J ppb
		Endosulfan II	8200.0 J ppb
		4,4'-DDT	100000.0 ppb
	Herb	2,4-D	160.0 ppb
		2,4,5-T	120.0 ppb
		2,4,5-TP	420.0 ppb
Soil OMS-SO-04	Metals	beryllium	0.43 ppm
		calcium	37500.0 ppm
		manganese	737.0 ppm
	VOCs	methylene chloride	14.0 ppb
		acetone	18.0 ppb
		2-butanone	2.8 J ppb
		4-methyl-2-pentanone	1.3 J ppb
		toluene	6.4 ppb
		xylenes	0.6 J ppb
	SVOCs	di-n-butylphthalate	60.0 J ppb

	Pest	Heptachlor epoxide	1.6 J ppb
		4,4'-DDT	6.9 ppb
Soil OMS-SO-05		ammonia	759.0 ppm
		nitrate+nitrite	197.0 ppm
	Metals	arsenic	59.0 ppm
		beryllium	0.81 ppm
		manganese	520.0 ppm
	VOCs	methylene chloride	6.4 ppb
		acetone	14.0 ppb
		chloroform	0.8 J ppb
		1,2-dichloroethane	3.0 J ppb
		2-butanone	14.0 ppb
		vinyl acetate	2.2 J ppb
		benzene	1.2 J ppb
		toluene	7.5 ppb
		ethyl benzene	2.1 J ppb
		xylenes	16.0 ppb
	SVOCs	2,4-Dichlorophenol	110.0 J ppb
		2,4,6-Trichlorophenol	490.0 ppb
		2,4,5-Trichlorophenol	990.0 ppb
		benzo(b)fluoranthene	96.0 J ppb
		benzo(k)fluoranthene	66.0 J ppb
	Pest	4,4'-DDE	16000.0 J ppb
		4,4'-DDD	20000.0 J ppb
		Endosulfan II	15000.0 J ppb
		4,4'-DDT	550000.0 ppb
	Herb	2,4-D	160.0 ppb
		2,4,5-TP (Silvex)	48.0 ppb
Soil OMS-SO-07		nitrate+nitrite	318.0 ppm

	Metals	beryllium	0.41 ppm
		calcium	40600.0 ppm
	VOCs	methylene chloride	11.0 ppb
		acetone	22.0 ppb
		2-butanone	8.4 J ppb
		4-methyl-2-pentanone	1.1 J ppb
		toluene	10.0 ppb
		xylenes	0.7 J ppb
	SVOCs	di-n-butylphthalate	130.0 J ppb
	Pest	Heptachlor	120.0 ppb
		Dieldrin	12.0 J ppb
		4,4'-DDD	88.0 ppb
		4,4'-DDT	37.0 ppb
		Chlordane	2900.0 ppb
Soil OMS-SO-08		Nitrate+nitrite	937.0 ppm
	Metals	beryllium	0.35 ppm
		calcium	42500.0 ppm
	VOCs	methylene chloride	12.0 ppb
		acetone	45.0 ppb
		2-butanone	37.0 ppb
		vinyl acetate	3.6 J ppb
		4-methyl-2-pentanone	0.5 J ppb
		toluene	27.0 ppb
	SVOCs	2,4-dichlorophenol	66.0 J ppb
		4-chloro-3-methylphenol	98.0 J ppb
		di-n-butylphthalate	170.0 J ppb
		chrysene	40.0 J ppb
	Pest	Heptachlor	180.0 ppb
		4,4'-DDE	25.0 J ppb

		Dieldrin	28.0 J ppb
		Endrin	23.0 J ppb
		4,4'-DDD	200.0 ppb
		4,4'-DDT	28.0 J ppb
		Endrin aldehyde	13.0 J ppb
		Endosulfan sulfate	8.7 J ppb
		Chlordane	4400.0 ppb
	Herb	2,4-D	480.0 ppb
Soil OMS-SO-09	Metals	Beryllium	0.49 ppm
		calcium	31700.0 ppm
		manganese	407.0 ppm
	VOCs	methylene chloride	8.0 ppb
		acetone	52.0 ppb
		2-butanone	45.0 ppb
		4-methyl-2-pentanone	1.0 J ppb
		toluene	49.0 ppb
	SVOCs	di-n-butylphthalate	160.0 J ppb
	Pest	delta-BHC	1.4 J ppb
		Heptachlor epoxide	1.0 J ppb
		Endosulfan I	2.3 ppb
		4,4'-DDT	3.5 ppb
		Chlordane	49.0 J ppb
Soil OMS-SO-10		Nitrate+nitrite	103.0 ppm
	Metals	beryllium	0.28 ppm
		calcium	84700.0 ppm
		manganese	390.0 ppm
	VOCs	methylene chloride	6.2 ppb
		acetone	48.0 ppb
		2-butanone	61.0 ppb

		4-methyl-2-pentanone	1.4 J ppb
		toluene	63.0 ppb
	SVOCs	naphthalene	2100.0 ppb
		2-methylnaphthalene	1700.0 ppb
		acenaphthylene	580.0 ppb
		acenaphthene	16000.0 ppb
		dibenzofuran	9000.0 ppb
		fluorene	17000.0 ppb
		phenanthrene	240000.0 ppb
		anthracene	27000.0 ppb
		di-n-butylphthalate	220.0 J ppb
		fluoranthene	330000.0 ppb
		pyrene	240000.0 ppb
		benzo(a)anthracene	110000.0 ppb
		chrysene	120000.0 ppb
		benzo(b)fluoranthene	70000.0 ppb
		benzo(k)fluoranthene	23000.0 ppb
		benzo(a)pyrene	100000.0 ppb
		indeno(1,2,3-cd)pyrene	5800.0 ppb
		dibenz(a,h)anthracene	15000.0 ppb
		benzo(g,h,i)perylene	25000.0 ppb
	Pest	aldrin	390.0 ppb
		heptachlor epoxide	30.0 J ppb
		endosulfan II	110.0 J ppb
		endosulfan sulfate	95.0 J ppb
		methoxychlor	930.0 J ppb
Soil OMS-SO-11		Nitrate+nitrite	336.0 ppm
	Metals	beryllium	0.20 ppm
	VOCs	methylene chloride	8.9 ppb

		acetone	72.0	ppb
		2-butanone	83.0	ppb
		toluene	46.0	ppb
	SVOCs	acenaphthylene	62.0	J ppb
		acenaphthene	35.0	J ppb
		fluorene	51.0	J ppb
		phenanthrene	290.0	J ppb
		anthracene	99.0	J ppb
		di-n-butylphthalate	36.0	J ppb
		fluoranthene	370.0	ppb
		pyrene	270.0	J ppb
		benzo(a)anthracene	130.0	J ppb
		chrysene	130.0	J ppb
		benzo(b)fluoranthene	98.0	J ppb
		benzo(k)fluoranthene	87.0	J ppb
		benzo(a)pyrene	110.0	J ppb
		indeno(1,2,3-cd)pyrene	49.0	J ppb
		benzo(g,h,i)perylene	58.0	J ppb
	Pest	heptachlor	32.0	ppb
		aldrin	13.0	J ppb
		4,4'-DDE	22.0	J ppb
		4,4'-DDD	89.0	ppb
		endrin aldehyde	31.0	J ppb
		endosulfan sulfate	9.2	J ppb
		chlordane	4200.0	ppb
	Herb	2,4,5-TP	33.0	ppb
Soil OMS-SO-17		Nitrate+nitrite	1070.0	ppm
	Metals	beryllium	0.53	ppm
		calcium	11900.0	ppm

	VOCs	methylene chloride	7.4 ppb
		acetone	13.0 ppb
		2-butanone	11.0 ppb
		toluene	52.0 ppb
	SVOCs	phenanthrene	78.0 J ppb
		di-n-butylphthalate	100.0 J ppb
		fluoranthene	95.0 J ppb
		pyrene	70.0 J ppb
		benzo(a)anthracene	41.0 J ppb
		chrysene	48.0 J ppb
		benzo(b)fluoranthene	34.0 J ppb
	Pest	Heptachlor	12.0 ppb
		aldrin	21.0 ppb
		4,4'-DDE	9.9 J ppb
		Endrin	10.0 J ppb
		4,4'-DDD	45.0 ppb
		endosulfan II	11.0 J ppb
		Endrin aldehyde	5.2 J ppb
		Chlordane	2000.0 ppb
Soil OMS-SO-18		nitrate+nitrite	1210.0 ppm
	Metals	beryllium	0.48 ppm
		calcium	20700.0 ppm
		manganese	494.0 ppm
	VOCs	methylene chloride	9.5 ppb
		acetone	14.0 ppb
		2-butanone	14.0 ppb
		toluene	42.0 ppb
	SVOCs	phenanthrene	37.0 J ppb
		di-n-butylphthalate	72.0 J ppb

		fluoranthene	38.0 J ppb
	Pest	Heptachlor	7.3 J ppb
		aldrin	6.0 J ppb
		Endrin	1.2 J ppb
		4,4'-DDD	32.0 ppb
		endosulfan II	7.9 J ppb
		Endrin aldehyde	4.4 J ppb
		Chlordane	930.0 ppb
Soil OMS-SO-19	Metals	beryllium	0.45 ppm
		calcium	11400.0 ppm
	VOCs	methylene chloride	5.0 ppb
		2-butanone	6.4 J ppb
		4-methyl-2-pentanone	0.6 J ppb
		toluene	22.0 ppb
	SVOCs	hexachlorobenzene	300.0 J ppb
		petachlorophenol	300.0 J ppb
		di-n-butylphthalate	130.0 J ppb
		pyrene	36.0 J ppb
	Pest	Heptachlor	1000.0 ppb
		aldrin	310.0 ppb
		4,4'-DDE	94.0 J ppb
		Endrin	180.0 J ppb
		4,4'-DDD	500.0 ppb
		endosulfan II	190.0 J ppb
		Endrin aldehyde	170.0 J ppb
		Chlordane	32000.0 ppb
Soil OMS-SO-20	Metals	beryllium	0.64 ppm
	VOCs	methylene chloride	5.6 ppb
		acetone	35.0 ppb

		2-butanone	27.0 ppb
		toluene	15.0 ppb
	SVOCs	phenanthrene	280.0 J ppb
		anthracene	69.0 J ppb
		di-n-butylphthalate	150.0 J ppb
		fluoranthene	550.0 ppb
		pyrene	450.0 ppb
		benzo(a)anthracene	260.0 J ppb
		chrysene	290.0 J ppb
		benzo(b)fluoranthene	200.0 J ppb
		benzo(k)fluoranthene	220.0 J ppb
		benzo(a)pyrene	230.0 J ppb
		indeno(1,2,3-cd)pyrene	130.0 J ppb
		dibenz(a,h)anthracene	54.0 J ppb
		benzo(g,h,i)perylene	140.0 J ppb
	Pest	Heptachlor	29.0 ppb
		aldrin	47.0 ppb
		4,4'-DDE	35.0 ppb
		4,4'-DDD	120.0 ppb
		endosulfan II	35.0 ppb
		4,4'-DDT	28.0 J ppb
		Endrin aldehyde	52.0 ppb
		Chlordane	3500.0 ppb

ppm - parts per million
ppb - parts per billion
J - The numerical value is an estimated quantity.

Table III
O.M. Scott & Sons Co.
Sediment Sample Results
December 8, 1994

Sample I.D.	Test	Compound	Result
Soil OMS-SD-03	Metals	beryllium	0.21 ppm
(downstream SR 33)		calcium	75500.0 ppm
		manganese	420.0 ppm
	VOCs	methylene chloride	2.3 J ppb
		carbon disulfide	0.7 J ppb
		chlorobenzene	0.4 J ppb
	SVOCs	naphthalene	36.0 J ppb
		acenaphthene	69.0 J ppb
		dibenzofuran	57.0 J ppb
		fluorene	91.0 J ppb
		phenanthrene	660.0 ppb
		anthracene	150.0 J ppb
		di-n-butylphthalate	47.0 J ppb
		fluoranthene	820.0 ppb
		pyrene	700.0 ppb
		benzo(a)anthracene	380.0 ppb
		bis(2-ethylhexyl)phthalate	110.0 J ppb
		chrysene	480.0 ppb
		benzo(b)fluoranthene	390.0 ppb
		benzo(k)fluoranthene	320.0 J ppb
		benzo(a)pyrene	390.0 ppb
		Indeno(1,2,3-cd)pyrene	200.0 ppb
		dibenz(a,h)anthracene	82.0 J ppb
		benzo(g,h,i)perylene	200.0 J ppb
	Pest	heptachlor	42.0 J ppb
		4,4'-DDE	120.0 J ppb

		4,4'-DDD	670.0 ppb
		4,4'-DDT	330.0 ppb
		endrin aldehyde	61.0 J ppb
		chlordane	7100.0 ppb
Soil OMS-SD-13	VOCs	methylene chloride	4.8 J ppb
		acetone	120.0 ppb
		carbon disulfide	11.0 ppb
		2-butanone	34.0 ppb
		benzene	2.4 J ppb
		4-methyl-2-pentanone	1.4 J ppb
		toluene	9.6 ppb
		xylenes	5.5 ppb
	SVOCs	fluorene	34.0 J ppb
		phenanthrene	190.0 J ppb
		anthracene	51.0 J ppb
		benzo(a)anthracene	140.0 J ppb
		bis(2-ethylhexyl)phthalate	140.0 J ppb
		chrysene	130.0 J ppb
		benzo(b)fluoranthene	74.0 J ppb
		benzo(k)fluoranthene	86.0 J ppb
		benzo(a)pyrene	88.0 J ppb
		Indeno(1,2,3-cd)pyrene	70.0 J ppb
		dibenz(a,h)anthracene	47.0 J ppb
		benzo(g,h,i)perylene	80.0 J ppb
	Pest	aldrin	61.0 ppb
		4,4'-DDD	17.0 ppb
Soil OMS-SD-15		Ammonia	1330.0 ppm
	Metals	beryllium	0.30 ppm
		calcium	28000.0 ppm

		magnesium	10800.0 ppm
		manganese	423.0 ppm
	VOCs	methylene chloride	1.7 J ppb
	SVOCs	phenanthrene	120.0 J ppb
		di-n-butylphthalate	180.0 J ppb
		fluoranthene	120.0 J ppb
		pyrene	95.0 J ppb
		benzo(a)anthracene	56.0 J ppb
		chrysene	80.0 J ppb
		benzo(b)fluoranthene	44.0 J ppb
		benzo(k)fluoranthene	44.0 J ppb
		benzo(a)pyrene	47.0 J ppb
	Pest	heptachlor	17.0 ppb
		aldrin	49.0 ppb
		4,4'-DDE	37.0 ppb
		dieldrin	31.0 J ppb
		4,4'-DDD	110.0 ppb
		4,4'-DDT	27.0 J ppb
		endrin aldehyde	4.5 J ppb
		endosulfan sulfate	1.5 J ppb
		chlordane	3900.0 ppb
Soil OMS-SD-16	Metals	beryllium	0.23 ppm
		calcium	14300.0 ppm
	VOCs	methylene chloride	9.8 ppb
		acetone	27.0 ppb
		carbon disulfide	0.9 J ppb
		2-butanone	3.5 J ppb
		toluene	0.5 J ppb
		xylenes	1.2 J ppb

	SVOCs	3+4-methylphenol	42.0 J ppb
		4-chloro-3-methylphenol	34.0 J ppb
		acenaphthene	49.0 J ppb
		fluorene	58.0 J ppb
		phenanthrene	620.0 ppb
		anthracene	140.0 J ppb
		di-n-butylphthalate	130.0 J ppb
		pyrene	680.0 ppb
		benzo(a)anthracene	400.0 ppb
		bis(2-ethylhexyl)phthalate	100.0 J ppb
		chrysene	510.0 ppb
		benzo(b)fluoranthene	390.0 ppb
		benzo(k)fluoranthene	330.0 ppb
		benzo(a)pyrene	380.0 ppb
		Indeno(1,2,3-cd)pyrene	270.0 J ppb
		dibenz(a,h)anthracene	110.0 J ppb
		benzo(g,h,i)perylene	290.0 J ppb
	Pest	heptachlor	12.0 J ppb
		4,4'-DDE	73.0 ppb
		dieldrin	19.0 J ppb
		endrin	28.0 J ppb
		4,4'-DDD	170.0 ppb
		endrin aldehyde	4.8 J ppb
		chlordane	5400.0 ppb

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