

CONTAMINANTS IN VACTOR TRUCK WASTES

Prepared for

Helen Pressley and Ann Wessel
Water Quality Program
Department of Ecology

by
Dave Serdar

Washington State Department of Ecology
Environmental Investigations and Laboratory Services Program
Toxics, Compliance, and Ground Water Investigations Section
Olympia, Washington 98504-7710

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ABSTRACT

The Washington State Department of Ecology is currently developing guidelines for the disposal of wastes generated by stormwater maintenance activities. This study characterizes contaminants in wastes removed from catch basins.

Decanted water and sediment samples were collected in 1991 and 1992 from vector trucks operating in residential and commercial areas of Snohomish County and industrial areas of Seattle. Samples were analyzed for conventional water quality variables, physical characteristics, cyanide, metals, volatile and semivolatile organic compounds, total petroleum hydrocarbons, chlorinated pesticides, and PCBs.

Water and sediment generally had elevated concentrations of metals, especially zinc, lead, chromium, copper, nickel, and arsenic. Metals in water were attributed to high solids concentrations and were generally undetected in the dissolved phase. Concentrations in water frequently exceeded EPA quality criteria for surface water, and sediment concentrations occasionally exceeded recommended guidelines for freshwater sediment quality. None of the samples analyzed using toxicity characteristic leaching procedures (TCLP) designated as dangerous waste under the state's dangerous waste regulations.

Aside from toluene, ethylbenzene, and xylenes, organics were infrequently detected in decanted water. Polycyclic aromatic hydrocarbons (PAH) and total petroleum hydrocarbons (TPH) were the predominant classes of organics in sediment. PAH and TPH concentrations exceeded the state's Model Toxics Control Act cleanup standards but did not surpass dangerous waste levels (PAH only). Neither chlorinated pesticides nor PCBs were detected.

Fecal coliform bacteria, lead, chromium, PAH, and TPH were considered to be highest priority contaminants. Concentrations of most contaminants tended to be highest in samples from industrial areas. Samples collected during the dry season generally had higher contaminant concentrations than those collected during the wet season.

Recommendations include establishing a program to periodically monitor vector truck wastes, determining the value of solids removal from decanted water, and using disposal sites where wastes cannot degrade surface waters.

INTRODUCTION

This report presents and discusses the results of chemical, physical, and bacteriological analyses of samples collected from vactor trucks in July 1991 and March/April 1992. Vactor trucks are widely used in urban areas to remove sediments from storm drain facilities such as catch basins. Samples of decanted water and sediments were collected from vactor trucks operating in residential, commercial, and heavily industrialized areas in the Puget Sound Basin. Although samples were analyzed for a variety of parameters, this report focuses on metals and organic compounds found in vactor truck wastes.

The study was conceived of by the Washington State Department of Ecology's (Ecology's) Stormwater Unit. It was conducted by Ecology's Toxics, Compliance, and Ground Water Investigations Section in conjunction with PTI Environmental Services of Bellevue, Washington.

Why was this Study Conducted?

Under a mandate of the Puget Sound Water Quality Management Plan, Ecology will require stormwater operation and maintenance programs for all jurisdictions within the Puget Sound Basin. As part of this requirement, Ecology is committed to develop guidelines for the disposal of wastes generated by maintenance of stormwater facilities such as catch basins. In order to develop these guidelines, Ecology must first have information on present disposal practices and the chemical, physical, and bacteriological nature of these wastes. A survey of disposal practices has recently been completed (Herrera Environmental Consultants, Inc., 1991-draft). The objective of this project is to characterize wastes that have been removed from catch basins by vactor trucks.

Why is this Important?

Disposal of vactor truck wastes is an important issue because of their potential to contaminate surface or ground waters. Current disposal practices potentially violate problem or dangerous waste regulations, water quality criteria, or may otherwise be harmful to the environment. There are presently few data on the characteristics of these wastes. However, contamination of catch basin sediments and water, which comprise the bulk of vactor wastes, has been well documented in the Puget Sound region (Tetra Tech, Inc., 1988; Resource Planning Associates, 1990). Lead, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and fecal coliform bacteria are examples of contaminants that have been found during catch basin surveys.

What are Vactor Trucks?

Vactor trucks vacuum the contents of catch basins into large holding tanks. Fresh water is often sprayed into catch basins to loosen sediments and ease removal. The solid material in the

resulting slurry generally settles to the bottom of the holding tank, allowing excess water to be decanted.

Disposal practices vary from jurisdiction to jurisdiction. In some cases, water is periodically decanted to a storm or sanitary sewer onsite to make room for more material. Sediment may be dumped and allowed to dewater before it is taken to a landfill. In many instances, water and sediment are dumped adjacent to the facility being cleaned.

The survey conducted by Herrera Environmental Consultants, Inc. (1991-draft) offers a categorical description of maintenance and disposal operations in 49 cities, counties, and private stormwater maintenance units. Half of the maintenance operators surveyed disposed of decanted water into storm drains and a majority stockpiled sediments or disposed of them in landfills.

Vector Operations for Present Study

During the course of collecting samples for this study, observations were made of catch basin maintenance and vector waste disposal practices from two jurisdictions: Snohomish County Public Works Department and Seattle Engineering Department. Although the methods for cleaning catch basins were nearly identical, the disposal practices differed greatly.

Crews from Snohomish County transported all of the vector wastes (water and sediment) to the Monroe dump station, a large gravel pit operated by the county. Water and sediment were dumped in one corner of the pit. Snohomish County plans to discontinue this practice once a decant/dewatering station is constructed or otherwise becomes available (Randy Johnson, personal communication).

Vector wastes generated by the Seattle vector crews were transported to a transfer station at the West Seattle maintenance yard. Decanted water was discharged to a sanitary sewer located at the yard; in some cases decanted water was discharged to sanitary sewers near the facilities being cleaned in order to make room for more material. Sediments were dumped into a concrete pit and allowed to dewater. Dewatered sediments were then removed by a private contractor to be used as a base for topsoil.

METHODS

Through an agreement with EPA, PTI Environmental Services conducted a portion of the sampling and analysis in this study. PTI developed a sampling and analysis plan, collected and analyzed decanted water samples in July 1991, performed quality assurance review of those analyses, and presented the data in a technical memorandum. All other work was completed by Ecology. More information on PTI's sampling and analysis plan may be found in *Characterization of Catch Basin Wastes: Sampling and Analysis Plan* (PTI Environmental Services, 1991a-draft). This sampling plan is the basis for the methods described in the following sections.

Two rounds of sample collection were conducted to represent dry and wet season conditions. Dry season sampling was conducted from July 22-31, 1991. The wet season sampling round was conducted from March 23 - April 7, 1992. Unfortunately, the months preceding each round of sampling were unusually dry and did not represent normal conditions. This resulted in very little standing water in catch basins during wet season sampling, and no standing water present during dry season sampling. Table 1 shows antecedent rainfall a month prior to each round of sampling.

Table 1. Precipitation for July 1991 and March 1992

Monitoring Station	Precipitation for July (inches)		Precipitation for March (inches)	
	1991	Normal	1992	Normal
Everett (Snohomish Co.)	0.34	1.08	1.77	3.55
Seattle	0.47	0.89	1.74	3.70

Source: NOAA. Climatological Data for Washington, July 1991 (Vol 95, No 7) and March 1992 (Vol 96, No 3).

Sampling Locations

Sites were selected to characterize contaminants from three broad land uses: high-density residential, heavy industrial, and commercial/light industrial. Commercial/light industrial areas were not sampled during the wet season. Table 2 lists sites where samples originated. Appendix A shows map locations of each station. Vector trucks operated exclusively in one of the three land use categories for each day of sampling.

Residential sites primarily consisted of housing developments with single family homes. Commercial/light industrial areas could be best described as small industrial parks or business districts with high vehicular traffic. The residential and commercial/light industrial areas used in this study are located in the southwest corner of Snohomish County.

Heavily industrialized areas were limited to Seattle’s Duwamish Plain where a large number of manufacturing and processing plants are located. In all the above cases, the drainage areas were limited to the specified land-use type.

Sampling Procedures

Figure 1 schematically diagrams the water and sediment sample collection. All of the Snohomish County samples were collected from vector trucks after they arrived at the Monroe dump station. Samples from Seattle were collected at the West Seattle maintenance yard or an auxiliary transfer station in West Seattle.

All sampling equipment was decontaminated prior to use by scrubbing with laboratory grade detergent (Alconox) followed by sequential rinses with tap water, deionized water, 6M hydrochloric acid or 10% nitric acid, deionized water, and pesticide-grade acetone. Sample

Table 2. Sites where samples originated for 1991–1992 survey of contaminants in vector truck wastes.

Station	City or County	Description	Land Use	Maintenance Jurisdiction	Sampling Date
R-1	Snohomish Co.	214th Ave. at 10th Pl.	Residential	Snohomish Co. Public Works Dept.	22 July 1991
R-2	Snohomish Co.	21 Oaks housing development	Residential	Snohomish Co. Public Works Dept.	23 July 1991
R-3	Snohomish Co.	21 Oaks housing development	Residential	Snohomish Co. Public Works Dept.	23 July 1991
C-4	Snohomish Co.	164th Ave. at 10th Ave. W	Commercial/Light Industrial	Snohomish Co. Public Works Dept.	24 July 1991
C-5	Snohomish Co.	164th Ave. at 6th Ave. W	Commercial/Light Industrial	Snohomish Co. Public Works Dept.	24 July 1991
C-6	Snohomish Co.	Rt. 9 just north of Rt. 522	Commercial/Light Industrial	Snohomish Co. Public Works Dept.	25 July 1991
C-7	Snohomish Co.	Rt. 9 just north of Rt. 522	Commercial/Light Industrial	Snohomish Co. Public Works Dept.	25 July 1991
I-8	Seattle	Lucile St. at 2nd Ave. S	Heavy Industrial	Seattle Engineering Dept.	29 July 1991
I-11	Seattle	Lucile St. at 6th Ave. S	Heavy Industrial	Seattle Engineering Dept.	29 July 1991
I-12	Seattle	5500 block of 1st Ave. S	Heavy Industrial	Seattle Engineering Dept.	30 July 1991
I-15	Seattle	Lucile St. at 3rd Ave. S	Heavy Industrial	Seattle Engineering Dept.	30 July 1991
R-16	Snohomish Co.	52nd Ave. W at 150th St. SW	Residential	Snohomish Co. Public Works Dept.	31 July 1991
21 Oaks-AM	Snohomish Co.	21 Oaks housing development	Residential	Snohomish Co. Public Works Dept.	23 March 1992
21 Oaks-PM	Snohomish Co.	21 Oaks housing development	Residential	Snohomish Co. Public Works Dept.	23 March 1992
Bailey St.	Seattle	Interstate 5 ramp at Bailey St.	Heavy Industrial	Seattle Engineering Dept.	25 March 1992
Casc. Hts-AM	Snohomish Co.	Cascade Hts. housing development	Residential	Snohomish Co. Public Works Dept.	30 March 1992
Casc. Hts-PM	Snohomish Co.	Cascade Hts. housing development	Residential	Snohomish Co. Public Works Dept.	30 March 1992
S. Brandon St.	Seattle	Brandon St. at 4th Ave. S	Heavy Industrial	Seattle Engineering Dept.	6 April 1992
S. Dawson St.	Seattle	Dawson St. at 2nd Ave. S	Heavy Industrial	Seattle Engineering Dept.	6 April 1992
Lucile St.	Seattle	Lucile St. at 3rd Ave. S	Heavy Industrial	Seattle Engineering Dept.	7 April 1992

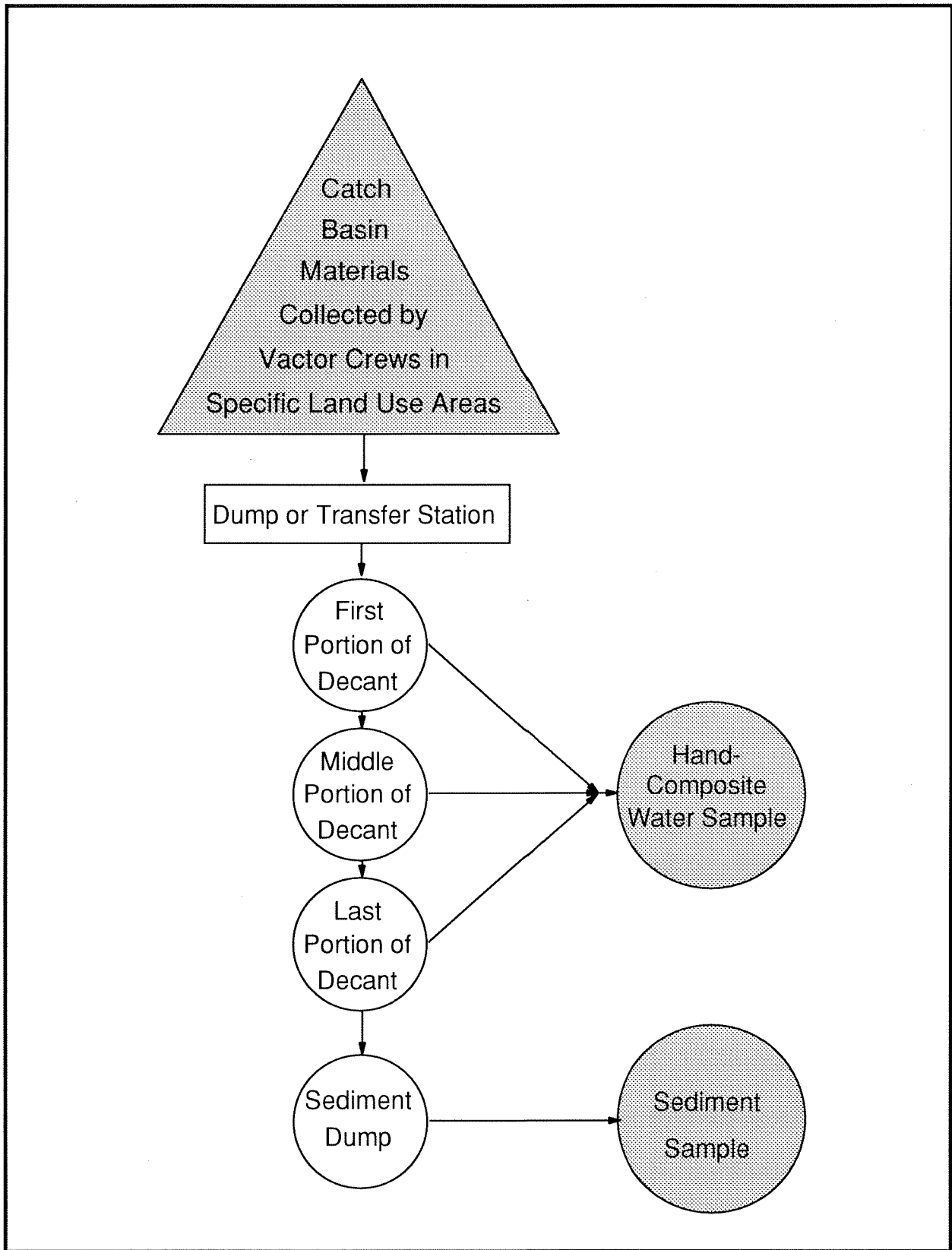


Figure 1. Schematic of water and sediment sample collection for 1991-1992 survey of contaminants in vector truck wastes

buckets were primed with decanted water prior to sampling to eliminate any residual chemicals used in the decontamination process.

Decanted Water

Samples of water were collected twice each day as water was decanted from the vector tanks. Composite samples of approximately nine liters were obtained by sampling directly from the decant hose or spout of the vector truck into a large stainless steel bucket. Approximately equal aliquots (*i.e.*, three liters each) of water from the initial, middle, and end portions of each decant were collected. The composite sample was then stirred and subsampled by pouring directly into appropriate containers for the indicated analyses, then placed on ice. Temperature, pH, and specific conductivity (dry season only) were measured in the field.

Sediment

After water was completely drained from the vector trucks, the remaining sediment was dumped on the ground. Sediments collected in Seattle during the second round of sampling were taken directly from the tank of the vector truck. In both cases, an effort was made to collect samples that were representative in terms of moisture content and grain size. Samples were placed in a stainless steel bucket and homogenized (minimally prior to taking subsamples for volatile organics analysis). Subsamples were placed into appropriate containers and stored on ice.

Laboratory Analysis and Data Quality

Table 3 summarizes the methods used to analyze vector water and sediments. Analytical tests used in the second round of sampling were consistent with first round samples except for the following:

- Specific conductivity, fecal coliform, oil and grease, total dissolved solids, cyanide, mercury, nickel, silver, semi-volatile organics, and PCB analyses in decanted water were dropped in the second round either because of previous low or non-detectable concentrations in the first round or, in a few cases, it was predicted the additional data would not provide any useful new information.
- Total petroleum hydrocarbon (TPH) analysis was added in decanted water because of high concentrations found in sediment during the first round of sampling. Settleable solids and dissolved metals analyses were also added to assess the distribution of metals in the dissolved and particulate phases. Total recoverable metals were also analyzed on several samples to determine the relationship to total metals.
- Only six metals (arsenic, cadmium, chromium, copper, lead, and zinc) were analyzed in sediment compared to thirteen for the first round. Several classes of organic chemicals had no significant concentrations in the first round. These analyses were dropped in the second round: PCBs, pesticides, and semi-volatiles except PAHs.

Table 3. Analytical methods used during 1991 – 1992 survey of contaminants in vector truck wastes.

Parameter	Method	Reference	Laboratory*
<u>WATER</u>			
pH	EPA 150.1	EPA, 1984	Columbia Analytical Services, Inc.
Conductivity	EPA 120.1	EPA, 1984	Columbia Analytical Services, Inc.
Hardness	EPA 6010/SM 314A	EPA, 1987/APHA, 1985	Columbia Analytical Services, Inc; Manchester Laboratory
Fecal Coliform	SM 9221C	APHA, 1989	Columbia Analytical Services, Inc.
Biological Oxygen Demand	EPA 405.1	EPA, 1984	Columbia Analytical Services, Inc; Manchester Laboratory
Chemical Oxygen Demand	EPA 410.1	EPA, 1984	Columbia Analytical Services, Inc; Sound Analytical Services, Inc.
Oil and Grease	EPA 413.1	EPA, 1984	Columbia Analytical Services, Inc.
Total Organic Carbon	EPA 415.1	EPA, 1984	Columbia Analytical Services, Inc; Manchester Laboratory
Total Solids	EPA 160.3	EPA, 1984	Manchester Laboratory
Total Suspended Solids	EPA 160.2	EPA, 1984	Columbia Analytical Services, Inc; Manchester Laboratory
Total Dissolved Solids	EPA 160.1	EPA, 1984	Columbia Analytical Services, Inc.
Settleable Solids	EPA 160.5	EPA, 1984	Columbia Analytical Services, Inc; Manchester Laboratory
Turbidity	EPA 180.1	EPA, 1984	Columbia Analytical Services, Inc; Manchester Laboratory
Cyanide	EPA 335.2	EPA, 1984	Columbia Analytical Services, Inc.
Total and Dissolved Metals			
As,Cd,Cu,Cr,Pb,Ni,Ag,Zn	ICP Scan/EPA 6010	EPA, 1987	Columbia Analytical Services, Inc; Manchester Laboratory
As	AA/EPA 7060	EPA, 1987	Columbia Analytical Services, Inc.
Hg	CVAA/EPA 7470	EPA, 1987	Columbia Analytical Services, Inc.
Total Recoverable Metals			
As,Cd,Cu,Cr,Pb,Zn	ICP Scan/EPA 3005-6010	EPA, 1987	Manchester Laboratory
Volatile Organic Compounds	GC-MS/EPA 8240	EPA, 1986a	Analytical Technologies, Inc; Manchester Laboratory
Semi-Volatile Organics	GC-MS/EPA 8270	EPA, 1986a	Analytical Technologies, Inc.
Total Petroleum Hydrocarbons	FTIR/EPA 418.1	EPA, 1984	Manchester Laboratory
PCBs	GC/EPA 8080	EPA, 1986a	Analytical Technologies, Inc.
<u>SEDIMENT</u>			
Percent Solids	EPA 160.3/SM 2540B	EPA, 1984/APHA, 1989	Sound Analytical Services, Inc.
Total Organic Carbon	EPA 415.1	EPA, 1984	Sound Analytical Services, Inc.
Grain Size	Sieve-Pipet	Tetra Tech, 1986	Soil Technology, Inc; Laucks Testing Laboratories, Inc.
Metals			
Sb,Be,Cd,Cu,Cr,Pb,Ni,Ag,Zn	ICP Scan	EPA, 1986a	Manchester Laboratory
As	AA/EPA 7060	EPA, 1986a	Manchester Laboratory
Se	AA/EPA 7740	EPA, 1986a	Manchester Laboratory
Tl	AA/EPA 7841	EPA, 1986a	Manchester Laboratory
Hg	CVAA/EPA 7471	EPA, 1986a	Manchester Laboratory
Volatile Organic Compounds	GC-MS/EPA 8240	EPA, 1986a	Weyerhaeuser Anal. and Test. Serv. Inc; Manchester Laboratory
Semi-Volatile Organics	GC-MS/EPA 8270	EPA, 1986a	Weyerhaeuser Analytical and Testing Services, Inc.
PAHs	GC-MS/EPA 8270-3630	EPA, 1986a	Manchester Laboratory
Total Petroleum Hydrocarbons	FTIR/EPA 418.1	EPA, 1984	Spectra Laboratories, Inc; Manchester Laboratory
Chlorinated Pesticides/PCBs	GC/EPA 8080	EPA, 1986a	Weyerhaeuser Analytical and Testing Services, Inc.

*Where two laboratories are listed for a single parameter, they represent the labs used for the first and second round sample analysis, respectively.

In general, the data quality objectives described in the sampling and analysis plan (PTI Environmental Services, 1991a-draft) and the project proposal (Serdar, 1991) were met. However, limits of detection for pesticide/PCB analysis in sediment were an order of magnitude higher than specified.

Analytical data from the first round of decanted water samples were reviewed for qualitative and quantitative accuracy, validity and usefulness by PTI and the laboratories performing the analyses. Sediment data from the first round of sampling and all data from the second round were reviewed by staff at the Ecology Manchester Environmental Laboratory. Reviewers evaluated initial and continuing instrument calibration, procedural (laboratory) blanks, matrix spike recoveries, analytical precision, ICP serial dilution analysis (metals only), and surrogate spike recoveries (organics only).

Many of the data are qualified as estimates (J). In most cases, the analytical results were either outside the specified calibration range or matrix spike recoveries were not within specified limits. However, the reviewers concluded that all data were acceptable for use.

Quality assurance samples collected in the field included duplicates (split samples) to measure precision, transfer blanks, and transport blanks. The precision, expressed as relative percent difference (RPD), was very good for most split samples (Table 4). Combined mean RPDs for water and sediment analyses were 11% for conventionals, 29% for metals, and 27% for organics. No contaminants were detected in transfer blanks. Acetone and methylene chloride, common laboratory and equipment-cleaning solvents, were the only contaminants detected in transport blanks.

RESULTS AND DISCUSSION

Results of conventional, metals, and organics analyses in decanted water and sediments collected from vector trucks are presented below. Complete results for decanted water analysis from each station are shown in Appendix B. First round (dry season) water sampling results are also reported in *Characterization of Catch Basin Wastes: Draft Technical Memorandum* (PTI Environmental Services, 1991b-draft). Complete sediment results are in Appendix C.

Conventional Water Quality

Results of conventional analysis of decanted water are presented in Table 5. Measurements of pH, conductivity, and hardness were fairly consistent in samples from all three land-use areas. Geometric mean values for fecal coliform bacteria were an order of magnitude lower in water from industrial areas compared to residential and commercial areas. Likely sources of coliform bacteria in residential and commercial areas include septage and pet wastes. Median values for these parameters are within the ranges reported from water quality surveys of Bellevue stormwater runoff (Pitt and Bissonnette, 1984).

Table 4. Precision of analytical results for duplicate (field split) water and sediment samples collected from I-15 and S. Dawson St. stations.

Variable	Relative Percent Difference *
WATER	
Conventionals	
Hardness	13%
Biological Oxygen Demand	14%
Chemical Oxygen Demand	4%
Total Organic Carbon	1%
Total Solids	5%
Total Suspended Solids	2%
Settleable Solids	32%
Turbidity	10%
Total Metals	
Arsenic	34%
Cadmium	35%
Chromium	44%
Copper	41%
Lead	27%
Zinc	17%
Dissolved Metals	
Copper	37%
Zinc	86%
Organics	
Toluene	1%
Total Petroleum Hydrocarbons	18%
SEDIMENT	
Conventionals	
Percent Solids	1%
Total Organic Carbon	0%
Grain Size	44%
Metals	
Arsenic	73%
Beryllium	0%
Cadmium	20%
Chromium	14%
Copper	16%
Lead	18%
Mercury	19%
Nickel	62%
Zinc	20%
Organics	
Volatiles	32%
Semi-Volatiles	
Bis(2-ethylhexyl)phthalate	9%
4-Methylphenol	28%
2-Methylnaphthalene	34%
Dibenzofuran	10%
1-Methylnaphthalene	50%
Low Molecular Weight PAHs	12%
High Molecular Weight PAHs	18%
Total Petroleum Hydrocarbons	14%

* Range as a percent of duplicate mean

Table 5. Results of conventional analyses of decanted water [median (range); geometric mean for fecal coliform].

Variable	Combined Land-Use (n = 20)*	Residential Areas (n = 8)**	Industrial Areas (n = 8)**	Commercial Areas (n = 4)
pH	6.94 (6.18-7.98)	6.88 (6.18-7.98)	6.89 (6.54-7.51)	7.25 (6.93-7.79)
Conductivity (umhos/cm)	364 (184-1,110)	420 (329-537)	422 (299-1,070)	198 (184-1,110)
Hardness (mg/L CaCO ₃)	234 (73-762)	150 (76-707)	320 (199-762)	110 (73-249)
Fecal Coliform Bacteria (MPN/100mL)	3,000	9,000	400	6,000
Biological Oxygen Demand (mg/L)	151 (28-1,250)	104 (42-471)	431 (260-1,250)	60 (28-290)
Chemical Oxygen Demand (mg/L)	900 (120-26,900)	410 (200-8,900)	3,400 (1,200-26,900)	490 (120-4,100)
Oil and Grease (mg/L)	11 (7-40)	12 (9-40)	14 (11-25)	9 (7-17)
Total Organic Carbon (mg/L)	136 (49-7,880)	98 (49-3,040)	2,210 (118-7,880)	135 (50-2,000)
Total Solids (mg/L)	1,930 (586-70,400)	785 (586-821)	25,500 (3,030-70,400)	NA
Total Dissolved Solids (mg/L)	212 (95-550)	220 (196-299)	233 (177-395)	122 (95-550)
Total Suspended Solids (mg/L)	2,960 (265-111,000)	567 (265-41,700)	21,500 (3,180-111,000)	1,680 (365-9,260)
Settleable Solids (mL/L/hr)	27 (2-234)	6 (2-210)	45 (16-324)	5 (2-65)
Turbidity (ntu)	1,000 (55-52,000)	300 (130-23,000)	1,700 (55-52,000)	1,400 (300-4,000)

* n=12 for conductivity, fecal coliform, oil and grease, and total dissolved solids; n=8 for total solids.

** n=4 for conductivity, fecal coliform, oil and grease, and total dissolved solids.

NA=Sample not analyzed for this variable.

Biological (BOD) and chemical oxygen demand (COD) were high in all land-use areas. COD was one of the most variable parameters tested. In general, BOD and COD levels were at least one-to-two orders of magnitude higher than those found in Bellevue stormwater runoff (Pitt and Bissonnette, 1984) and by EPA (1983) in residential, commercial, and industrial areas as part of their Nationwide Urban Runoff Program (NURP).

Oil and grease concentrations were fairly uniform among land-use categories. The method used to measure oil and grease (EPA 413.1) includes animal and vegetable lipids as well as non-volatile mineral hydrocarbons (Ecology, 1991a). Therefore, it is not a useful measure of petroleum-derived hydrocarbons. EPA has only qualitative criteria for oil and grease in freshwater which includes a statement that "Surface waters shall be virtually free from floating non-petroleum oils of vegetable or animal origin, as well as petroleum-derived oils" (EPA, 1986b). Almost all of the decanted water samples had an oily sheen and an oily odor, and would therefore exceed EPA freshwater criterion based on this description.

Total solids (TS) and total suspended solids (TSS) concentrations were generally one-to-two orders of magnitude higher in samples from industrial areas. Dissolved solids were low compared to TSS and had similar concentrations in samples from all three land-use areas. Settleable solids concentrations were highest in samples with high turbidity. Unfortunately, the settleable solids data reported here cannot be directly compared to TS and TSS data since the latter are determined as weight per unit volume (mg/L) while settleable solids are determined volumetrically (mL/L/hr).

Differences in solids concentrations of vactor decanted water may, in part, be due to different practices, equipment, and amounts of freshwater used by various vactor crews. For instance, a short time period between cleaning catch basins and decanting water, small quantities of freshwater used to clean catch basins, or vigorous shaking during transport to the dump site each contribute to elevated concentrations of solids in decanted water. The significance of solids concentrations in decanted water will be discussed later in this report.

Physical Characteristics of Sediments

Percent solids, total organic carbon (TOC), and grain size analyses of sediments are shown in Table 6. Vactor sediments were relatively consistent in terms of moisture content and grain size with sand being the predominant component (Figure 2). Approximately 60 - 80% of each sample was composed of sand. Percent fines (fraction < 62 μm) was fairly low in all samples. Storm drain sediments tend to be low in fines because stormwater velocities are usually high enough to flush fine materials through the system, while sand and heavier particles settle.

Metals and Cyanide Concentrations

Decanted Water

Results of total metals and cyanide analyses in decanted water are shown in Table 7. Zinc, lead, and copper were found at the highest concentrations, followed by nickel, chromium, and arsenic.

Table 6. Results of conventional analyses of vector sediments [median (range)].

Variable	Combined and-Use (n = 20)	Residential Areas (n = 8)	Industrial Areas (n = 8)	Commercial Areas (n = 4)
Solids (%)	73 (61-85)	74 (61-81)	76 (68-85)	70 (61-73)
Total Organic Carbon (mg/Kg, dry)	16,000 (10,000-44,000)	16,000 (13,000-44,000)	18,000 (10,000-25,000)	16,000 (12,000-22,000)
Grain Size (%):				
gravel (>2,000um)	12 (1-33)	15 (1-26)	12 (7-33)	14 (6-19)
sand (2,000-62um)	72 (57-90)	73 (59-90)	76 (57-84)	66 (63-71)
silt (62-2um)	10 (4-28)	10 (7-16)	10 (4-13)	20 (10-28)
clay (<2um)	2 (0-3)	1 (0-3)	2 (0-3)	1 (0-3)

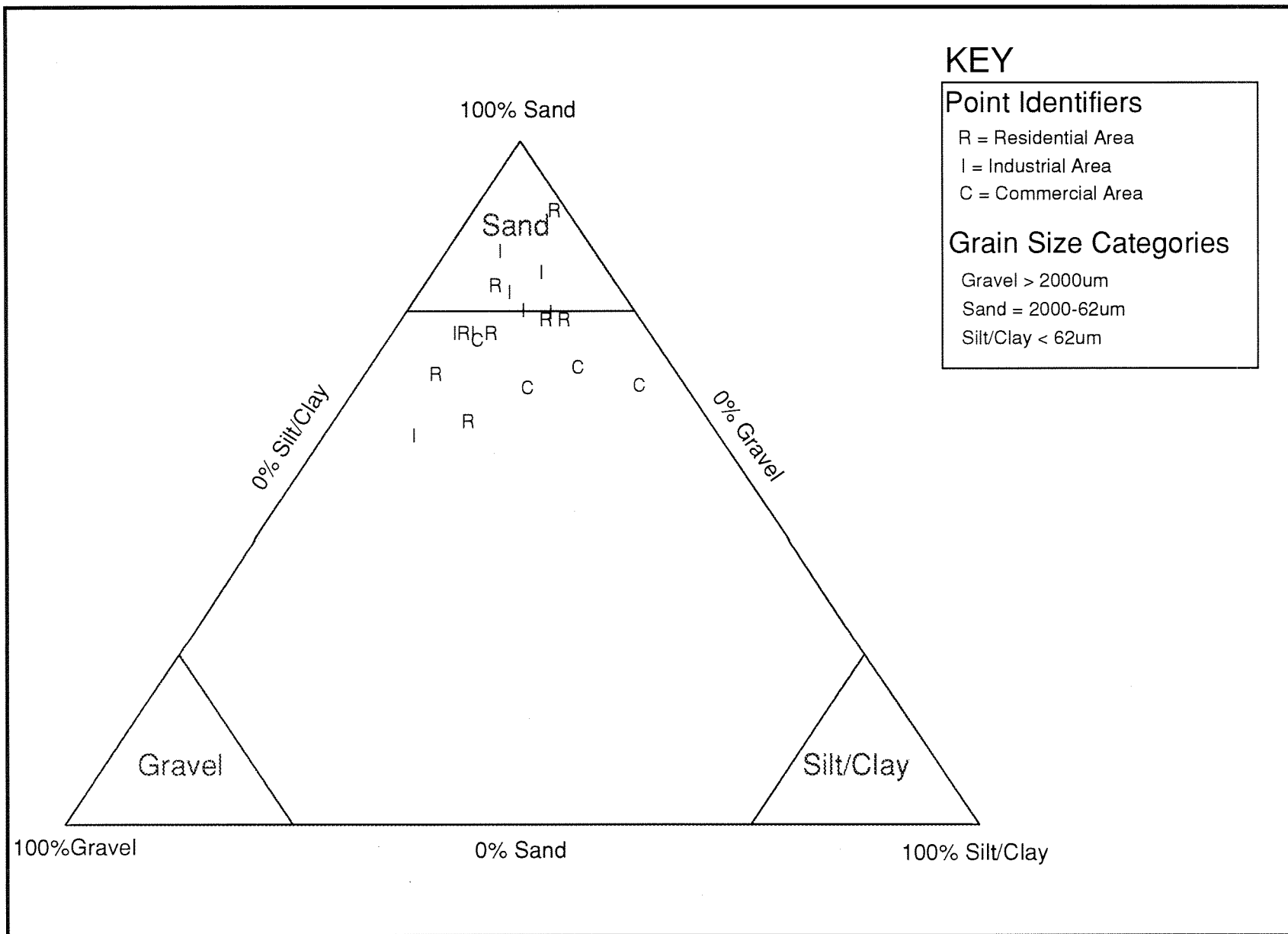


Figure 2. Grain size distribution of sediments collected from vector trucks.

Table 7. Total metals and cyanide concentrations in decanted water [median (range), ug/L].

Variable	Combined Land-Use (n = 20)*	Residential Areas (n = 8)**	Industrial Areas (n = 8)**	Commercial Areas (n = 4)
Zinc	4,440 (401-18,000)	1,100 (401-6,100)	6,400 (4,290-18,000)	1,200 (730-9,000)
Lead	1,120 (255-13,000)	880 (255-2,600)	3,520 (2,000-13,000)	490 (370-680)
Copper	690 (81-7,600)	160 (81-1,000)	1,870 (1,110-7,600)	250 (110-450)
Nickel	320 (40-1,300)	380 (40-760)	610 (400-1,300)	120 (40-250)
Chromium	230 (13-1,810)	32 (13-630)	360 (220-1,810)	150 (40-500)
Arsenic	110 (10-1,240)	40 (30-590)	280 (140-1,240)	40 (10-80)
Cadmium	30 (6.4U-120)	11 (6.4-50)	49 (30-120)	20 (10U-80)
Cyanide	20 (10U-70)	10 (10U-30)	40 (30-70)	10U (10U-60)
Mercury	4.4 (0.5U-21.9)	7.3 (0.6-15.9)	17.2 (3.2-21.9)	0.5U (0.5U-5.6)
Silver	20U (20U-30)	20U (all 20U)	20U (20U-30)	20U (all 20U)

* n=12 for nickel, cyanide, mercury, and silver.

** n=4 for nickel, cyanide, mercury, and silver.

U=Undetected at detection limit shown.

Median concentrations of these metals in industrial areas showed at least a two-to-ten fold elevation compared to residential and commercial areas. Cadmium, cyanide and mercury concentrations were also higher in industrial samples. Silver was not detected on average at detection limits of 20 - 30 $\mu\text{g/L}$.

Decanted water contained substantial loads of suspended solids as well as high concentrations of metals. Regression analysis of vactor decanted water showed positive, but not strong, correlations of total arsenic, cadmium, chromium, copper, lead, and zinc to TSS. Arsenic showed the strongest correlation ($r=0.60$) and zinc the weakest ($r=0.45$). Galvin and Moore (1982) also found a consistent relationship between total metals concentrations and solids in urban stormwater. They reported that copper and zinc were the only dissolved metals found at substantial concentrations.

To further assess the distribution of metals in decanted water, second round samples were analyzed for both total and dissolved metals. Dissolved metals are defined as those passing through a 0.45 μm filter. Dissolved copper, lead, and zinc concentrations averaged 0.6% of total concentrations. Arsenic, cadmium, and chromium were not detected as a dissolved component of any samples. Results for dissolved metals are shown in Appendix B.

In addition to TSS concentrations, other characteristics of solids in decanted water may play a role in metals concentrations. Organic material, clay, carbonates, and ferric and manganese oxide content of waterborne solids probably contribute to the partitioning of metals (Combest, 1991).

Two samples (Lucile St. and one of the duplicate samples from S. Dawson St.) were also analyzed for total recoverable metals. "Total recoverable" refers to metals measured in an unfiltered sample treated with hot, dilute mineral acid where "total metals" uses a more vigorous acid digestion (APHA, 1985; EPA, 1986b). Comparison of total, total recoverable, and dissolved metals concentrations of these samples is shown in Figure 3. Total and total recoverable analyses yielded nearly identical results for all samples analyzed.

Sediments

Analyses of all 13 EPA priority pollutant metals were conducted in vactor sediments during dry season sampling and six of these metals were analyzed during the wet season (Table 8). Overall, zinc was found in the highest concentration followed by lead, chromium, nickel, copper, and arsenic. Except for chromium, these metals were generally found at elevated concentrations in industrial areas relative to other areas, yet median concentration differences between the land-uses were not as pronounced as in water samples. Median chromium concentrations were highest in commercial samples and lowest in industrial samples.

Median concentrations of cadmium, beryllium, and mercury were low and fairly consistent in all land-use categories. Antimony was only detected in residential and commercial areas and

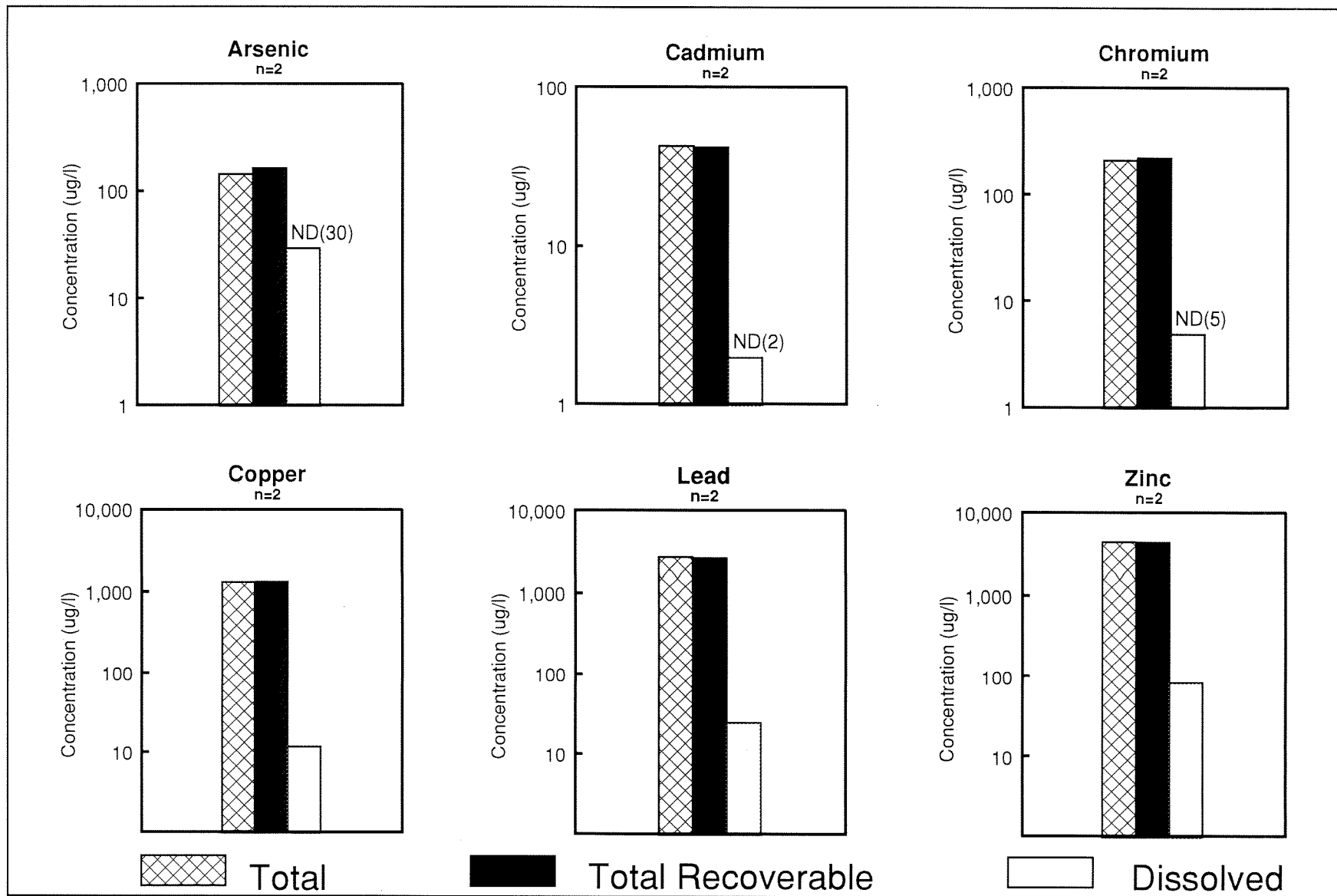


Figure 3. Comparison of mean concentrations of total, total recoverable, and dissolved metals measured in decant water samples from the S. Dawson St. and Lucile St. stations during April 1992. (logarithmic scale; ND = not detected)

Table 8. Metals concentrations in vector sediments [median (range); mg/kg,dry].

Variable	Combined Land-Use (n = 12)*	Residential Areas (n = 4)**	Industrial Areas (n = 4)**	Commercial Areas (n = 4)
Zinc	200 (80-558)	118 (80-174)	241 (196-558)	233 (140-247)
Lead	101 (24-194)	80 (24-141)	136 (70-194)	95 (47-128)
Chromium	88 (19-241)	58 (19-213)	36 (26-241)	113 (98-200)
Nickel	48 (33-86)	43 (39-50)	50 (35-86)	49 (33-51)
Copper	39 (18-560)	25 (18-38)	90 (73-560)	37 (26-42)
Arsenic	5.4 (3.0U-24)	4.0 (3.0U-6.1)	14 (3.0-24)	4.8 (3.6-6.8)
Cadmium	1.0 (0.5-2.0)	0.8 (0.5-1.2)	1.0 (0.9-2.0)	1.4 (1.1-1.8)
Beryllium	0.42 (0.35-0.53)	0.42 (0.35-0.53)	0.41 (0.35-0.41)	0.45 (0.36-0.47)
Mercury	0.10 (0.04-0.16)	0.08 (0.07-0.14)	0.13 (0.07-0.16)	0.08 (0.04-0.15)
Antimony	3.0U (3.0U-5.1)	3.4 (3.0U-5.1)	3.0U (all 3.0U)	3.0U (3.0U-3.0)
Silver	0.3U (0.3U-0.50)	0.3U (all 0.3U)	0.3U (0.3U-0.5)	0.3U (all 0.3U)
Thallium	0.25U (all 0.25U)	0.25U (all 0.25U)	0.25U (all 0.25U)	0.25U (all 0.25U)
Selenium	0.2U (0.2U-0.8)	0.2U (0.2U-0.4)	0.2U (all 0.2U)	0.3 (0.2U-0.8)

* n=20 for zinc, lead, chromium, copper, arsenic, and cadmium.

** n=8 for zinc, lead, chromium, copper, arsenic, and cadmium.

U=Undetected at detection limit shown.

selenium was not detected in industrial areas. Silver was rarely detected (one sample only) and thallium was not detected in any samples.

Occurrence and Concentrations of Organic Compounds

Decanted Water

Sixteen volatile and nine semi-volatile organic compounds were detected in water decanted from vactor trucks. Because of the low occurrence of organics in water collected during the first (dry) round of sampling, they were analyzed on a limited basis during the second (wet) round. Benzene, toluene, ethylbenzene, and xylenes (collectively referred to as BTEX) were the only compounds analyzed in all 20 decanted water samples. BTEX compounds are commonly detected gasoline and diesel fuel components and are also used in paints and thinners (PTI Environmental Services, 1991c).

Figure 4 compares the detection frequency of organics for the 20 samples analyzed. Toluene was the most frequently detected compound, followed by 1,2,4-trimethylbenzene, total xylenes, 1,3,5-trimethylbenzene, 4-methyl-2-pentanone, naphthalene, and ethylbenzene.

More than half (14 of 25) of the organic compounds detected are EPA priority pollutants, and 16 are considered pollutants of concern in Puget Sound based on their high toxicity, persistence, and potential for bioaccumulation (PTI Environmental Services, 1991c). Only four of these compounds were frequently detected (10% or more) in the 121 samples analyzed for priority pollutants during NURP (EPA, 1983). These were bis(2-ethylhexyl)phthalate, phenol, phenanthrene, and fluoranthene.

Table 9 shows the distribution of the most frequently detected compounds among the various land uses. Toluene was generally found at elevated concentrations compared to other organic compounds. Aside from toluene and total xylenes, no compounds were detected at concentrations greater than 100 $\mu\text{g/L}$.

The low incidence of detection and the inconsistency of analysis between samples confounds comparisons among land-use areas. Organics were more frequently detected in samples from industrial areas, while concentrations were generally highest in residential areas. Few compounds were detected in decanted water originating in commercial areas.

PCBs were not detected in any samples at detection limits of 0.5 - 1.3 $\mu\text{g/L}$ (Appendix B).

Sediments

Vactor sediments collected during the first round of sampling were analyzed for volatile organics, semi-volatile organics, chlorinated pesticides, and PCBs. Because of low to non-detectable concentrations and low detection frequencies of most organic compounds, wet season

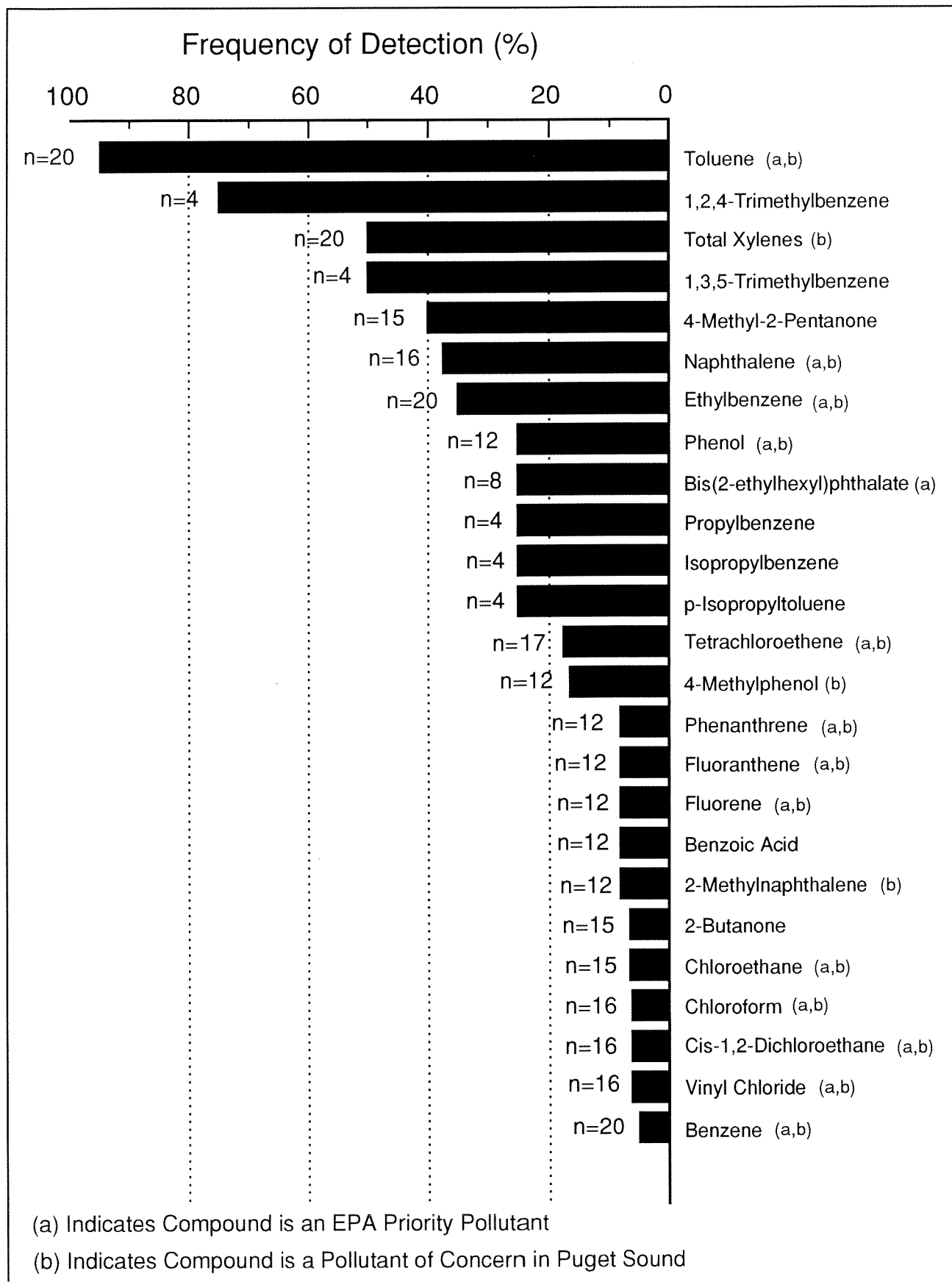


Figure 4. Frequency of detection for organic compounds in decanted water

Table 9. Occurrence and concentrations of the most frequently detected organic compounds in decanted water (ug/L).

Compound	Combined Land-Use Concentration Range	Individual Land-Use					
		Residential		Industrial		Commercial	
		Frequency of Detection	Maximum Conc.	Frequency of Detection	Maximum Conc.	Frequency of Detection	Maximum Conc.
<u>Volatile Organics</u>							
Toluene	5U – 180	8/8	180	8/8	180	3/4	96
1,2,4-Trimethylbenzene	5U – 57	1/1	57	2/3	5	NA	-
Total Xylenes	5U – 360	3/8	360	6/8	20	1/4	32
1,3,5-Trimethylbenzene	5U – 32	1/1	32	1/3	1	NA	-
4-Methyl-2-Pentanone	5U – 11	0/4	10U	6/7	11	0/4	10U
Ethylbenzene	1U – 51	3/8	51	4/8	4	0/4	5U
<u>Semi-Volatile Organics</u>							
Naphthalene	5U – 57	1/5	57	5/7	11	0/4	10U
Phenol	10U – 75	1/4	15	1/4	2	1/4	75
4-Methylphenol	10U – 33	0/4	50U	2/4	33	0/4	50U

U=Undetected at detection limits shown.

NA=Sample not analyzed for this compound.

analyses were limited to a short list of volatile compounds and polycyclic aromatic hydrocarbons (PAHs).

Figure 5 compares the detection frequency for organic compounds in sediments. Unlike decanted water, semi-volatile organic compounds - especially PAHs - were more prevalent than volatile compounds in sediments. Overall, seven of the ten most frequently detected organic compounds in sediments were PAHs. In contrast, only one PAH compound, naphthalene, was detected in 10% or more of decanted water samples. This discrepancy is probably due to the relative low solubility of PAHs in water and high affinity to carbon-containing sediments (Callahan *et al.*, 1979; PTI Environmental Services, 1991c).

PAHs are formed during the incomplete combustion of organic material, especially fossil fuels. High molecular weight PAHs (HPAH; those with four or more aromatic rings) are produced more as a combustion product while low molecular weight PAHs (LPAH) are more prevalent as uncombusted components of fossil fuels (PTI Environmental Services, 1991c).

A comparison of LPAH and HPAH levels in vector sediments is shown in Table 10. Overall, median HPAH levels were four times higher than LPAH, which may reflect their lower volatility and stronger affinity to sediments than LPAH, but also suggests petroleum fuel combustion as a major source in the study area. Pyrene for example, is commonly found in automobile emissions. It was detected in 19 of 20 samples and accounted for approximately 17% of total PAH. It is difficult, however, to identify sources of PAH contamination without investigating all additional nonpoint sources, which may include asphalt roads, coal tar, creosote-treated wood, and municipal waste incineration (Sittig, 1980; PTI Environmental Services, 1991c).

One sample in particular had an extremely high concentration of HPAH. Sediment sampled in July 1991 from the 21 Oaks housing development in Snohomish County (Station R-2) had a total HPAH concentration of 137,000 $\mu\text{g}/\text{kg}$, more than five times the mean of any land-use area. Sample concentrations of TPH and BTEX, both stemming from petroleum fuels, were not elevated to the same degree, which suggests a nearby point source, rather than automobiles and trucks, as the possible source of contamination.

Median BTEX concentrations are also shown in Table 10. BTEX compounds were the most prevalent volatile organics in sediments in terms of occurrence and concentrations. As in decanted water, toluene was the most frequently detected and found at the highest median concentration. Industrial BTEX concentrations were nearly twice the residential and six times the commercial concentrations.

None of the 27 chlorinated pesticide and PCB compounds were found at detection limits ranging from 22 to 540 $\mu\text{g}/\text{kg}$ (Appendix C).

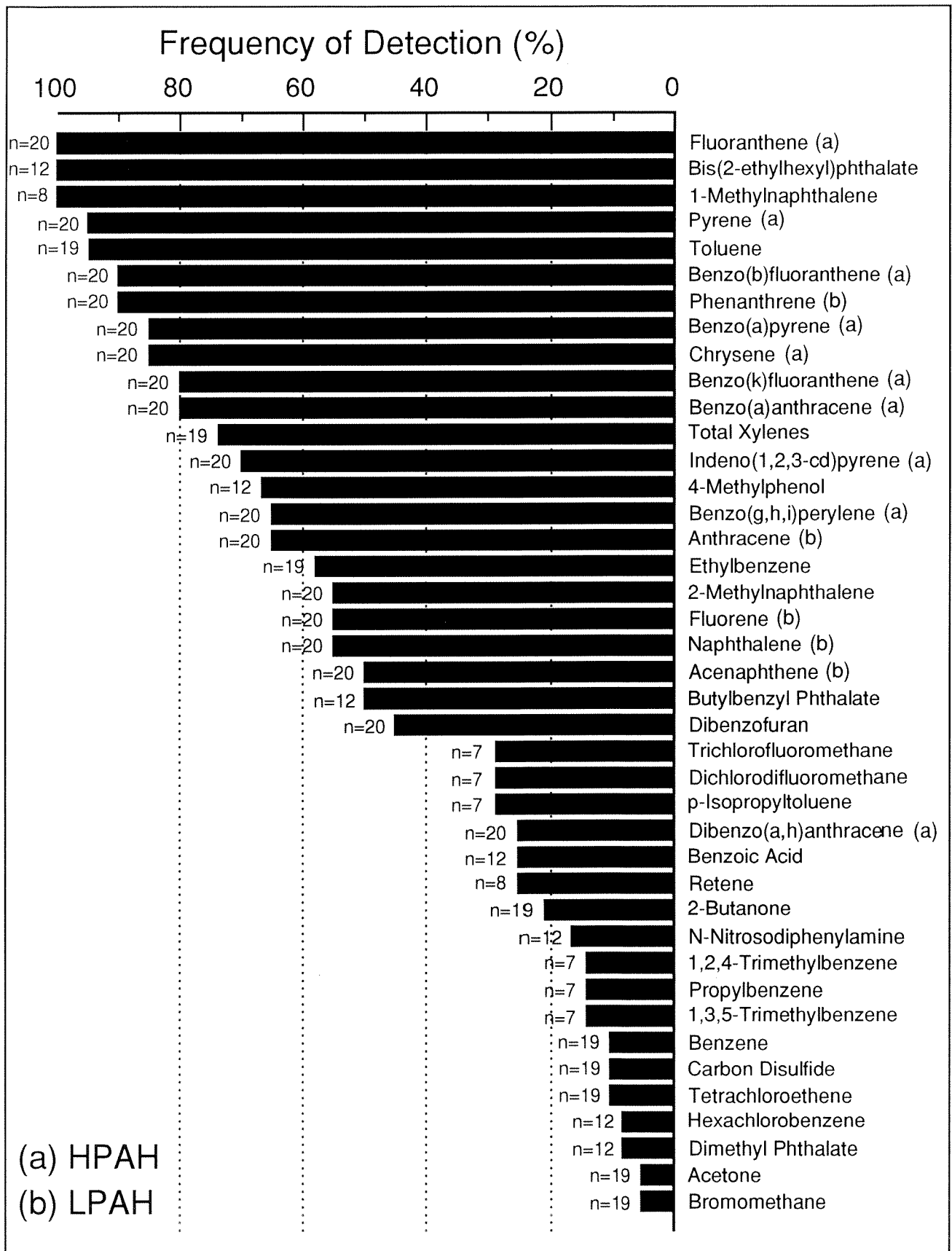


Figure 5. Frequency of detection for organic compounds in vector sediments

Table 10. PAH and BTEX concentrations in vector sediments [median (range); ug/kg,dry].

Variable	Combined Land-Use (n = 20)*	Residential Areas (n = 8)	Industrial Areas (n = 8)**	Commercial Areas (n = 4)
LPAH	2,200 (50-13,000)	1,200 (50-9,400)	2,600 (1,100-13,000)	2,200 (160-6,900)
HPAH	7,800 (520-137,000)	3,200 (850-137,000)	12,200 (3,200-56,500)	14,400 (520-32,600)
Total PAH	10,900 (680-146,000)	7,400 (890-146,000)	14,900 (4,300-69,600)	16,600 (680-39,500)
Total BTEX	176 (4.3-2,915)	264 (97-2,420)	412 (4.3-2,915)	70 (134-680)

* n=19 for total BTEX

** n=7 for total BTEX

Total Petroleum Hydrocarbons in Water and Sediment

Results of TPH measurements in decanted water and sediments are shown in Table 11. TPHs include a number of long-chain hydrocarbons which originate from gasoline, kerosene, jet fuel, diesel, and lubricating oils (Ecology, 1991a).

TPH concentrations from industrial water samples were approximately twice as high than residential samples, and three times higher in industrial and commercial sediments compared to residential sediments. Commercial and industrial area catch basins selected for this survey drained streets with a much higher volume of car and truck traffic than those in the residential basins.

Table 11. Total petroleum hydrocarbon concentrations in vactor decanted water and sediments [median(range)].

Land-Use	Water		Sediment	
	n	Concentration (mg/L)	n	Concentration (mg/kg,dry)
Combined	8	7.2(1.9-12)	20	2,020(200-4,600)
Residential	4	5.0(2.6-8.2)	8	870(440-1,850)
Industrial	4	9.5(1.9-12)	8	2,860(200-3,380)
Commercial	0	NA	4	2,800(440-4,600)

NA=Sample not analyzed for this parameter

There appears to be little relationship between suspended solids levels and TPH or BTEX concentrations. There was only a weak positive correlation between TSS and TPH concentrations ($r=0.21$) and BTEX concentrations were negatively correlated with TSS.

Since dissolved TPH concentrations were not measured, it is impossible to determine the contribution of TPH sorbed to particulates in decanted water. However, results of a study by Zawlocki (1981) showed a substantial portion of nine different classes of organic compounds were sorbed to the particulate fraction in samples of highway runoff. Other studies have shown up to 93% of TPH and 90% of aliphatic and aromatic hydrocarbons are associated with particulates in urban runoff (Hoffman *et al.*, 1982; Hunter *et al.*, 1979).

Seasonal Differences in Contaminant Concentrations

General Characteristics of Water and Sediment

For those water quality variables measured in both dry and wet seasons, average concentrations in dry season samples tended to be highest. For instance, COD, TOC, and turbidity were an order of magnitude higher in dry season samples. Water hardness was about twice as high in

dry season samples. Total suspended solids were about 30 times higher in dry season samples from residential areas compared to their wet season counterparts. Biological oxygen demand was higher in residential decanted water during the dry season, but lower in dry season industrial samples. Measurements of pH were similar for both seasons across all land use types.

Sediment characteristics showed less seasonal difference. Percent solids and percent fines were slightly higher in dry season samples. Average TOC content of wet season residential sediments was about twice that found during the dry season, but industrial TOC concentrations were nearly equal.

Metals

Figure 6 illustrates seasonal differences for concentrations of arsenic, cadmium, chromium, copper, lead, and zinc in water. The boxes in each graph represent the interquartile range (25th to 75th percentile) of values. The lines bisecting the boxes represent the median value, and the "whiskers" extending vertically from each box represent the maximum and minimum values, respectively. For example, the interquartile range for cadmium from samples originating in industrial areas during dry weather (INDDRY) is 39-86 $\mu\text{g/L}$; the median value is 50 $\mu\text{g/L}$; and the maximum and minimum values are 120 $\mu\text{g/L}$ and 30 $\mu\text{g/L}$, respectively.

Median metals concentrations in decanted water collected during the dry season were always higher compared to the wet season. Overall, median metals concentration were four times higher in the dry season. Water samples collected during the wet season also had less variability in metals concentrations.

Seasonal differences in sediment metals concentrations generally reflected those of decanted water (Figure 7). Samples collected during the dry season were elevated relative to the wet season, with the exception of arsenic concentrations in industrial area samples and copper from residential areas.

Organics

In decanted water, BTEX compounds were the only group of organics sampled at all sites during both seasons. Median concentrations did not appear to be strongly related to season. Residential concentrations were substantially higher in the wet season (119 versus 22 $\mu\text{g/L}$), but in industrial areas, dry weather BTEX concentrations were about 50% higher than in the wet season (109 versus 74 $\mu\text{g/L}$).

Seasonal differences in sediment BTEX concentrations generally reflected those of water. In sediment, however, dry season samples from industrial areas were elevated compared to all other areas during both seasons. Median industrial dry and wet season BTEX concentrations were 2,200 and 8.1 $\mu\text{g/kg}$, respectively. Dry and wet season residential concentrations were 150 and 530 $\mu\text{g/kg}$, respectively.

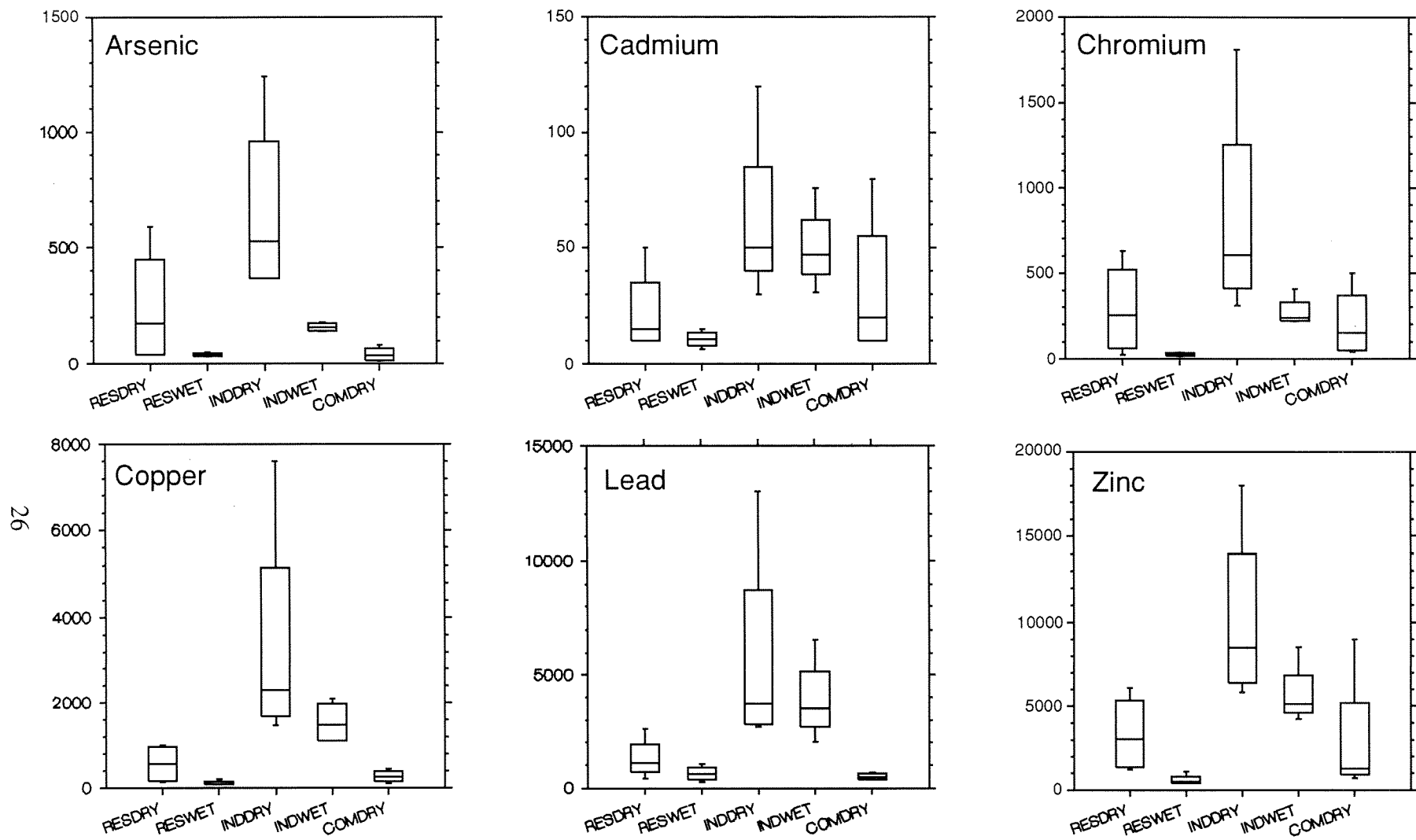


Figure 6. Comparison of metals concentrations in water from different land-use areas and seasons (ug/L; see text for explanation of box plots).

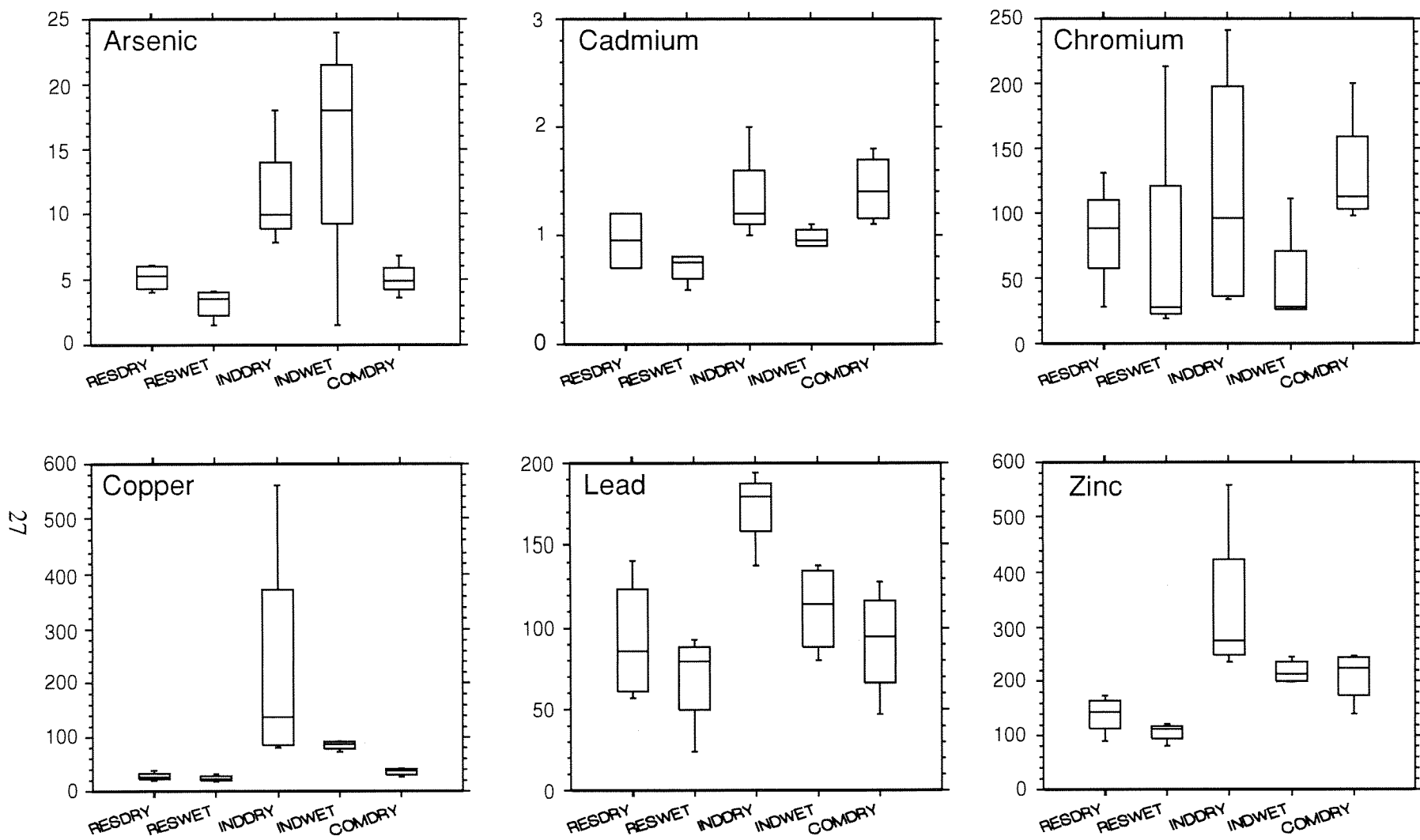


Figure 7. Comparison of metals concentrations in sediments from different land-use areas and seasons (mg/kg, dry weight; see text for explanation of box plots).

Figure 8 shows seasonal differences for total PAH and TPH concentrations in sediment. For PAH, median dry season concentrations were substantially elevated compared to those in the wet season. The large range of PAH concentrations in dry season residential sediments is mainly due to the sample from Station R-2 (total PAH = 146,000 $\mu\text{g}/\text{kg}$). Sediments sampled from a vactor truck cleaning catch basins in a nearby residential neighborhood the previous day had 1,700 $\mu\text{g}/\text{kg}$ PAH, which demonstrates the highly variable nature of catch basin contents.

Petroleum hydrocarbon concentrations were generally more consistent within seasons than other classes of contaminants. Overall, dry season concentrations were higher than wet season.

It is not clear why, for most contaminants, samples collected during the dry season had higher concentrations than the wet season. One possible explanation is that the frequent flushing of catch basins with stormwater during the winter does not permit contaminants to accumulate. In the summer, water from low-intensity storms may transport contaminants from the street to catch basins, but there may not be adequate discharge to "flush" the catchments. In this case, contaminants would tend to accumulate without being flushed through the system.

Comparison to Environmental Criteria

Water Column Criteria

Comparisons of total metals and cyanide in decanted water to EPA water quality criteria for toxic substances in surface waters (EPA, 1986b) are shown in Table 12. These criteria are based on toxicity to aquatic organisms using a variety of tests and species. In all, criteria were exceeded in 107 of 168 analyses and every sample exceeded acute and chronic copper, lead, and zinc standards.

These comparisons should be used cautiously because decanted water is not necessarily discharged to surface waters. The extent to which present disposal practices result in direct or indirect discharge to streams is not known, although half of the maintenance operators surveyed disposed of decanted water to storm drains (Herrera Environmental Consultants, Inc., 1991-draft). In Western Washington, the potential also exists for discharge of decanted water to Puget Sound. In this scenario, marine water quality criteria, which are generally more stringent than freshwater, would be used for comparison.

Although total metals were analyzed in this study and EPA recommends using total recoverable metals for comparison to criteria, data previously presented here indicate the two analytical methods yield comparable results in decanted water.

Ecology has recently adopted water quality standards for Washington which employ dissolved concentrations for cadmium, copper, lead, nickel, silver, and zinc (WAC 173-201A). However, comparisons to these standards were not used because: 1) only a subset of samples was analyzed for dissolved metals, 2) detection limits for dissolved metals analyses were often above criterion

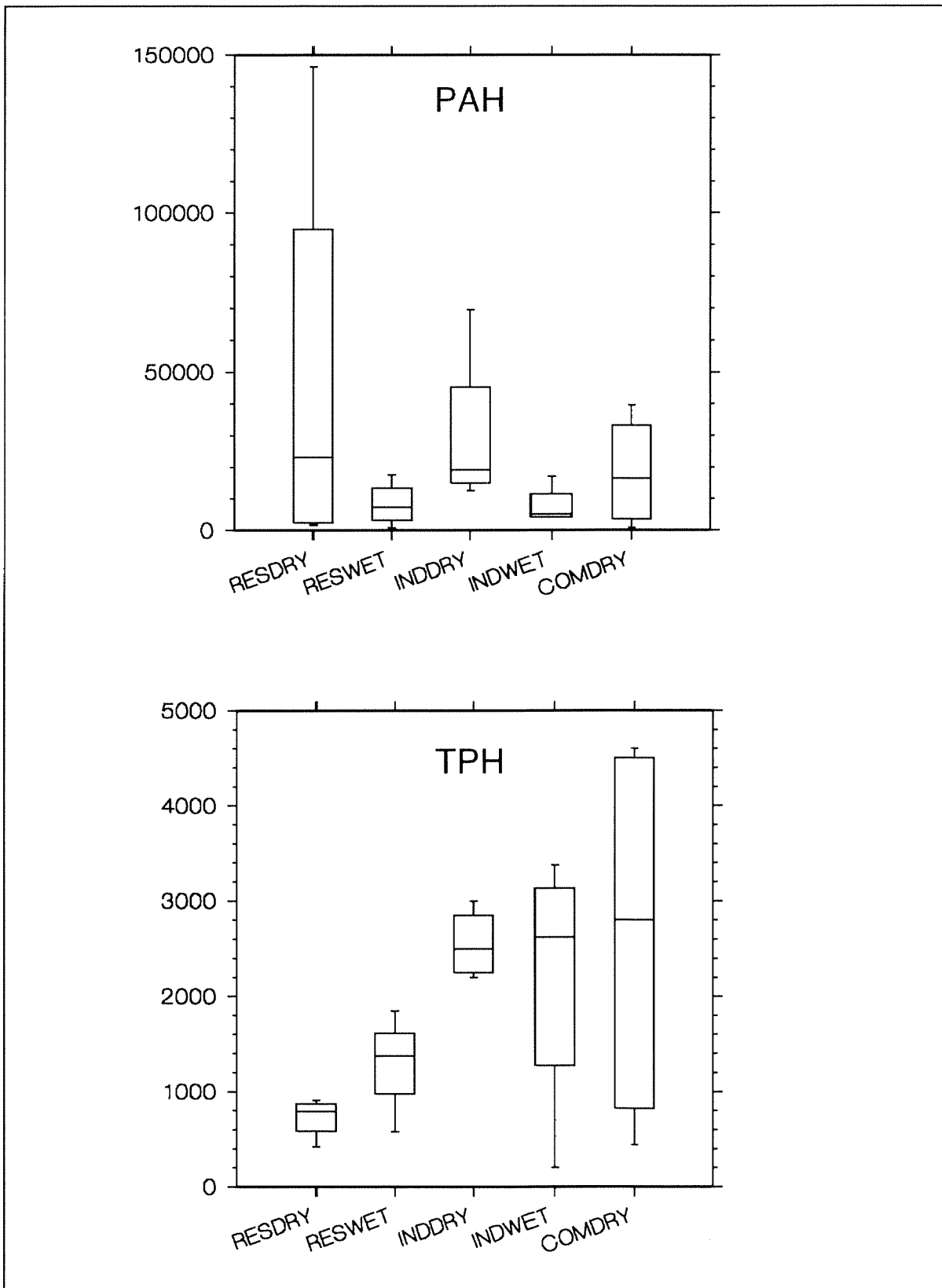


Figure 8. Comparison of PAH (ug/kg) and TPH (mg/kg) concentrations in vector sediments from different land-use areas and seasons.

Table 12. Comparison of total metals and cyanide concentrations in decanted water to EPA criteria for freshwater aquatic life.

	Arsenic(a)	Cadmium	Chromium(b)	Copper	Cyanide	Lead	Mercury	Nickel	Silver	Zinc
EPA Criteria (ug/L)										
acute	360	8.6(c)	3,064(c)	34(c)	22	197(c)	2.4	2,549(c)	13.4(c)	211(c)
chronic	190	2.0(c)	365(c)	21(c)	5.2	7.7(c)	0.012	283(c)	0.12(c)	199(c)
Present Survey (ug/L)										
R-1	310	20	630	1,000	30	1,000	13.4	760	20U	4,600
R-2	590	50	410	930	20	2,600	15.9	610	20U	6,100
R-3	40	10	20	140	10U	1,200	1.2	40	20U	1,200
R-16	40	10U	100	190	10U	400	0.6	150	20U	1,500
21 Oaks-AM	53 J	15	37	202		1,050				1,090
21 Oaks-PM	40 J	6.4 J	13 J	112		757				522
Casc. Hts-AM	37 J	9 J	26	84		255				401
Casc. Hts-PM	30 J	12 J	19	81		458				421
I-8	1,240	120	1,810	7,600	70	13,000 J	3.2	1,300	30	18,000
I-11	370	30	310	1,470	30	2,700	22	400	20U	5,800
I-12	680	50	700	2,700	40	4,500	22	680	20U	10,000
I-15	370	50	510	1,900	30	2,900	12.7	540	20U	7,000
Bailey St.	140	31	227	1,110		3,370				5,200
S. Brandon St.	180	76	407 J	2,090		6,560				8,540
S.Dawson St.	145 J	48	218 J	1,112		2,005				4,245
Lucile St.	170	46	256 J	1,840		3,680				5,020
C-4	10	10U	40	110	10U	370	0.5U	40	20U	730
C-5	20	10	60	190	10U	600	0.5U	70	20U	1,100
C-6	50	30	240	310	10U	390	0.7	180	20U	1,400
C-7	80	80	500	450	60	680	5.6	250	20U	9,000

U=Undetected at detection limits shown.

J=Estimate. See text for further explanation.

(a) Criteria for trivalent arsenic used

(b) Criteria for trivalent chromium used

(c) Criteria for cadmium, chromium, copper, lead, nickel, silver, and zinc are hardness-dependent. These values are examples of criteria calculated from a hardness of 200 mg/L CaCO3. For hardness data, see Appendix B.

Exceeds EPA chronic freshwater criteria (EPA 1986b), see text for caveats.

Exceeds EPA acute and chronic freshwater criteria (EPA 1986b), see text for caveats.

values, and 3) a small percentage of metals were present in the dissolved phase compared to the particulate phase.

None of the organic compounds detected in decanted water surpassed EPA criteria except for bis(2-ethylhexyl)phthalate, a common plasticizer. This compound exceeded chronic levels for fresh and marine waters in both samples where it was detected.

Sediment Criteria

Neither EPA nor Ecology have developed freshwater sediment criteria. Ecology is in the process of developing criteria for contaminated sediments, and investigators have reviewed a number of existing federal, state, and provincial guidelines (Ecology, 1991b). For the interim, they recommend using those developed by Ontario, Canada (Persaud *et al.*, 1992) for comparison because they are best supported by *in situ* impacts on benthic organisms (Jim Cabbage, personal communication). A comparison of metals and PAH concentrations in vactor sediments to Ontario sediment quality guidelines is shown in Table 13. Concentrations exceeding the severe effect level are considered detrimental to the majority of benthic species (Persaud *et al.*, 1992; Ecology, 1991b).

As with decanted water, most of the guidelines exceeded were for metals. Severe effects levels for chromium, copper, and nickel were surpassed in 35%, 10%, and 8% of samples, respectively.

The Ontario guidelines also include total PAH, normalized for organic carbon (OC). One sample, R-2, had slightly higher total PAH concentrations than the severe effects guideline of 11,000 mg/kg OC.

Ecology has developed quality standards for the management of marine sediments (Ch. 173-204 WAC). In contrast with freshwater guidelines, only one sample exceeded marine sediment standards for metals. Sediment from Station I-8 had copper and zinc concentrations of 560 and 558 mg/kg, respectively, which exceed the 390 mg/kg copper and 410 mg/kg zinc marine standards (Ecology, 1991c).

Vactor sediments often exceeded individual PAHs listed in the marine standards. Table 14 shows the frequency at which PAH standards are surpassed by vactor sediment samples. Note that sediment standard concentrations have been normalized to mg/kg OC. Vactor sediments were OC-normalized for these comparisons.

HPAH standards were exceeded more often than LPAH. More notable, however, is the number of exceedances in dry season samples compared to those collected during the wet season. This reflects the general pattern of elevated contaminant levels in samples collected during the dry season.

Table 13. Comparison of metals and PAH concentrations in vector sediments to freshwater sediment quality guidelines.

	Metals (mg/kg,dry)							Total PAH (mg/kg OC)	
	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel		Zinc
Ontario Sediment Quality Guidelines (Persaud et al., 1992) severe effect level	33	10	110	110	250	2	75	820	11,000
Present Survey									
R-1	6.1	0.7 J	87	19	57	0.10 J	41	90	121
R-2	4.6	1.2 J	131	27	107	0.07 J	50	135	11,200
R-3	4.0	1.2 J	89	38	141	0.14 J	45	153	2,690
R-16	5.9	0.7 J	28 J	26	65	0.10	39	174 J	182
21 Oaks-AM	4.1 J	0.8 J	26 J	24	84 J			121 J	545
21 Oaks-PM	3.0 J	0.8 J	213 J	32	93			114	387
Casc. Hts-AM	3.0 U	0.5 J	29 J	21	24 J			80 J	56
Casc. Hts-PM	4.0 J	0.7 J	19 J	18	75 J			109 J	23
I-8	9.9	2.0	154 J	560	194	0.07 J	47	558 J	1,100
I-11	7.8	1.0 J	241 J	89	181	0.13 J	86	236 J	3,680
I-12	10	1.2 J	34 J	80	178	0.13	35	262 J	1,130
I-15	18	1.2 J	38 J	185	138	0.16	52	288 J	632
Bailey St.	3.0 U	1.1 J	111 J	73	132 J			246 J	680
S. Brandon St.	17	0.9 J	30	92 J	138 J			199 J	530
S. Dawson St.	24	1.0 J	26	90 J	80 J			200 J	287
Lucile St.	19	0.9 J	26	83 J	97 J			227 J	300
C-4	3.6	1.2 J	118	26	85	0.04 J	50	206	427
C-5	4.8	1.6	98	40	128	0.15	51	247	1,770
C-6	6.8	1.1 J	108 J	34	47	0.06 J	33	140 J	58
C-7	4.9	1.8	200 J	42	105	0.11 J	48	241 J	1,500

OC=Organic Carbon

J=Estimate. See text for further explanation.

U=Undetected at detection limits shown.

Exceeds severe effects level

Table 14. Number of times vector sediment samples exceeded Ecology's Marine Sediment Quality Standards (Ch. 173-204 WAC).

Chemical Parameter	Marine Sediment Standards (mg/kg OC)	Number of Exceedances				
		Residential		Industrial		Commercial
		Dry Weather n=4	Wet Weather n=4	Dry Weather n=4	Wet Weather n=4	Dry Weather n=4
Naphthalene	99	0	0	0	0	0
Acenaphthylene	66	0	0	0	0	0
Acenaphthene	16	1	0	1	1	0
Fluorene	23	2	0	0	1	1
Phenanthrene	100	2	0	4	1	2
Anthracene	220	0	0	0	0	0
2-Methylnaphthalene	38	0	1	2	0	0
Fluoranthene	160	2	0	3	1	2
Pyrene	1,000	1	0	0	0	0
Benzo(a)anthracene	110	2	0	1	0	1
Chrysene	110	2	0	3	0	2
Total Benzofluoranthenes*	230	2	0	1	0	2
Benzo(a)pyrene	99	2	0	1	0	2
Indeno(1,2,3-cd)pyrene	34	2	0	3	0	2
Dibenzo(a,h)anthracene	12	1	0	1	0	2
Benzo(g,h,i)perylene	31	2	0	4	0	2
LPAH	370	2	0	1	0	0
HPAH	960	2	0	3	0	2
TOTAL NO. EXCEEDANCES		25	1	28	4	20

OC=Organic Carbon

* Sum of concentrations of b,j, and k isomers.

LPAH=Low Molecular Weight Polycyclic Aromatic Hydrocarbons. It is the sum concentrations of Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, and Anthracene.

HPAH=High Molecular Weight Polycyclic Aromatic Hydrocarbons. It is the sum concentrations of Fluoranthene, Pyrene, Benzo(a)anthracene, Chrysene, Total Benzofluoranthenes, Benzo(a)pyrene, Indeno(1,2,3-cd)pyrene, Dibenzo(a,h)anthracene, and Benzo(g,h,i)perylene.

Again, these standards and guidelines were developed to protect aquatic life. The value of comparing them to vector contaminant concentrations will depend on the potential for disposal of vector wastes to impact aquatic ecosystems.

Solid Waste Criteria

The toxicity characteristic leaching procedure (TCLP) was conducted on three vector sediment samples with high lead and/or chromium concentrations to determine if they designated as dangerous waste in accordance with Ecology’s Dangerous Waste Regulations (Ch. 173-303 WAC; Ecology, 1991d). Lead and chromium are constituents of the toxicity characteristic list described in these regulations. Solid waste may be designated as dangerous waste if concentrations of one or both of these metals is 5.0 mg/L or greater when analyzed using TCLP procedures. Concentrations of other metals found in vector sediments would not be expected to exceed dangerous waste criteria based on the rule of thumb that dry weight toxicant concentrations (mg/kg) exceeding the criteria by a factor of 20 are potential dangerous or hazardous waste.

None of the samples surpassed dangerous waste criteria for lead or chromium (Table 15). Although not all of the samples with elevated lead and/or chromium levels were analyzed using TCLP, results suggest that none of the other sediment samples approach dangerous waste levels based on the TCLP extraction efficiencies found here. Extraction efficiencies (TCLP conc./ sediment conc. x 20 x 100%) were < 0.1% and 0.4% for chromium and 10% and 12% for lead.

Table 15. Results of lead and chromium TCLP analysis of vector sediments (mg/L).

		Station		
		21 Oaks-AM	Bailey St.	S.Brandon St.
	Dangerous waste Criteria (a)			
Lead	5.0	NA	0.79	0.66
Chromium	5.0	0.0005 U	0.022	NA

(a)Ch. 173-303 WAC

NA=Sample not analyzed for this parameter

U=Undetected at detection limit shown

PAH concentrations in vector sediments were also compared to dangerous waste criteria. Waste containing greater than 1.0% PAH is classified as extremely hazardous waste, based on persistence. In vector sediment, however, the highest total PAH concentration found was 0.015%. On average, PAH concentrations in vector sediments were three orders of magnitude lower than the designation level.

Although vector sediments sampled during this survey did not meet dangerous waste designation requirements, they did exceed cleanup standards from the Model Toxics Control Act (MTCA;

Ch. 173-340 WAC) (Ecology, 1991e). The MTCA cleanup level for carcinogenic PAH in generic soils is 1.0 mg/kg [sum concentrations of benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene]. This value was exceeded, on average, in vactor sediment samples from all three land-use categories. All 20 vactor sediment samples also equalled or exceeded the MTCA cleanup level for TPH (200 mg/kg). Chromium concentrations were exceeded in 8 of 20 samples (MTCA=100 mg/kg) and arsenic and cadmium were exceeded in one sample each (MTCA=20 mg/kg and 2.0 mg/kg, respectively).

The MTCA cleanup values cited here provide a perspective for evaluating some of the contaminants of concern in vactor waste. Exceedances of these values, however, do not necessarily precipitate requirements for cleanup under the Model Toxics Control Act.

Land disposal of vactor wastes is presently decided locally on a case-by-case basis, although disposal requirements may be based on the State's dangerous waste and MTCA criteria. For instance, the Seattle/King County Health Department has set contaminant limits on materials accepted at the Cedar Hill lined sanitary landfill which closely parallel those listed in the dangerous waste regulations (Herrera Environmental Consultants, Inc., 1991-draft). Based on the data presented here, vactor wastes would be accepted at Cedar Hills. King County unregulated or demolition landfills, however, cannot accept wastes with concentrations over 200 mg/kg TPH. Those landfills would be required to reject all vactor sediments collected during this survey.

SUMMARY AND CONCLUSIONS

Table 16 summarizes many of the results and findings of this report by grouping major contaminants into primary, secondary, and low levels of concern. Comparisons to environmental criteria are shown, along with a review of differences in land-use and season.

Fecal coliform bacteria, chromium, lead, PAH, and TPH were considered to be the contaminants of greatest concern. This consideration was based on detection frequencies, concentrations, and exceedances of environmental criteria. Additional conclusions about these high priority contaminants, and vactor wastes in general, are listed below:

- 1) Zinc, lead, chromium, copper, nickel, and arsenic were present at appreciable concentrations in both vactor decanted water and sediments. In decanted water, total metals concentrations were positively correlated with solids and were present at low levels in the dissolved phase.
- 2) Volatile organic compounds were the most frequently detected organic compounds in water decanted from vactor trucks. Toluene and xylenes were the only organic compounds detected in 50% or more of all decanted water samples analyzed. Unlike metals, concentrations of organic compounds in water were not closely associated with total suspended solids concentrations.

Table 16. Summary of results for 1991-1992 survey of contaminants in vector truck wastes.

Level of Concern	Contaminant(s)	Detection Frequency	Median Concentration	Maximum Concentration	Maximum Land-Use (Average)	Maximum Season (Average)	Exceeds Water Quality Criteria on Average	Dangerous Waste?	Exceeds MTCA Cleanup Standards
Primary	Fecal Coliform	92%	3,000/100mL	16,000/100mL	RES	Dry Only	Yes(a)	No	DNA
		NA	NA	NA	NA	NA	NA	NA	NA
	Cr	100%	230 ug/L	1,800 ug/L	IND	Dry	No(b)	No	DNA
		100%	88 mg/kg	241 mg/kg	COM	Dry	Yes	No	Yes(c)
	Pb	100%	1,120 ug/L	13,000 ug/L	IND	Dry	Yes	No	DNA
		100%	101 mg/kg	194 mg/kg	IND	Dry	Yes	No	No
	PAH	<40%	<10 ug/L	57 ug/L	IND	Dry Only	No	No	DNA
		100%	10,900 ug/kg	146,000 ug/kg	COM	Dry	Yes	No	Yes
	TPH	100%	7.2 mg/L	12 mg/L	IND	Wet Only	DNA	No	DNA
		100%	2,020 mg/kg	4,600 mg/kg	IND	Wet	DNA	No	Yes
Secondary	COD	100%	900 mg/L	26,900 mg/L	IND	Dry	DNA	No	DNA
		NA	NA	NA	NA	NA	NA	NA	NA
	TSS	100%	2,960 mg/L	110,000 mg/L	IND	Dry	DNA	No	DNA
		NA	NA	NA	NA	NA	NA	NA	NA
	Cu, Cd, Zn, As	High	High	High	IND	Dry	Yes	No	DNA
		High	High	High	IND	Dry	Yes	No	No(d)
	BTEX	95%	74 ug/L	600 ug/L	IND	Wet	No	No	DNA
		95%	176 ug/kg	3,400 ug/kg	IND	Dry	No	No	No
Low	CN, Hg, Ni, Ag	Variable	Mod.-Low	Mod.-Low	IND	Dry Only	Yes(e)	No	DNA
		Variable	Mod.-Low	Mod.-Low	IND	Dry Only	No(f)	No	No
	Pest./PCBs	Not Detected	-	-	-	-	No	No	DNA
		Not Detected	-	-	-	-	No	No	No

Water
Sediment

(a)Exceeds criteria for bathing and shellfish harvesting waters

NA=Not Analyzed

(b)Criteria for trivalent chromium used

(c)Exceeds MTCA standards in 8 of 20 samples

DNA=Does Not Apply to these criteria

(d)Except for one sample exceeding cadmium and one sample exceeding arsenic standard

(e)Cyanide and Mercury exceed criteria on average

(f)Nickel exceeds criteria on average

- 3) Polycyclic aromatic hydrocarbons were the most frequently detected class of organic compounds in vector sediments. Total PAH concentrations ranged from 0.7 to 146 mg/kg. Total petroleum hydrocarbon concentrations were also high, ranging from 200 to 4,600 mg/kg.
- 4) Overall, samples originating from heavily industrialized areas had the highest concentrations of contaminants.
- 5) Concentrations of conventional water quality variables and metals in water and sediment were consistently higher in samples collected during the dry season. Other than PAH, which were highest in dry season samples, concentrations of organic compounds did not appear to vary seasonally.
- 6) Cyanide and metals concentrations in decanted water frequently exceeded EPA acute and chronic quality criteria for surface waters. Except for chromium, sediment metals and PAH concentrations rarely exceeded Ontario guidelines for freshwater sediment quality.
- 7) Based on contaminant concentrations, sediments do not designate as dangerous or hazardous wastes. However, carcinogenic PAH and TPH concentrations exceeded Model Toxic Control Act (MTCA) cleanup standards. Chromium levels also exceeded MTCA standards in 8 of 20 samples.

RECOMMENDATIONS

- 1) Establish local or statewide programs to periodically monitor vector wastes. At a minimum, chromium, lead, PAH, and TPH should be analyzed. Where lead and chromium concentrations are high, TCLP analysis should be done to determine dangerous waste status. Major focus should be on sampling wastes generated in heavy industrial areas and sites where vehicle use is high.
- 2) Prevent disposal of vector wastes where they may drain or leach to surface waters. Disposal of vector decanted water in sanitary sewers and sediments in regulated landfills appears to be the best current disposal option.
- 3) Further study should be conducted to establish the relationship between solids and contaminant concentrations in decanted water. This may be done by measuring concentrations before and after solids removal (centrifugation may be the best method). Any solids removed from decanted water should also be analyzed to determine the most appropriate disposal method for this fraction.
- 4) Several techniques currently being used to treat contaminated soils should be tested on vector solids. Composting and thermodesorption may be effective in organic compound reduction and could potentially decrease TPH levels below disposal limits set by unregulated landfills.

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APPENDIX A

Location of Vector Sites

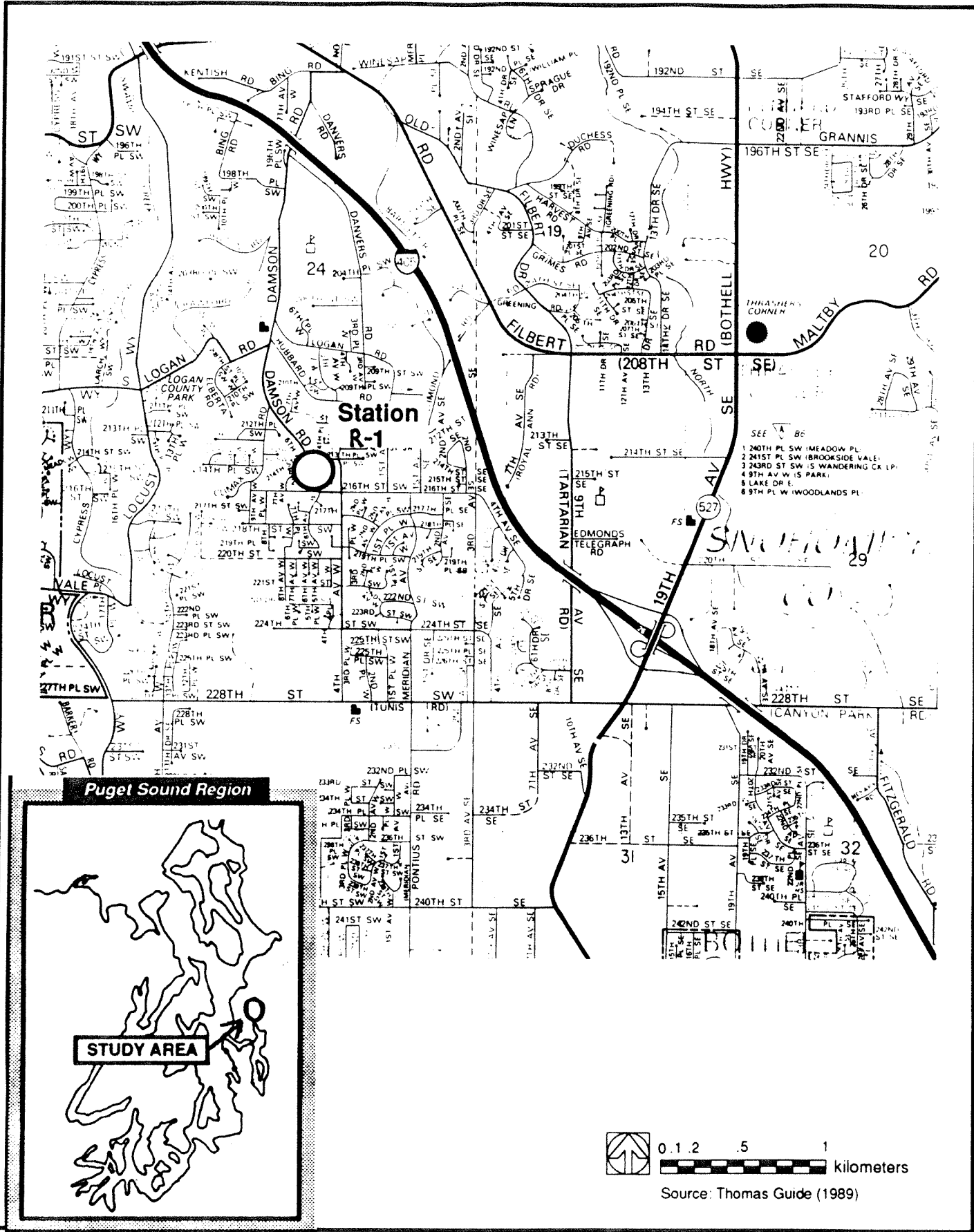


Figure A-1. Location of Station R-1

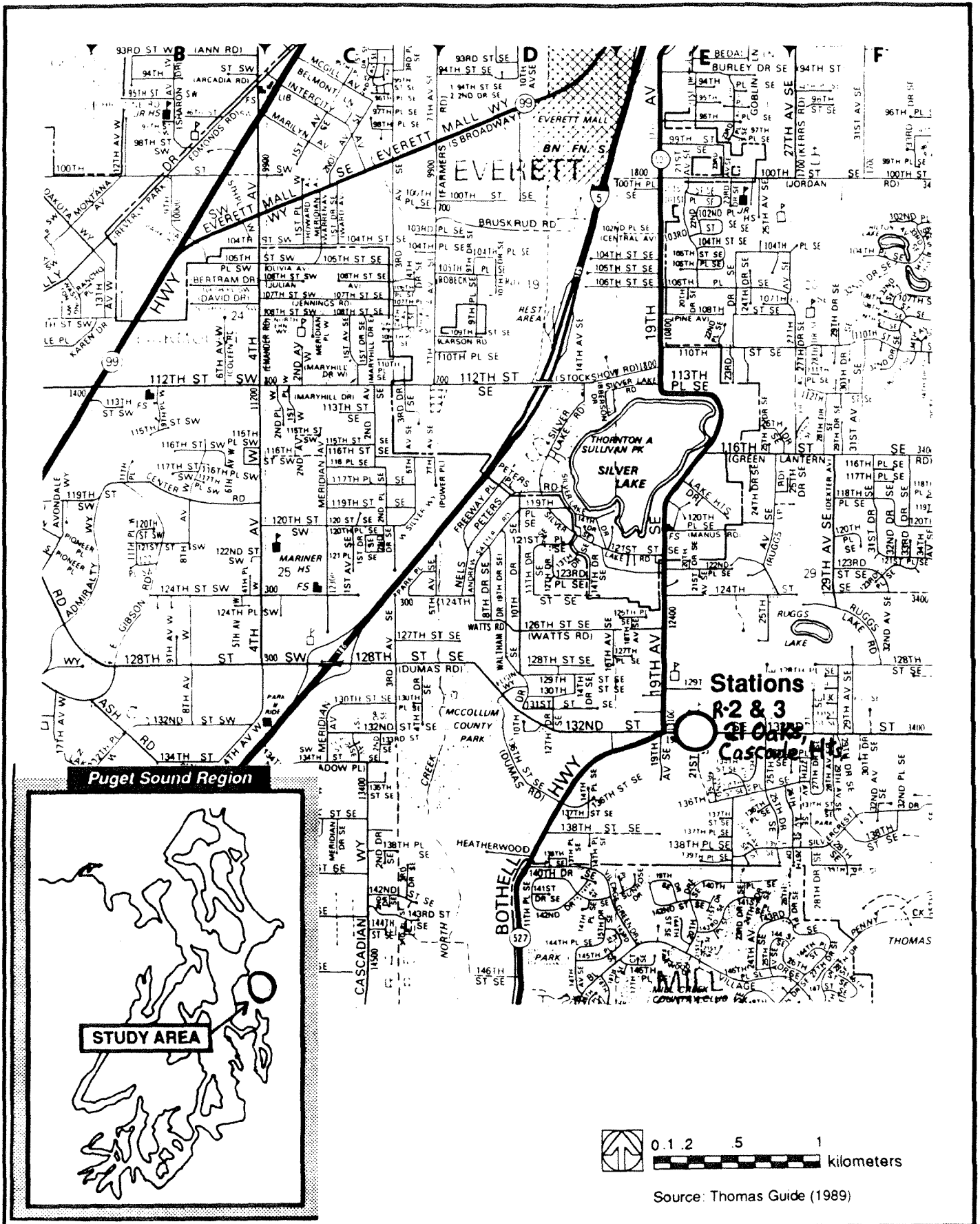


Figure A-2. Location of Stations R-2 & 3, 21 Oaks and Cascade Hts

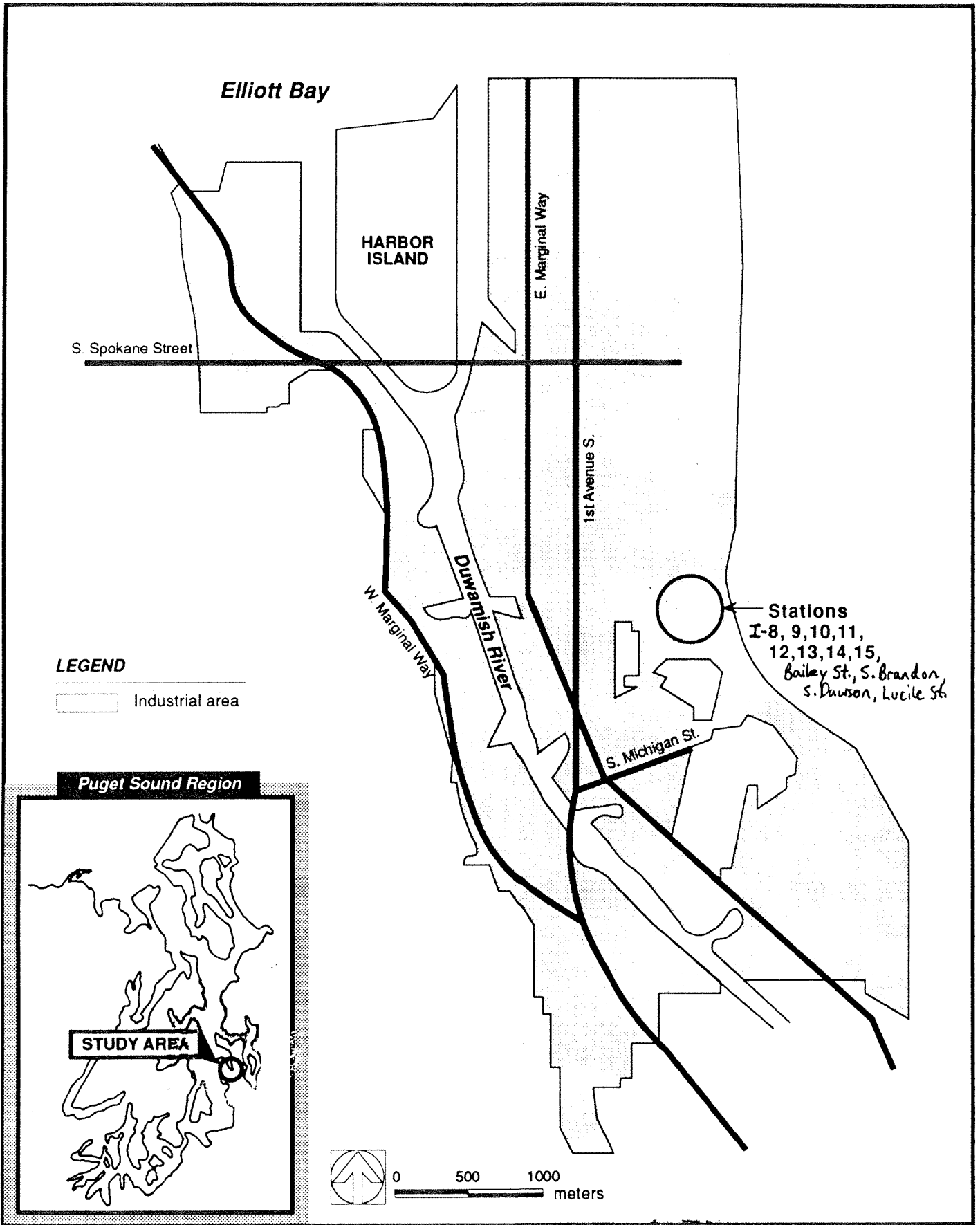


Figure A-3. Location of Industrial Stations

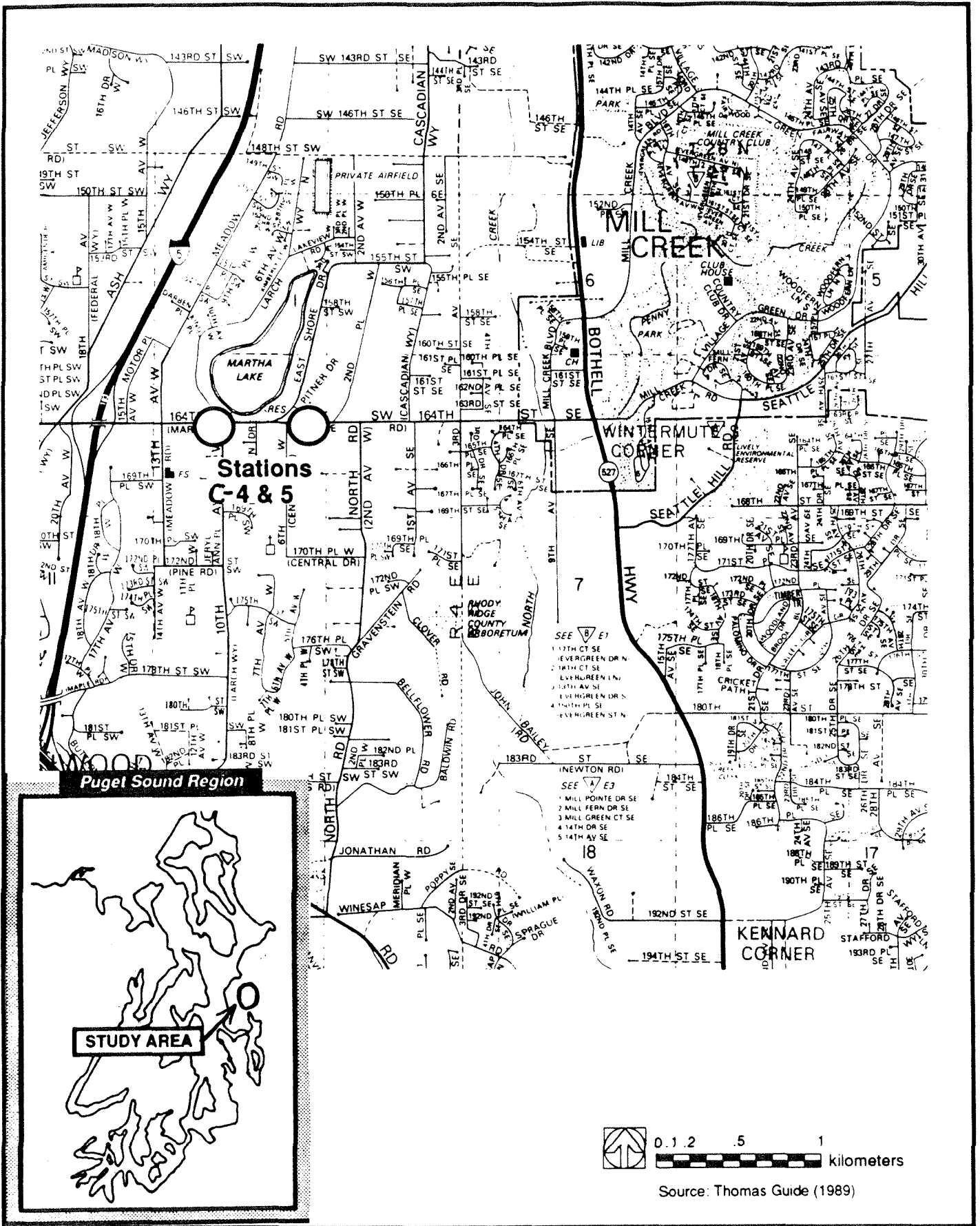


Figure A-4. Locations of Stations C-4 & 5

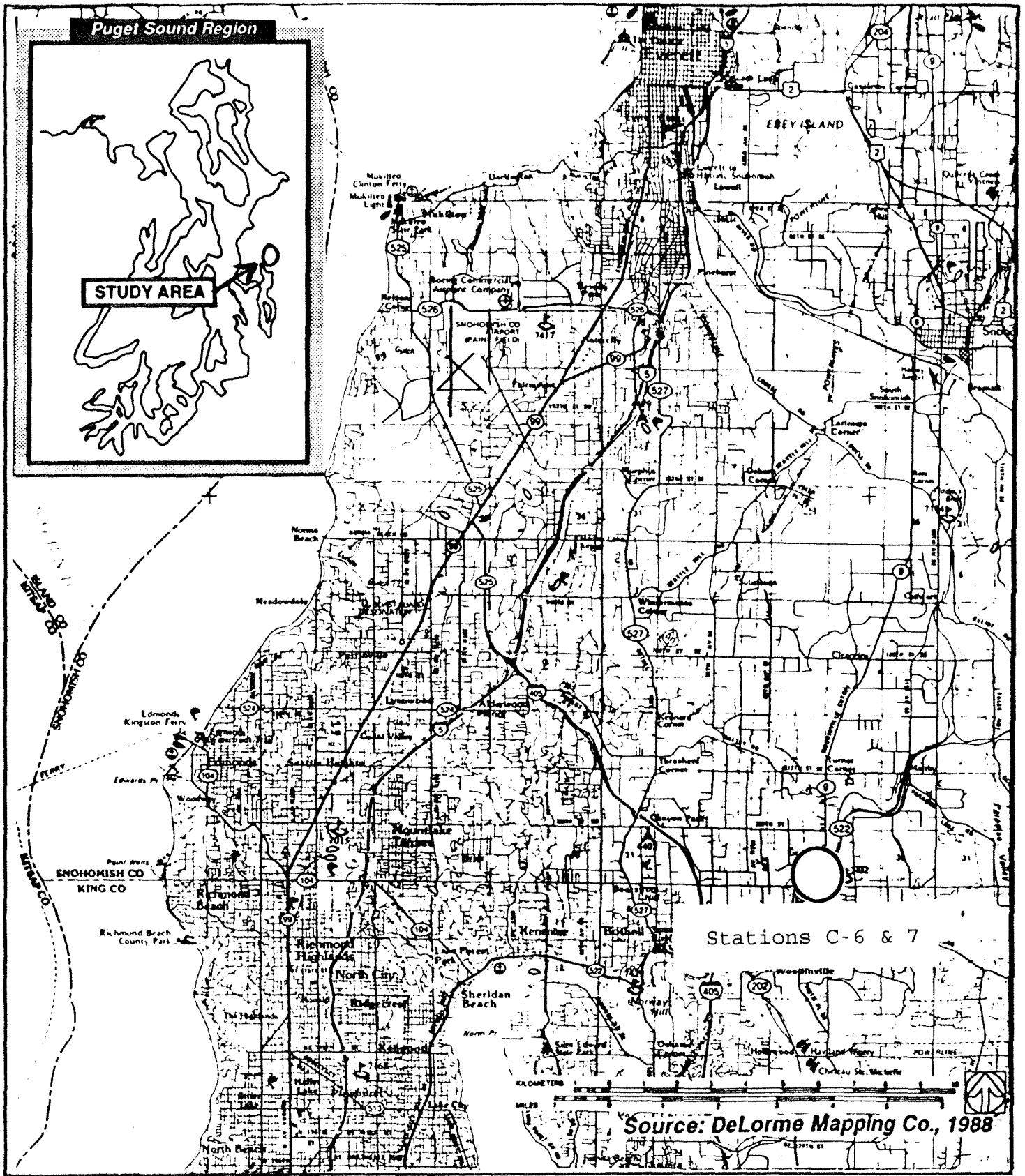


Figure A-5. Location of Stations C-6 & 7

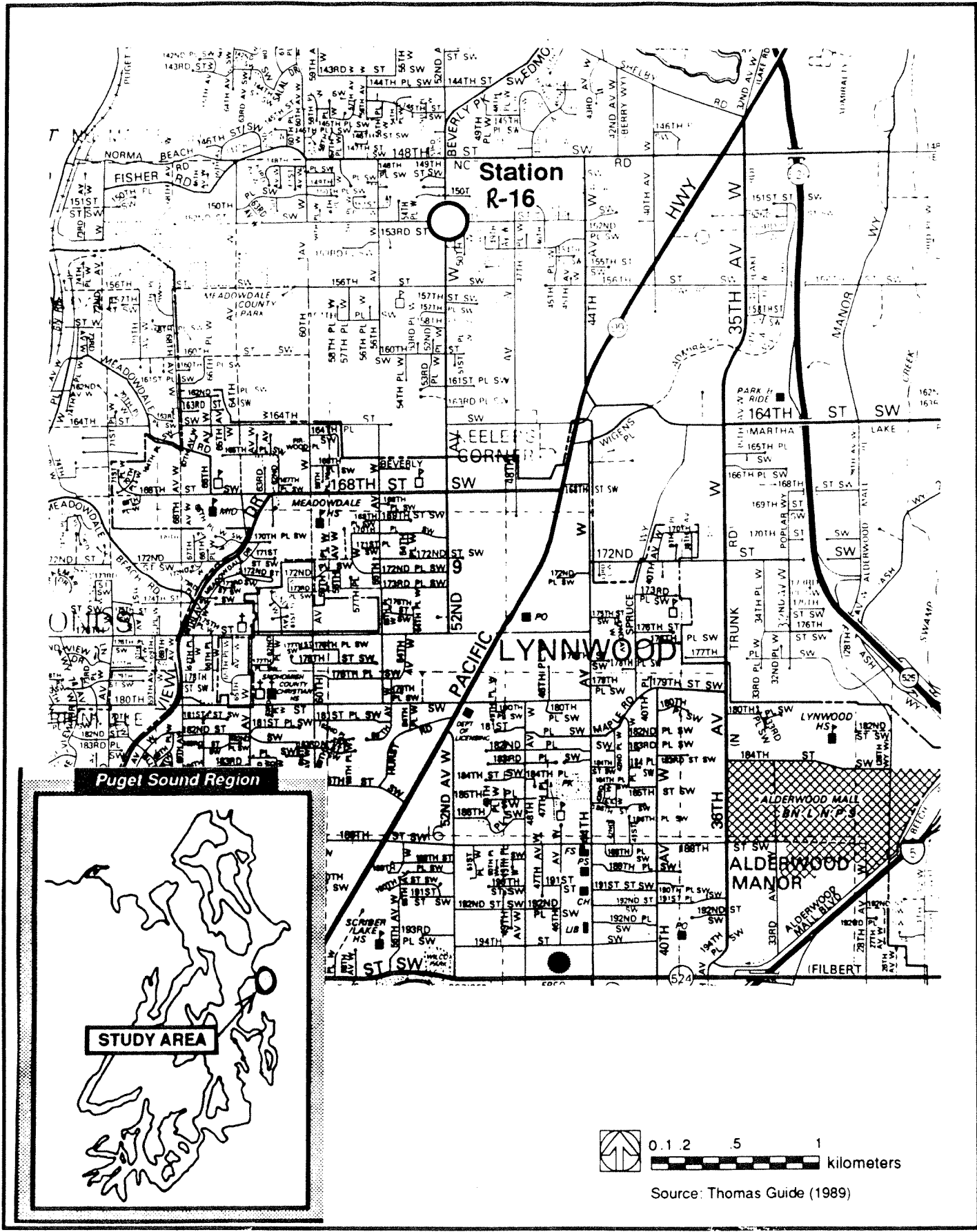


Figure A-6 Location of Station 16.

APPENDIX B

Results of Decanted Water Analysis

APPENDIX B

Results of conventional analysis of vector decant water.

Site Name	Land-Use	Date	Ecology Sample No.	pH	Conductivity (μ mhos/cm)	Hardness as CaCO ₃ (mg/l)	Fecal Coliform Bacteria (MPN/100ml)	Biological Oxygen Demand (mg/l)	Chemical Oxygen Demand (mg/l)	Oil & Grease (mg/l)	Total Organic Carbon (mg/l)	Total Solids (mg/l)	Total Dissolved Solids (mg/l)	Total Suspended Solids (mg/l)	Solids, Settleable (ml/l/hr)	Turbidity (ntu)
R-1	RES	7/22/91		7.98	537	707	16000	100	200	9	50	NA	299	265	184	23000
R-2	RES	7/23/91		7.33	475	678	16000	471	8900	9	3040	NA	232	41700	210	15000
R-3	RES	7/23/91		6.89	365	92	16000	109	530	40	90	NA	196	1020	6	130
R-16	RES	7/31/91		7.24 J	329	200	1600	90	500	16	280	NA	207	2750	145	310
21 Oaks-AM	RES	3/23/92	138105	6.18	NA	99	NA	118 J	420	NA	106	820	NA	578	5	500
21 Oaks-PM	RES	3/23/92	138106	6.41	NA	268	NA	184 J	400	NA	112	821	NA	309	2	200
Casc. Hts.-AM	RES	3/30/92	138108	6.86	NA	76	NA	42	230	NA	50	750	NA	556	2	280
Casc. Hts.-PM	RES	3/30/92	138109	6.62	NA	80	NA	57	300	NA	49	586	NA	371	2	270
I-8	IND	7/29/91		7.51	1070	762	2	276	1900	16	5340	NA	395	111000	324	52000
I-11	IND	7/29/91		7.10 J	364	413	1600	260	15100	11	5520	NA	216	24300	117	17000
I-12	IND	7/30/91		7.38	481	483	16000	285	26900	11	7880	NA	250	10700	42	92
I-15	IND	7/30/91		6.94	299	400	1600	1090 J	13600	25	4260	NA	177	14600	24	55
Bailey St.	IND	3/25/92	138107	6.54	NA	199	NA	1250 J	1400	NA	141	32600	NA	31800 J	90	1400
S. Brandon	IND	4/6/92	158110	6.70	NA	241 J	NA	790	4500	NA	169	70400	NA	74900 J	30	2200
S. Dawson	IND	4/6/92	158111	6.84	NA	224 J	NA	125	2300	NA	132	17900	NA	18800 J	16	1900
S. Dawson(Dup.)	IND	4/6/92	158112	6.84	NA	256 J	NA	109	2200	NA	133	18800	NA	18500 J	22	2100
Lucile St.	IND	4/6/92	158113	6.66	NA	229 J	NA	577	1200	NA	118	3030	NA	3180 J	48	1200
C-4	COM	7/24/92		7.39	189	73	2200	28	120	7	50	NA	95	365	2	300
C-5	COM	7/24/92		6.93	197	74	16000	86	600	10	170	NA	114	910	6	900
C-6	COM	7/25/92		7.79	184	147	2800	34	380	8	100	NA	130	2460	4	1800
C-7	COM	7/25/92		7.10	1110	249	16000	290	4100	17	2000	NA	550	9260	65	4000

NA=Sample not analyzed for this parameter

MPN=Most probable number of fecal coliform bacteria colonies.

J=Estimated

APPENDIX B

Total metals and cyanide in vactor decant water (ug/l).

Site Name	Land-Use	Date	Ecology Sample No.	Arsenic	Cadmium	Chromium	Copper	Cyanide	Lead	Mercury	Nickel	Silver	Zinc
R-1	RES	7/22/91		310	20	630	1000	30	1000	13.4	760	20 U	4600
R-2	RES	7/23/91		590	50	410	930	20	2600	15.9	610	20 U	6100
R-3	RES	7/23/91		40	10	20	140	10 U	1200	1.2	40	20 U	1200
R-16	RES	7/31/91		40	10 U	100	190	10 U	400	0.6	150	20 U	1500
21 Oaks-AM	RES	3/23/92	138105	53 J	15	37	202	NA	1050	NA	NA	NA	1090
21 Oaks-PM	RES	3/23/92	138106	40 J	6.4 J	13 J	112	NA	757	NA	NA	NA	522
Casc. Hts.-AM	RES	3/30/92	138108	37 J	9 J	26	84	NA	255	NA	NA	NA	401
Casc. Hts.-PM	RES	3/30/92	138109	30 J	12 J	19	81	NA	458	NA	NA	NA	421
I-8	IND	7/29/91		1240	120	1810	7600	70	13000 J	3.2	1300	30	18000
I-11	IND	7/29/91		370	30	310	1470	30	2700	21.9	400	20 U	5800
I-12	IND	7/30/91		680	50	700	2700	40	4500	21.8	680	20 U	10000
I-15	IND	7/30/91		370	50	510	1900	30	2900	12.7	540	20 U	7000
Bailey St.	IND	3/25/92	138107	140	30.8	227	1110	NA	3370	NA	NA	NA	5200
S. Brandon	IND	4/6/92	158110	180	76	407 J	2090	NA	6560	NA	NA	NA	8540
S. Dawson	IND	4/6/92	158111	120 J	40	170 J	884	NA	1730	NA	NA	NA	3930
S. Dawson(Dup.)	IND	4/6/92	158112	170	57	266 J	1340	NA	2280	NA	NA	NA	4650
Lucile St.	IND	4/6/92	158113	170	46	256 J	1840	NA	3680	NA	NA	NA	5020
C-4	COM	7/24/91		10	10 U	40	110	10 U	370	0.5 U	40	20 U	730
C-5	COM	7/24/91		20	10	60	190	10 U	600	0.5 U	70	20 U	1100
C-6	COM	7/25/91		50	30	240	310	10 U	390	0.7	180	20 U	1400
C-7	COM	7/25/91		80	80	500	450	60	680	5.6	250	20 U	9000
Transfer Blank		3/30/92	138114	30 U	2 U	5	3 U	NA	20 U	NA	NA	NA	4 U

NA=Sample not analyzed for this parameter

U=Undetected

J=Estimated

APPENDIX B

Dissolved metals in vector decant water (ug/l).

Site Name	Land-Use	Date	Ecology Sample No.	Arsenic	Cadmium	Chromium	Copper	Lead	Zinc
21 Oaks-AM	RES	3/23/92	138105	30 U	2 U	5 U	17	48 J	76
21 Oaks-PM	RES	3/23/92	138106	30 U	2 U	5 U	5.9 J	20 U	36
Casc. Hts.-AM	RES	3/30/92	138108	30 U	2 U	5 U	12	20 U	19 J
Casc. Hts.-PM	RES	3/30/92	138109	30 U	2 U	5 U	3 U	20 U	6.2 J
Bailey St.	IND	3/25/92	138107	30 U	2 U	5 U	3 U	20 U	12 J
S. Brandon	IND	4/6/92	158110	30 U	2 U	5 UJ	5.6 J	20 U	38
S. Dawson	IND	4/6/92	158111	30 U	2 U	5 UJ	16	40 J	140
S. Dawson(Dup.)	IND	4/6/92	158112	30 U	2 U	5 UJ	11	20 U	56
Lucile St.	IND	4/6/92	158113	30 U	2 U	5 UJ	9 J	20 U	31

U=Undetected

J=Estimated

Total recoverable metals in vector decant water (ug/l).

Site Name	Land-Use	Date	Ecology Sample No.	Arsenic	Cadmium	Chromium	Copper	Lead	Zinc
S. Dawson	IND	4/6/92	158111	150 J	48 J	247 J	1250	2050	4420
Lucile St.	IND	4/6/92	158113	180	36 J	205 J	1520	3240	4460

J=Estimated

APPENDIX B

Volatile organics in vector decant water (ug/l)

Site Name	Land-Use	Ecology Date	Ecology Sample No.	Acetone	Benzene	Bromo-benzene	Bromo-dichloro-methane	Bromo-chloro-methane	Bromo-form	Bromo-methane	2-Butanone	Butyl-benzene	Carbon Disulfide	Carbon tetra-chloride
R-1	RES	7/22/91		B	5 U	NA	5 U	NA	5 U	10 U	10 U	NA	5 U	5 U
R-2	RES	7/23/91		B	5 U	NA	5 U	NA	5 U	10 U	10 U	NA	5 U	5 U
R-3	RES	7/23/91		850 J	5 U	NA	5 U	NA	5 U	10 U	10 U	NA	5 U	5 U
R-16	RES	7/31/91		B	5 U	NA	5 U	NA	5 U	10 U	10 U	NA	5 U	5 U
21 Oaks-AM	RES	3/23/92	138105	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
21 Oaks-PM	RES	3/23/92	138106	NA	4 J	NA	NA	NA	NA	NA	NA	NA	NA	NA
Casc. Hts.-AM	RES	3/30/92	138108	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Casc. Hts.-PM	RES	3/30/92	138109	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
I-8	IND	7/29/91		B	5 U	NA	5 U	NA	5 U	10 U	10 U	NA	5 U	5 U
I-11	IND	7/29/91		B	5 U	NA	5 U	NA	5 U	10 U	10 U	NA	5 U	5 U
I-12	IND	7/30/91		B	5 U	NA	5 U	NA	5 U	10 U	10 U	NA	5 U	5 U
I-15	IND	7/30/91		B	5 U	NA	5 U	NA	5 U	10 U	20	NA	5 U	5 U
Bailey St.	IND	3/25/92	138107	B	1 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
S. Brandon	IND	4/6/92	158110	B	5 U	1 U	1 U	1 U	1 UJ	1 U	17 U	1 U	1 U	1 U
S. Dawson	IND	4/6/92	158111	B	5 U	5 U	5 U	5 U	5 U	5 U	47 U	5 U	5 U	5 U
S. Dawson(Dup.)	IND	4/6/92	158112	B	5 U	5 U	5 U	5 U	5 U	5 U	40 U	5 U	25 U	5 U
Lucile St.	IND	4/6/92	158113	B	1 U	5 U	5 U	5 U	5 U	5 U	27 U	5 U	25 U	5 U
C-4	COM	7/24/91		B	5 U	NA	5 U	NA	5 U	10 U	10 U	NA	5 U	5 U
C-5	COM	7/24/91		B	5 U	NA	5 U	NA	5 U	10 U	10 U	NA	5 U	5 U
C-6	COM	7/25/91		B	5 U	NA	5 U	NA	5 U	10 U	10 U	NA	5 U	5 U
C-7	COM	7/25/91		B	5 U	NA	5 U	NA	5 U	10 U	10 U	NA	5 U	5 U
Transfer Blank		3/30/92	138114	140	1 U	1 U	1 U	1 U	1 UJ	1 U	6 U	1 U	1 U	1 U
Trip Blank		7/30/91		140	NA	5 U	NA	5 U	5 U	10 U	NA	10 U	5 U	5 U
Trip Blank		7/30/91		50	NA	5 U	NA	5 U	5 U	10 U	NA	10 U	5 U	5 U
Trip Blank		7/30/91		16	NA	5 U	NA	5 U	5 U	10 U	NA	10 U	5 U	5 U

B = Values not reported due to blank contamination

NA=Sample not analyzed for this parameter

U=Undetected

J=Estimated

850 J Indicates analyte was detected

APPENDIX B

Volatile organics in vector decant water (ug/l)

Site Name	Land-Use	Date	Ecology Sample No.	Chloro-benzene	Chloro-ethane	Chloro-form	Chloro-methane	2-Chloro-toluene	4-Chloro-toluene	1,2-Dibromo-ethane	Dibromo-chloro-methane	Dibromo-methane	1,2-Dichloro-benzene	1,3-Dichloro-benzene
R-1	RES	7/22/91		5 U	10 U	5 U	10 U	NA	NA	NA	5 U	NA	NA	NA
R-2	RES	7/23/91		5 U	10 U	5 U	10 U	NA	NA	NA	5 U	NA	NA	NA
R-3	RES	7/23/91		5 U	10 U	5 U	10 U	NA	NA	NA	5 U	NA	NA	NA
R-16	RES	7/31/91		5 U	10 U	5 U	10 U	NA	NA	NA	5 U	NA	NA	NA
21 Oaks-AM	RES	3/23/92	138105	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
21 Oaks-PM	RES	3/23/92	138106	NA	NA	0.2	NA	NA	NA	NA	NA	NA	NA	NA
Casc. Hts.-AM	RES	3/30/92	138108	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Casc. Hts.-PM	RES	3/30/92	138109	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I-8	IND	7/29/91		5 U	10 U	5 U	10 U	NA	NA	NA	5 U	NA	NA	NA
I-11	IND	7/29/91		5 U	10 U	5 U	10 U	NA	NA	NA	5 U	NA	NA	NA
I-12	IND	7/30/91		5 U	10 U	5 U	10 U	NA	NA	NA	5 U	NA	NA	NA
I-15	IND	7/30/91		5 U	10 U	5 U	10 U	NA	NA	NA	5 U	NA	NA	NA
Bailey St.	IND	3/25/92	138107	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S. Brandon	IND	4/6/92	158110	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
S. Dawson	IND	4/6/92	158111	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
S. Dawson(Dup.)	IND	4/6/92	158112	5 U	1 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Lucile St.	IND	4/6/92	158113	5 U	5 UJ	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
C-4	COM	7/24/91		5 U	10 U	5 U	10 U	NA	NA	NA	5 U	NA	NA	NA
C-5	COM	7/24/91		5 U	10 U	5 U	10 U	NA	NA	NA	5 U	NA	NA	NA
C-6	COM	7/25/91		5 U	10 U	5 U	10 U	NA	NA	NA	5 U	NA	NA	NA
C-7	COM	7/25/91		5 U	10 U	5 U	10 U	NA	NA	NA	5 U	NA	NA	NA
Transfer Blank		3/30/92	138114	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trip Blank		7/30/91		5 U	10 U	5 U	NA	NA	NA	10 U	NA	NA	NA	NA
Trip Blank		7/30/91		5 U	10 U	5 U	NA	NA	NA	10 U	NA	NA	NA	NA
Trip Blank		7/30/91		5 U	10 U	5 U	NA	NA	NA	10 U	NA	NA	NA	NA

B = Values not reported due to blank contamination

NA=Sample not analyzed for this parameter

U=Undetected

J=Estimated

0.2 Indicates analyte was detected

APPENDIX B

Volatile organics in vactor decant water (ug/l)

Site Name	Land-Use	Date	Ecology Sample No.	1,4-Dichloro-benzene	Dichloro-difluoro-methane	1,1-Di-chloro-ethane	1,2-Di-chloro-ethane	1,1-Di-chloro-ethene	1,2-Di-chloro-ethene	1,2-Di-chloro-propane	1,3-Di-chloro-propane	2,2-Di-chloro-propane	1,1-Di-chloro-propene	1,2-Di-chloro-propene
R-1	RES	7/22/91		NA	NA	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U
R-2	RES	7/23/91		NA	NA	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U
R-3	RES	7/23/91		NA	NA	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U
R-16	RES	7/31/91		NA	NA	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U
21 Oaks-AM	RES	3/23/92	138105	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
21 Oaks-PM	RES	3/23/92	138106	NA	NA	NA	5	NA	NA	NA	NA	NA	NA	NA
Casc. Hts.-AM	RES	3/30/92	138108	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Casc. Hts.-PM	RES	3/30/92	138109	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I-8	IND	7/29/91		NA	NA	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U
I-11	IND	7/29/91		NA	NA	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U
I-12	IND	7/30/91		NA	NA	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U
I-15	IND	7/30/91		NA	NA	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U
Bailey St.	IND	3/25/92	138107	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S. Brandon	IND	4/6/92	158110	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA
S. Dawson	IND	4/6/92	158111	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	NA
S. Dawson(Dup.)	IND	4/6/92	158112	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	NA
Lucile St.	IND	4/6/92	158113	5 U	25 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	NA
C-4	COM	7/24/91		NA	NA	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U
C-5	COM	7/24/91		NA	NA	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U
C-6	COM	7/25/91		NA	NA	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U
C-7	COM	7/25/91		NA	NA	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U
Transfer Blank		3/30/92	138114	1 U	5 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	NA
Trip Blank		7/30/91		NA	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	5 U
Trip Blank		7/30/91		NA	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	5 U
Trip Blank		7/30/91		NA	5 U	5 U	5 U	5 U	NA	NA	NA	NA	5 U	5 U

B = Values not reported due to blank contamination

NA=Sample not analyzed for this parameter

U=Undetected

J=Estimated

Indicates analyte was detected

APPENDIX B

Volatile organics in vector decant water (ug/l)

Site Name	Land-Use	Date	Ecology Sample No.	Cis	Trans	Ethyl- benzene	Hexachloro- butadiene	2- Hexanone	Isopropyl- benzene	p-Isopropyl Toluene	4-	Methylene Chloride	Propyl- Benzene	Sec-
				1,3-Di- chloro- propene	1,3-Di- chloro- propene						Methyl-2 Pentanone			Butyl- benzene
R-1	RES	7/22/91		5 U	5 U	5 U	NA	10 U	NA	NA	10 U	5 U	NA	NA
R-2	RES	7/23/91		5 U	5 U	5 U	NA	10 U	NA	NA	10 U	5 U	NA	NA
R-3	RES	7/23/91		5 U	5 U	5 U	NA	10 U	NA	NA	10 U	5 U	NA	NA
R-16	RES	7/31/91		5 U	5 U	1 J	NA	10 U	NA	NA	10 U	B	NA	NA
21 Oaks-AM	RES	3/23/92	138105	NA	NA	15	NA	NA	NA	NA	NA	NA	NA	NA
21 Oaks-PM	RES	3/23/92	138106	NA	NA	51	NA	NA	NA	3.4	NA	NA	12	NA
Casc. Hts.-AM	RES	3/30/92	138108	NA	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA
Casc. Hts.-PM	RES	3/30/92	138109	NA	NA	1 U	NA	NA	NA	NA	NA	NA	NA	NA
I-8	IND	7/29/91		5 U	5 U	2 J	NA	10 U	NA	NA	9 J	B	NA	NA
I-11	IND	7/29/91		5 U	5 U	2 J	NA	10 U	NA	NA	11	B	NA	NA
I-12	IND	7/30/91		5 U	5 U	5 U	NA	10 U	NA	NA	7 J	B	NA	NA
I-15	IND	7/30/91		5 U	5 U	4 J	NA	10 U	NA	NA	9 J	B	NA	NA
Bailey St.	IND	3/25/92	138107	NA	NA	0.9 J	NA	NA	NA	NA	NA	NA	NA	NA
S. Brandon	IND	4/6/92	158110	NA	NA	1 U	1 U	1 U	1 U	1 U	6	1 U	1 U	1 U
S. Dawson	IND	4/6/92	158111	NA	NA	5 U	5 U	5 U	5 U	5 U	10	5 U	5 U	5 U
S. Dawson(Dup.)	IND	4/6/92	158112	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Lucile St.	IND	4/6/92	158113	NA	NA	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
C-4	COM	7/24/91		5 U	5 U	5 U	NA	10 U	NA	NA	10 U	5 U	NA	NA
C-5	COM	7/24/91		5 U	5 U	5 U	NA	10 U	NA	NA	10 U	5 U	NA	NA
C-6	COM	7/25/91		5 U	5 U	5 U	NA	10 U	NA	NA	10 U	5 U	NA	NA
C-7	COM	7/25/91		5 U	5 U	5 U	NA	10 U	NA	NA	10 U	5 U	NA	NA
Transfer Blank		3/30/92	138114	NA	NA	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trip Blank		7/30/91		5 U	5 U	NA	5 U	NA	NA	10 U	10 U	NA	NA	B
Trip Blank		7/30/91		5 U	5 U	NA	5 U	NA	NA	10 U	10 U	NA	NA	8
Trip Blank		7/30/91		5 U	5 U	NA	5 U	NA	NA	10 U	10 U	NA	NA	11

B = Values not reported due to blank contamination

NA=Sample not analyzed for this parameter

U=Undetected

J=Estimated

Indicates analyte was detected

APPENDIX B

Volatile organics in vactor decant water (ug/l)

Site Name	Land-Use	Date	Ecology Sample No.	1,1,2,2-										
				Styrene	Tert-butyl-benzene	Tetra-chloro-ethane	Tetra-chloro-ethylene	Toluene	1,2,3-Trichloro-benzene	1,2,4-Trichloro-benzene	1,1,1-Trichloro-ethane	1,1,2-Trichloro-ethane	Trichloro-fluoro-methane	
R-1	RES	7/22/91		5 U	NA	5 U	5 U	26	NA	NA	5 U	5 U	5 U	NA
R-2	RES	7/23/91		5 U	NA	5 U	5 U	16	NA	NA	5 U	5 U	5 U	NA
R-3	RES	7/23/91		5 U	NA	5 U	5 U	32	NA	NA	5 U	5 U	5 U	NA
R-16	RES	7/31/91		5 U	NA	5 U	5 U	3	NA	NA	5 U	5 U	5 U	NA
21 Oaks-AM	RES	3/23/92	138105	NA	NA	NA	0.9	84 J	NA	NA	NA	NA	NA	NA
21 Oaks-PM	RES	3/23/92	138106	NA	NA	NA	NA	180	NA	NA	NA	NA	NA	NA
Casc. Hts.-AM	RES	3/30/92	138108	NA	NA	NA	NA	47	NA	NA	NA	NA	NA	NA
Casc. Hts.-PM	RES	3/30/92	138109	NA	NA	NA	NA	4	NA	NA	NA	NA	NA	NA
I-8	IND	7/29/91		5 U	NA	5 U	5 U	180	NA	NA	5 U	5 U	5 U	NA
I-11	IND	7/29/91		5 U	NA	5 U	5 U	100	NA	NA	5 U	5 U	5 U	NA
I-12	IND	7/30/91		5 U	NA	5 U	5 U	15	NA	NA	5 U	5 U	5 U	NA
I-15	IND	7/30/91		5 U	NA	5 U	5 U	84	NA	NA	5 U	5 U	5 U	NA
Bailey St.	IND	3/25/92	138107	NA	NA	NA	442 J	84	NA	NA	NA	NA	NA	NA
S. Brandon	IND	4/6/92	158110	1 U	1 U	1 U	0.8 J	49	1 U	1 U	1 U	1 U	1 U	1 U
S. Dawson	IND	4/6/92	158111	5 U	5 U	5 U	5 U	71	5 U	5 U	5 U	5 U	5 U	5 U
S. Dawson(Dup.)	IND	4/6/92	158112	5 U	5 U	5 U	5 U	70	5 U	5 U	5 U	5 U	5 U	5 U
Lucile St.	IND	4/6/92	158113	5 U	5 U	5 U	5 U	77 J	5 U	5 U	5 U	5 U	5 U	5 U
C-4	COM	7/24/91		5 U	NA	5 U	5 U	6	NA	NA	5 U	5 U	5 U	NA
C-5	COM	7/24/91		5 U	NA	5 U	5 U	83	NA	NA	5 U	5 U	5 U	NA
C-6	COM	7/25/91		5 U	NA	5 U	5 U	5 U	NA	NA	5 U	5 U	5 U	NA
C-7	COM	7/25/91		5 U	NA	5 U	5 U	96	NA	NA	5 U	5 U	5 U	NA
Transfer Blank		3/30/92	138114	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trip Blank		7/30/91		NA	5 U	5 U	5 U	NA	NA	5 U	5 U	5 U	NA	NA
Trip Blank		7/30/91		NA	5 U	5 U	5 U	NA	NA	5 U	5 U	5 U	NA	NA
Trip Blank		7/30/91		NA	5 U	5 U	5 U	NA	NA	5 U	5 U	5 U	NA	NA

B = Values not reported due to blank contamination

NA=Sample not analyzed for this parameter

U=Undetected

J=Estimated

Indicates analyte was detected

APPENDIX B

Volatile organics in vector decant water (ug/l)

Site Name	Land-Use	Date	Ecology Sample No.	1,2,3- Trichloro- propane	1,2,4- Trimethyl- Benzene	1,3,5- Trimethyl- Benzene	Vinyl Acetate	Vinyl Chloride	Total Xylenes
R-1	RES	7/22/91		NA	NA	NA	NA	10 U	5 U
R-2	RES	7/23/91		NA	NA	NA	NA	10 U	5 U
R-3	RES	7/23/91		NA	NA	NA	NA	10 U	5 U
R-16	RES	7/31/91		NA	NA	NA	10 U	10 U	12
21 Oaks-AM	RES	3/23/92	138105	NA	NA	NA	NA	NA	92
21 Oaks-PM	RES	3/23/92	138106	NA	125	35	NA	1.5	360
Casc. Hts.-AM	RES	3/30/92	138108	NA	NA	NA	NA	NA	1 U
Casc. Hts.-PM	RES	3/30/92	138109	NA	NA	NA	NA	NA	1 U
I-8	IND	7/29/91		NA	NA	NA	10 U	10 U	7
I-11	IND	7/29/91		NA	NA	NA	10 U	10 U	8
I-12	IND	7/30/91		NA	NA	NA	10 U	10 U	7
I-15	IND	7/30/91		NA	NA	NA	10 U	10 U	20
Bailey St.	IND	3/25/92	138107	NA	NA	NA	NA	NA	4 J
S. Brandon	IND	4/6/92	158110	1 U	3	0.7 J	NA	1 U	5 U
S. Dawson	IND	4/6/92	158111	5 U	5 U	5 U	NA	5 U	5 U
S. Dawson(Dup.)	IND	4/6/92	158112	5 U	5 U	5 U	NA	5 U	5 U
Lucile St.	IND	4/6/92	158113	5 U	5 U	5 U	NA	5 U	5 U
C-4	COM	7/24/91		NA	NA	NA	NA	10 U	5 U
C-5	COM	7/24/91		NA	NA	NA	NA	10 U	5 U
C-6	COM	7/25/91		NA	NA	NA	NA	10 U	5 U
C-7	COM	7/25/91		NA	NA	NA	NA	10 U	32
Transfer Blank		3/30/92	138114	1 U	1 U	1 U	NA	1 U	1 U
Transport Blank		7/30/91		NA	NA	5 U	10 U	10 U	5 U
Transport Blank		7/30/91		NA	NA	5 U	10 U	10 U	5 U
Transport Blank		7/30/91		NA	NA	5 U	NA	10 U	5 U

B = Values not reported due to blank contamination

NA=Sample not analyzed for this parameter

U=Undetected

J=Estimated

Indicates analyte was detected

APPENDIX B

Semi-volatile organics in vector decant water (ug/l)

Site Name	Land-Use	Date	N-Nitroso-Dimethyl-amine	Phenol	Aniline	Bis(2-chloro-ethyl) ether	2-Chloro-phenol	1,3-Di-chloro-benzene	1,4-Di-chloro-benzene	Benzyl Alcohol	1,2-Di-chloro-benzene	2-Methyl-phenol	Chloro-isopropyl) ether	4-Methyl-phenol	Nitroso Di-n-propylamine
R-1	RES	7/22/91	10 U	15	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
R-2	RES	7/23/91	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
R-3	RES	7/23/91	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
R-16	RES	7/31/91	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
I-8	IND	7/29/91	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	33	50 U
I-11	IND	7/29/91	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
I-12	IND	7/30/91	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
I-15	IND	7/30/91	10 U	2 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	4 J	10 U
C-4	COM	7/24/91	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
C-5	COM	7/24/91	10 U	75	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
C-6	COM	7/25/91	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U
C-7	COM	7/25/91	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U

U=Undetected

J=Estimated

 Indicates analyte was detected

APPENDIX B

Semi-volatile organics in vector decant water (ug/l)

Site Name	Land-Use	Date	Hexa-chloro-ethane	Nitro-benzene	Iso-phorone	2-Nitro-phenol	2,4-Dimethyl phenol	Benzoic Acid	Bis(2-chloro-ethoxy) methane	2,4-Dichloro-phenol	1,2,4-Trichloro-benzene	Naph-thalene (a)	4-Chloro-aniline	Hexa-chloro-butadiene	4-chloro-3-Methyl phenol
R-1	RES	7/22/91	10 U	10 U	10 U	10 U	10 U	18 J	10 U	10 U	10 U	10 U	10 U	10 U	10 U
R-2	RES	7/23/91	50 U	50 U	50 U	50 U	50 U	250 UJ	50 U	50 U	50 U	50 U	50 U	50 U	50 U
R-3	RES	7/23/91	50 U	50 U	50 U	50 U	50 U	250 UJ	50 U	50 U	50 U	50 U	50 U	50 U	50 U
R-16	RES	7/31/91	10 U	10 U	10 U	10 U	10 U	50 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U
I-8	IND	7/29/91	50 U	50 U	50 U	50 U	50 U	250 UJ	50 U	50 U	50 U	50 U	50 U	50 U	50 U
I-11	IND	7/29/91	10 U	10 U	10 U	10 U	10 U	50 UJ	10 U	10 U	10 U	4 J	10 U	10 U	10 U
I-12	IND	7/30/91	10 U	10 U	10 U	10 U	10 U	50 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U
I-15	IND	7/30/91	10 U	10 U	10 U	10 U	10 U	50 UJ	10 U	10 U	10 U	7 J	10 U	10 U	10 U
C-4	COM	7/24/91	10 U	10 U	10 U	10 U	10 U	50 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U
C-5	COM	7/24/91	10 U	10 U	10 U	10 U	10 U	50 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U
C-6	COM	7/25/91	10 U	10 U	10 U	10 U	10 U	50 UJ	10 U	10 U	10 U	10 U	10 U	10 U	10 U
C-7	COM	7/25/91	50 U	50 U	50 U	50 U	50 U	250 UJ	50 U	50 U	50 U	50 U	50 U	50 U	50 U

(a) Also detected at 21 Oaks-PM (57 ug/l), S.Brandon (11 ug/l), S.Dawson (1 ug/l), and Lucile St. (6 ug/l).

U=Undetected

J=Estimated

 Indicates analyte was detected

APPENDIX B

Semi-volatile organics in vector decant water (ug/l)

Site Name	Land-Use	Date	2-Methyl Naphthalene	Hexa-chloro-cyclopentadiene	2,4,6-Trichlorophenol	2,4,5-Trichlorophenol	2-Chloro-Naphthalene	2-Nitroaniline	Dimethyl phthalate	Ace-naphthylene	3-Nitroaniline	Acenaphthene	2,4-Dinitrophenol	4-Nitrophenol	Dibenzo-furan
R-1	RES	7/22/91	10 U	10 U	10 U	50 U	10 U	50 U	10 U	10 U	50 U	10 U	50 U	50 UJ	10 U
R-2	RES	7/23/91	50 U	50 U	50 U	250 U	50 U	250 U	50 U	50 U	250 U	50 U	250 U	250 UJ	50 U
R-3	RES	7/23/91	50 U	50 U	50 U	250 U	50 U	250 U	50 U	50 U	250 U	50 U	250 U	250 UJ	50 U
R-16	RES	7/31/91	10 U	10 U	10 U	50 U	10 U	50 U	10 U	10 U	50 U	10 U	50 U	50 UJ	10 U
I-8	IND	7/29/91	50 U	50 U	50 U	250 U	50 U	250 U	50 U	50 U	250 U	50 U	250 U	250 UJ	50 U
I-11	IND	7/29/91	10 U	10 U	10 U	50 U	10 U	50 U	10 U	10 U	50 U	10 U	50 U	50 UJ	10 U
I-12	IND	7/30/91	10 U	10 U	10 U	50 U	10 U	50 U	10 U	10 U	50 U	10 U	50 U	50 UJ	10 U
I-15	IND	7/30/91	3 J	10 U	10 U	50 U	10 U	50 U	10 U	10 U	50 U	10 U	50 U	50 UJ	10 U
C-4	COM	7/24/91	10 U	10 U	10 U	50 U	10 U	50 U	10 U	10 U	50 U	10 U	50 U	50 UJ	10 U
C-5	COM	7/24/91	10 U	10 U	10 U	50 U	10 U	50 U	10 U	10 U	50 U	10 U	50 U	50 UJ	10 U
C-6	COM	7/25/91	10 U	10 U	10 U	50 U	10 U	50 U	10 U	10 U	50 U	10 U	50 U	50 UJ	10 U
C-7	COM	7/25/91	50 U	50 U	50 U	250 U	50 U	250 U	50 U	50 U	250 U	50 U	250 U	250 UJ	50 U

U=Undetected

J=Estimated

3 J Indicates analyte was detected

APPENDIX B

Semi-volatile organics in vector decant water (ug/l)

Site Name	Land-Use	Date	2,4-Dinitro-toluene	2,6-Dinitro-toluene	Diethyl phthalate	4-Chloro-phenyl phenyl ether	Fluorene	4-Nitro-aniline	2-Methyl 4,6-Di-nitro-phenol	N-Nitroso-Diphenyl-amine	4-Bromo-phenyl phenyl ether	Hexa-chloro-benzene	Penta-chloro-phenol	Phenan-threne	Anthracene
R-1	RES	7/22/91	10 U	10 U	10 U	10 U	10 U	50 U	50 U	10 U	10 U	10 U	50 U	10 U	10 U
R-2	RES	7/23/91	50 U	50 U	50 U	50 U	50 U	250 U	250 U	50 U	50 U	50 U	250 U	50 U	50 U
R-3	RES	7/23/91	50 U	50 U	50 U	50 U	50 U	250 U	250 U	50 U	50 U	50 U	250 U	50 U	50 U
R-16	RES	7/31/91	10 U	10 U	10 U	10 U	10 U	50 U	50 U	10 U	10 U	10 U	50 U	10 U	10 U
I-8	IND	7/29/91	50 U	50 U	50 U	50 U	50 U	250 U	250 U	50 U	50 U	50 U	250 U	50 U	50 U
I-11	IND	7/29/91	10 U	10 U	10 U	10 U	10 U	50 U	50 U	10 U	10 U	10 U	50 U	10 U	10 U
I-12	IND	7/30/91	10 U	10 U	10 U	10 U	10 U	50 U	50 U	10 U	10 U	10 U	50 U	10 U	10 U
I-15	IND	7/30/91	10 U	10 U	10 U	10 U	3 J	50 U	50 U	10 U	10 U	10 U	50 U	7 J	10 U
C-4	COM	7/24/91	10 U	10 U	10 U	10 U	10 U	50 U	50 U	10 U	10 U	10 U	50 U	10 U	10 U
C-5	COM	7/24/91	10 U	10 U	10 U	10 U	10 U	50 U	50 U	10 U	10 U	10 U	50 U	10 U	10 U
C-6	COM	7/25/91	10 U	10 U	10 U	10 U	10 U	50 U	50 U	10 U	10 U	10 U	50 U	10 U	10 U
C-7	COM	7/25/91	50 U	50 U	50 U	50 U	50 U	250 U	250 U	50 U	50 U	50 U	250 U	50 U	50 U

U=Undetected

J=Estimated

 Indicates analyte was detected

APPENDIX B

Semi-volatile organics in vector decant water (ug/l)

Site Name	Land-Use	Date	Pyrene	Butyl benzyl phthalate	3,3'-Dichloro-benzidine	Benzo(a)anthracene	Bis(2-ethyl-hexyl-phthalate)	Chrysene	Di-n-octyl phthalate	Benzo(b)fluor-anthene	Benzo(k)fluor-anthene	Benzo(a)pyrene	Indeno (1,2,3-cd)-pyrene	Dibenzo (a,h)anthracene	Benzo (g,h,i)perylene
R-1	RES	7/22/91	10 U	10 U	20 U	10 U	29	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U
R-2	RES	7/23/91	50 U	50 U	100 U	50 U	B	50 U	50 U	50 U	50 U	50 U	50 UJ	50 U	50 UJ
R-3	RES	7/23/91	50 U	50 U	100 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 UJ	50 U	50 UJ
R-16	RES	7/31/91	10 U	10 U	20 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 UJ
I-8	IND	7/29/91	50 U	50 U	100 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 UJ	50 U	50 UJ
I-11	IND	7/29/91	10 U	10 U	20 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U	10 U	10 U	10 U
I-12	IND	7/30/91	10 U	10 U	20 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 UJ
I-15	IND	7/30/91	10 U	10 U	20 U	10 U	10 U	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 UJ
C-4	COM	7/24/91	10 U	10 U	20 U	10 U	B	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 UJ
C-5	COM	7/24/91	10 U	10 U	20 U	10 U	B	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 UJ
C-6	COM	7/25/91	10 U	10 U	20 U	10 U	B	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 UJ
C-7	COM	7/25/91	50 U	50 U	100 U	50 U	440	50 U	50 U	50 UJ	50 U	50 U	50 U	50 U	50 U

U=Undetected

J=Estimated

Indicates analyte was detected

B=Values not reported due to blank contamination

APPENDIX B

Semi-volatile organics in vactor decant water (ug/l)

Site Name	Land-Use	Date	Di-n-butyl-phthalate	Fluor-anthene	Benzidine
R-1	RES	7/22/91	10 U	10 U	100 U
R-2	RES	7/23/91	50 U	50 U	500 U
R-3	RES	7/23/91	50 U	50 U	500 U
R-16	RES	7/31/91	10 U	10 U	100 U
I-8	IND	7/29/91	50 U	50 U	500 U
I-11	IND	7/29/91	10 U	10 U	100 U
I-12	IND	7/30/91	10 U	10 U	100 U
I-15	IND	7/30/91	10 U	3 J	100 U
C-4	COM	7/24/91	10 U	10 U	100 U
C-5	COM	7/24/91	10 U	10 U	100 U
C-6	COM	7/25/91	10 U	10 U	100 U
C-7	COM	7/25/91	50 U	50 U	500 U

U=Undetected

J=Estimated

Indicates analyte was detected

APPENDIX B

Results of PCB analysis of vector decant water (ug/l)

Site Name	Land-Use	Date	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
R-2	RES	7/23/91	0.6 U	1.3 U	1.3 U	0.6 U	0.6 U	0.6 U	0.6 U
R-3	RES	7/23/91	0.5 U	1.0 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U
I-8	IND	7/29/91	0.6 U	1.1 U	1.1 U	0.6 U	0.6 U	0.6 U	0.6 U
I-11	IND	7/29/91	0.5 U	1.0 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U
I-12	IND	7/30/91	0.5 U	1.0 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U
I-15	IND	7/30/91	0.5 U	1.0 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U
C-4	COM	7/24/91	0.5 U	1.0 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U
C-5	COM	7/24/91	0.5 U	1.0 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U
C-6	COM	7/25/91	0.5 U	1.0 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U
C-7	COM	7/25/91	0.5 U	1.0 U	1.0 U	0.5 U	0.5 U	0.5 U	0.5 U

U=Undetected

APPENDIX B

Total petroleum hydrocarbons in vector decant water (mg/l).

Site Name	Land-Use	Date	Ecology Sample No.	Total Petroleum Hydrocarbons
21 Oaks-AM	RES	3/23/92	138105	8.2
21 Oaks-PM	RES	3/23/92	138106	2.6
Casc. Hts.-AM	RES	3/30/92	138108	4
Casc. Hts.-PM	RES	3/30/92	138109	6.1
Bailey St.	IND	3/25/92	138107	1.9
S. Brandon	IND	4/6/92	158110	9.2
S. Dawson	IND	4/6/92	158111	12
S. Dawson(Dup.)	IND	4/6/92	158112	10
Lucile St.	IND	4/6/92	158113	9.7

APPENDIX C

Results of Sediment Analysis

APPENDIX C

Results of conventional analysis of vector sediment.

Site Name	Land-Use	Date	Ecology Sample No.	Percent Solids (%)	Total Organic Carbon (mg/Kg, dry)	Grain Size (%)			
						gravel (> 2000um)	sand (2000-62um)	silt (62-2um)	clay (< 2um)
R-1	RES	7/22/91	308130	73	14000	26	59	12	3
R-2	RES	7/23/91	308131	74	13000	7	75	16	2
R-3	RES	7/23/91	308132	69	16000	10	74	15	1
R-16	RES	7/31/91	308142	61	17000	17	72	11	0
21 Oaks-AM	RES	3/23/92	137000	76	33000	13	79	7	1
21 Oaks-PM	RES	3/23/92	137001	76	15000	26	66	8	0
Casc. Hts.-AM	RES	3/30/92	138120	81	16000	1	90	7	2
Casc. Hts.-PM	RES	3/30/92	138121	73	44000	20	72	8	0
I-8	IND	7/29/91	308137	73	19000	9	75	13	3
I-11	IND	7/29/91	308138	68	19000	33	57	9	1
I-12	IND	7/30/91	308139	71	15000	7	81	10	2
I-15	IND	7/30/91	308140	73	16000	20	70	9	1
I-15(Dup.)	IND	7/30/91	308141	69	16000	3	81	11	5
Bailey St.	IND	3/25/92	138107	83	25000	12	78	10	0
S. Brandon	IND	4/6/92	158122	85	10000	21	72	4	3
S. Dawson	IND	4/6/92	158123	82	15000	11	84	5	0
S. Dawson(Dup.)	IND	4/6/92	158124	81	15000	9	84	5	2
Lucile St.	IND	4/6/92	158125	79	20000	19	72	6	3
C-4	COM	7/24/92	308133	73	15000	19	71	10	0
C-5	COM	7/24/92	308134	61	22000	6	63	28	3
C-6	COM	7/25/92	308135	68	12000	10	67	21	2
C-7	COM	7/25/92	308136	72	18000	17	64	19	0

APPENDIX C

Metals in vactor sediment (mg/kg, dry).

Site Name	Land-Use	Date	Ecology Sample No.	Antimony	Arsenic	Beryllium	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Selenium	Silver	Thallium	Zinc
R-1	RES	7/22/91	308130	3.7 J	6.1	0.53	0.7 J	87	19	57	0.10 J	41	0.2 J	0.3 U	0.25 U	90
R-2	RES	7/23/91	308131	3 U	4.6	0.42 J	1.2 J	131	27	107	0.07 J	50	0.2 U	0.3 U	0.25 U	135
R-3	RES	7/23/91	308132	5.1 J	4.0	0.41 J	1.2 J	89	38	141	0.14 J	45	0.4 J	0.3 U	0.25 U	153
R-16	RES	7/31/91	308142	3 U	5.9	0.35 J	0.7 J	28 J	26	65	0.10	39	0.2 U	0.3 U	0.25 U	174 J
21 Oaks-AM	RES	3/23/92	137000	NA	4.1 J	NA	0.8 J	26 J	24	84 J	NA	NA	NA	NA	NA	121 J
21 Oaks-PM	RES	3/23/92	137001	NA	3.0 J	NA	0.8 J	213 J	32	93	NA	NA	NA	NA	NA	114
Casc. Hts.-AM	RES	3/30/92	138120	NA	3.0 U	NA	0.5 J	29 J	21	24 J	NA	NA	NA	NA	NA	80 J
Casc. Hts.-PM	RES	3/30/92	138121	NA	4.0 J	NA	0.7 J	19 J	18	75 J	NA	NA	NA	NA	NA	109 J
I-8	IND	7/29/91	308137	3 U	9.9	0.35 J	2	154 J	560	194	0.07 J	47	0.2 U	0.51	0.25 U	558 J
I-11	IND	7/29/91	308138	3 U	7.8	0.41 J	1 J	241 J	89	181	0.13 J	86	0.2 U	0.3 U	0.25 U	236 J
I-12	IND	7/30/91	308139	3 U	10	0.41 J	1.2 J	34 J	80	178	0.13	35	0.2 U	0.3 U	0.25 U	262 J
I-15	IND	7/30/91	308140	3 U	18	0.44 J	1 J	43 J	186	147	0.14	68	0.2 U	0.3 U	0.25 U	295 J
I-15(Dup.)	IND	7/30/91	308141	3 U	17	0.44 J	1.5	34 J	184	130	0.17	36	0.2 U	0.3 U	0.25 U	280 J
Bailey St.	IND	3/25/92	138107	NA	3.0 J	NA	1.1 J	111 J	73	132 J	NA	NA	NA	NA	NA	246 J
S. Brandon	IND	4/6/92	158122	NA	17	NA	0.9 J	30	92 J	138 J	NA	NA	NA	NA	NA	199 J
S. Dawson	IND	4/6/92	158123	NA	25	NA	1.0 J	26	103 J	70 J	NA	NA	NA	NA	NA	203 J
S. Dawson(Dup.)	IND	4/6/92	158124	NA	22	NA	1.0 J	27	76 J	89 J	NA	NA	NA	NA	NA	196 J
Lucile St.	IND	4/6/92	158125	NA	19	NA	0.9	26	83 J	97 J	NA	NA	NA	NA	NA	227 J
C-4	COM	7/24/92	308133	3 J	3.6	0.47 J	1.2 J	118	26	85	0.04 J	50	0.2 U	0.3 U	0.25 U	206
C-5	COM	7/24/92	308134	3 U	4.8	0.47 J	1.6	98	40	128	0.15	51	0.2 J	0.3 U	0.25 U	247
C-6	COM	7/25/92	308135	3 U	6.8	0.36 J	1.1 J	108 J	34	47	0.06 J	33	0.4 J	0.3 U	0.25 U	140 J
C-7	COM	7/25/92	308136	3 U	4.9	0.43 J	1.8	200 J	42	105	0.11 J	48	0.8	0.3 U	0.25 U	241 J

NA=Sample not analyzed for this parameter

U=Undetected

J=Estimated

APPENDIX C

Volatile Organics in vector sediment (ug/kg, dry).

Site Name	Land-Use	Date	Ecology Sample No.	Acetone	Benzene	Bromo-benzene	Bromo-dichloro-methane	Bromo-chloro-methane	Bromo-form	Bromo-methane	2-Butanone	Butyl-benzene
R-1	RES	7/22/91	308130	55 UJ	7 U	NA	7 U	NA	7 U	13 U	13 U	NA
R-2	RES	7/23/91	308131	150 J	7 U	NA	7 U	NA	7 U	14 U	11 J	NA
R-3	RES	7/23/91	308132	100 UJ	7 U	NA	7 U	NA	7 U	15 U	19 J	NA
R-16	RES	7/31/91	308142	45 UJ	8 U	NA	8 U	NA	8 U	17 U	17 U	NA
21 Oaks-AM	RES	3/23/92	137000	NA	3 U	NA	NA	NA	NA	NA	NA	NA
21 Oaks-PM	RES	3/23/92	137001	NA	5	NA	NA	NA	NA	NA	NA	NA
Casc. Hts.-AM	RES	3/30/92	138120	NA	3 U	NA	NA	NA	NA	NA	NA	NA
Casc. Hts.-PM	RES	3/30/92	138121	NA	2 J	NA	NA	NA	NA	NA	NA	NA
I-8	IND	7/29/91	308137	50 UJ	7 U	NA	7 U	NA	7 U	15 U	24 J	NA
I-11	IND	7/29/91	308138	60 UJ	7 U	NA	7 U	NA	7 U	14 U	14 U	NA
I-12	IND	7/30/91	308139	60 UJ	7 U	NA	7 U	NA	7 U	14 U	20 J	NA
I-15	IND	7/30/91	308140	140 UJ	8 U	NA	8 U	NA	8 U	16 U	16 U	NA
I-15(Dup.)	IND	7/30/91	308141	1800 UJ	7 U	NA	7 U	NA	7 U	14 U	14 U	NA
Bailey St.	IND	3/25/92	138107	NA	10 U	NA	NA	NA	NA	NA	NA	NA
S. Brandon	IND	4/6/92	158122	89 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
S. Dawson	IND	4/6/92	158123	205	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
S. Dawson(Dup.)	IND	4/6/92	158124	206	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Lucile St.	IND	4/6/92	158125	NA	NA	NA	NA	NA	NA	NA	NA	NA
C-4	COM	7/24/92	308133	30 UJ	7 U	NA	7 U	NA	7 U	14 U	14 U	NA
C-5	COM	7/24/92	308134	60 UJ	8 U	NA	8 U	NA	8 U	16 U	16 U	NA
C-6	COM	7/25/92	308135	45 UJ	7 U	NA	7 U	NA	7 U	14 U	14 U	NA
C-7	COM	7/25/92	308136	25 UJ	7 U	NA	7 U	NA	7 U	15 U	15 U	NA

NA=Sample not analyzed for this parameter

U=Undetected

J=Estimated

Indicates analyte was detected

APPENDIX C

Volatile Organics in vector sediment (ug/kg, dry).

Site Name	Land-Use	Date	Ecology Sample No.	Carbon Disulfide	Carbon tetra-chloride	Chloro-benzene	Chloro-ethane	Chloro-form	Chloro-methane	1,2-Dibromo-ethane	Dibromo-chloro-methane	1,2-Dichloro-benzene
R-1	RES	7/22/91	308130	7 U	7 U	45	13 U	7 U	13 U	NA	7 U	NA
R-2	RES	7/23/91	308131	7 U	7 U	7 U	14 U	7 U	14 U	NA	7 U	NA
R-3	RES	7/23/91	308132	7 U	7 U	7 U	15 U	7 U	15 U	NA	7 U	NA
R-16	RES	7/31/91	308142	8 U	8 U	8 U	17 U	8 U	17 U	NA	8 U	NA
21 Oaks-AM	RES	3/23/92	137000	NA	NA	NA	NA	NA	NA	NA	NA	NA
21 Oaks-PM	RES	3/23/92	137001	NA	NA	NA	NA	NA	NA	NA	NA	NA
Casc. Hts.-AM	RES	3/30/92	138120	NA	NA	NA	NA	NA	NA	NA	NA	NA
Casc. Hts.-PM	RES	3/30/92	138121	NA	NA	NA	NA	NA	NA	NA	NA	NA
I-8	IND	7/29/91	308137	7 U	7 U	7 U	15 U	7 U	15 U	NA	7 U	NA
I-11	IND	7/29/91	308138	7 U	7 U	7 U	14 U	7 U	14 U	NA	7 U	NA
I-12	IND	7/30/91	308139	7 U	7 U	7 U	14 U	7 U	14 U	NA	7 U	NA
I-15	IND	7/30/91	308140	8 U	8 U	8 U	16 U	8 U	16 U	NA	8 U	NA
I-15(Dup.)	IND	7/30/91	308141	7 U	7 U	7 U	14 U	7 U	14 U	NA	7 U	NA
Bailey St.	IND	3/25/92	138107	NA	NA	NA	NA	NA	NA	NA	NA	NA
S. Brandon	IND	4/6/92	158122	0.5 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
S. Dawson	IND	4/6/92	158123	1 J	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
S. Dawson(Dup.)	IND	4/6/92	158124	0.9 J	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Lucile St.	IND	4/6/92	158125	NA	NA	NA	NA	NA	NA	NA	NA	NA
C-4	COM	7/24/92	308133	7 U	7 U	7 U	14 U	7 U	14 U	NA	7 U	NA
C-5	COM	7/24/92	308134	8 U	8 U	8 U	16 U	8 U	16 U	NA	8 U	NA
C-6	COM	7/25/92	308135	7 U	7 U	7 U	14 U	7 U	14 U	NA	7 U	NA
C-7	COM	7/25/92	308136	7 U	7 U	7 U	15 U	7 U	15 U	NA	7 U	NA

NA=Sample not analyzed for this parameter

U=Undetected

J=Estimated

 Indicates analyte was detected

APPENDIX C

Volatile Organics in vector sediment (ug/kg, dry).

Site Name	Land-Use	Date	Ecology Sample No.	1,3-Dichloro-benzene	Dichloro-difluoro-methane	1,1-Di-chloro-ethane	1,2-Di-chloro-ethane	1,1-Di-chloro-ethene	1,2-Di-chloro-ethene	1,2-Di-chloro-propane	1,3-Di-chloro-propane	2,2-Di-chloro-propane
R-1	RES	7/22/91	308130	NA	NA	7 U	7 U	7 U	7 U	7 U	NA	NA
R-2	RES	7/23/91	308131	NA	NA	7 U	7 U	7 U	7 U	7 U	NA	NA
R-3	RES	7/23/91	308132	NA	NA	7 U	7 U	7 U	7 U	7 U	NA	NA
R-16	RES	7/31/91	308142	NA	NA	8 U	8 U	8 U	8 U	8 U	NA	NA
21 Oaks-AM	RES	3/23/92	137000	NA	NA	NA	NA	NA	NA	NA	NA	NA
21 Oaks-PM	RES	3/23/92	137001	NA	NA	NA	NA	NA	NA	NA	NA	NA
Casc. Hts.-AM	RES	3/30/92	138120	NA	NA	NA	NA	NA	NA	NA	NA	NA
Casc. Hts.-PM	RES	3/30/92	138121	NA	NA	NA	NA	NA	NA	NA	NA	NA
I-8	IND	7/29/91	308137	NA	NA	7 U	7 U	7 U	7 U	7 U	NA	NA
I-11	IND	7/29/91	308138	NA	NA	7 U	7 U	7 U	7 U	7 U	NA	NA
I-12	IND	7/30/91	308139	NA	NA	7 U	7 U	7 U	7 U	7 U	NA	NA
I-15	IND	7/30/91	308140	NA	NA	8 U	8 U	8 U	8 U	8 U	NA	NA
I-15(Dup.)	IND	7/30/91	308141	NA	NA	7 U	7 U	7 U	7 U	7 U	NA	NA
Bailey St.	IND	3/25/92	138107	NA	NA	NA	NA	NA	NA	NA	NA	NA
S. Brandon	IND	4/6/92	158122	5 U	64	5 U	5 U	5 U	5 U	5 U	5 U	5 U
S. Dawson	IND	4/6/92	158123	5 U	85	5 U	5 U	5 U	5 U	5 U	5 U	5 U
S. Dawson(Dup.)	IND	4/6/92	158124	6 U	60	6 U	6 U	6 U	6 U	6 U	6 U	6 U
Lucile St.	IND	4/6/92	158125	NA	NA	NA	NA	NA	NA	NA	NA	NA
C-4	COM	7/24/92	308133	NA	NA	7 U	7 U	7 U	7 U	7 U	NA	NA
C-5	COM	7/24/92	308134	NA	NA	8 U	8 U	8 U	8 U	8 U	NA	NA
C-6	COM	7/25/92	308135	NA	NA	7 U	7 U	7 U	7 U	7 U	NA	NA
C-7	COM	7/25/92	308136	NA	NA	7 U	7 U	7 U	7 U	7 U	NA	NA

NA=Sample not analyzed for this parameter

U=Undetected

J=Estimated

Indicates analyte was detected

APPENDIX C

Volatile Organics in vector sediment (ug/kg, dry).

Site Name	Land-Use	Date	Ecology Sample No.	1,1-Di-chloro-propene	Cis 1,3-Di-chloro-propene	Trans 1,3-Di-chloro-propene	Ethyl-benzene	Hexachloro-butadiene	2-Hexanone	Isopropyl-benzene	p-Isopropyl Toluene	4-Methyl-2 Pentanone
R-1	RES	7/22/91	308130	NA	7 U	7 U	7 U	NA	13 U	NA	NA	13 U
R-2	RES	7/23/91	308131	NA	7 U	7 U	7 U	NA	14 U	NA	NA	14 U
R-3	RES	7/23/91	308132	NA	7 U	7 U	10 J	NA	15 U	NA	NA	15 U
R-16	RES	7/31/91	308142	NA	8 U	8 U	10	NA	17 U	NA	NA	17 U
21 Oaks-AM	RES	3/23/92	137000	NA	NA	NA	20	NA	NA	NA	NA	NA
21 Oaks-PM	RES	3/23/92	137001	NA	NA	NA	270	NA	NA	NA	NA	NA
Casc. Hts.-AM	RES	3/30/92	138120	NA	NA	NA	3 U	NA	NA	NA	NA	NA
Casc. Hts.-PM	RES	3/30/92	138121	NA	NA	NA	7	NA	NA	NA	NA	NA
I-8	IND	7/29/91	308137	NA	7 U	7 U	32	NA	15 U	NA	NA	15 U
I-11	IND	7/29/91	308138	NA	7 U	7 U	7 UJ	NA	14 U	NA	NA	14 U
I-12	IND	7/30/91	308139	NA	7 U	7 U	9 J	NA	14 U	NA	NA	14 U
I-15	IND	7/30/91	308140	NA	8 U	8 U	190 J	NA	16 U	NA	NA	16 U
I-15(Dup.)	IND	7/30/91	308141	NA	7 U	7 U	140	NA	14 U	NA	NA	14 U
Bailey St.	IND	3/25/92	138107	NA	NA	NA	5 J	NA	NA	NA	NA	NA
S. Brandon	IND	4/6/92	158122	5 U	5 U	5 U	0.5 J	5 U	5 U	5 U	7	5 U
S. Dawson	IND	4/6/92	158123	5 U	5 U	5 U	0.4 J	5 U	5 U	5 U	19	5 U
S. Dawson(Dup.)	IND	4/6/92	158124	6 U	6 U	6 U	6 U	6 U	6 U	6 U	14	6 U
Lucile St.	IND	4/6/92	158125	NA	NA	NA	NA	NA	NA	NA	NA	NA
C-4	COM	7/24/92	308133	NA	7 U	7 U	7 U	NA	14 U	NA	NA	14 U
C-5	COM	7/24/92	308134	NA	8 U	8 U	8 U	NA	16 U	NA	NA	16 U
C-6	COM	7/25/92	308135	NA	7 U	7 U	7 U	NA	14 U	NA	NA	14 U
C-7	COM	7/25/92	308136	NA	7 U	7 U	7 U	NA	15 U	NA	NA	15 U

NA=Sample not analyzed for this parameter

U=Undetected

J=Estimated

Indicates analyte was detected

APPENDIX C

Volatile Organics in vector sediment (ug/kg, dry).

Site Name	Land-Use	Date	Ecology Sample No.	Methylene Chloride	Propyl-Benzene	Sec-Butyl-benzene	Styrene	Tert-butyl-benzene	1,1,2,2-Tetra-chloro-ethane	Tetra-chloro-ethylene	Toluene	1,2,3-Trichloro-benzene
R-1	RES	7/22/91	308130	7 U	NA	NA	7 U	NA	7 U	NA	83	NA
R-2	RES	7/23/91	308131	7 U	NA	NA	7 U	NA	7 U	NA	160	NA
R-3	RES	7/23/91	308132	7 U	NA	NA	7 U	NA	7 U	NA	780	NA
R-16	RES	7/31/91	308142	8 U	NA	NA	8 U	NA	8 U	NA	54	NA
21 Oaks-AM	RES	3/23/92	137000	NA	NA	NA	NA	NA	NA	NA	220	NA
21 Oaks-PM	RES	3/23/92	137001	NA	NA	NA	NA	NA	NA	NA	470	NA
Casc. Hts.-AM	RES	3/30/92	138120	NA	NA	NA	NA	NA	NA	NA	97	NA
Casc. Hts.-PM	RES	3/30/92	138121	NA	NA	NA	NA	NA	NA	NA	660	NA
I-8	IND	7/29/91	308137	7 U	NA	NA	7 U	NA	7 U	NA	3300	NA
I-11	IND	7/29/91	308138	7 U	NA	NA	7 U	NA	7 U	NA	1300	NA
I-12	IND	7/30/91	308139	7 U	NA	NA	7 U	NA	7 U	NA	600	NA
I-15	IND	7/30/91	308140	8 U	NA	NA	8 U	NA	8 U	NA	1200	NA
I-15(Dup.)	IND	7/30/91	308141	7 U	NA	NA	7 U	NA	7 U	NA	1300	NA
Bailey St.	IND	3/25/92	138107	NA	NA	NA	NA	NA	NA	1950	160	NA
S. Brandon	IND	4/6/92	158122	5 U	0.4 J	5 U	5 U	5 U	5 U	5 U	2 J	5 U
S. Dawson	IND	4/6/92	158123	5 U	5 U	5 U	5 U	5 U	5 U	0.7 J	8 J	5 U
S. Dawson(Dup.)	IND	4/6/92	158124	6 U	6 U	6 U	6 U	6 U	6 U	6 U	6	6 U
Lucile St.	IND	4/6/92	158125	NA	NA	NA	NA	NA	NA	NA	NA	NA
C-4	COM	7/24/92	308133	7 U	NA	NA	7 U	NA	7 U	NA	140	NA
C-5	COM	7/24/92	308134	8 U	NA	NA	8 U	NA	8 U	NA	680	NA
C-6	COM	7/25/92	308135	7 U	NA	NA	7 U	NA	7 U	NA	7 U	NA
C-7	COM	7/25/92	308136	7 U	NA	NA	7 U	NA	7 U	NA	120 J	NA

NA=Sample not analyzed for this parameter

U=Undetected

J=Estimated

Indicates analyte was detected

APPENDIX C

Volatile Organics in vector sediment (ug/kg, dry).

Site Name	Land-Use	Date	Ecology Sample No.	1,2,4-Trichloro-benzene	1,1,1-Trichloro-ethane	1,1,2-Trichloro-ethane	Trichloro-ethene	Trichloro-fluoro-methane	1,2,3-Trichloro-propane	1,2,4-Trimethyl-Benzene	1,3,5-Trimethyl-Benzene	Vinyl Acetate
R-1	RES	7/22/91	308130	NA	NA	NA	7 U	NA	NA	NA	NA	13 U
R-2	RES	7/23/91	308131	NA	NA	NA	7 U	NA	NA	NA	NA	14 U
R-3	RES	7/23/91	308132	NA	NA	NA	7 U	NA	NA	NA	NA	15 U
R-16	RES	7/31/91	308142	NA	NA	NA	8 U	NA	NA	NA	NA	17 U
21 Oaks-AM	RES	3/23/92	137000	NA	NA	NA	NA	NA	NA	NA	NA	NA
21 Oaks-PM	RES	3/23/92	137001	NA	NA	NA	NA	NA	NA	NA	NA	NA
Casc. Hts.-AM	RES	3/30/92	138120	NA	NA	NA	NA	NA	NA	NA	NA	NA
Casc. Hts.-PM	RES	3/30/92	138121	NA	NA	NA	NA	NA	NA	NA	NA	NA
I-8	IND	7/29/91	308137	NA	NA	NA	7 U	NA	NA	NA	NA	15 U
I-11	IND	7/29/91	308138	NA	NA	NA	7 U	NA	NA	NA	NA	14 U
I-12	IND	7/30/91	308139	NA	NA	NA	7 U	NA	NA	NA	NA	14 U
I-15	IND	7/30/91	308140	NA	NA	NA	8 U	NA	NA	NA	NA	16 U
I-15(Dup.)	IND	7/30/91	308141	NA	NA	NA	7 U	NA	NA	NA	NA	14 U
Bailey St.	IND	3/25/92	138107	NA	NA	NA	NA	NA	NA	NA	NA	NA
S. Brandon	IND	4/6/92	158122	5 U	5 U	5 U	5 U	2 J	5 U	4 J	4 J	5 U
S. Dawson	IND	4/6/92	158123	5 U	5 U	5 U	5 U	2 J	5 U	5 U	5 U	5 U
S. Dawson(Dup.)	IND	4/6/92	158124	6 U	6 U	6 U	6 U	3 J	6 U	6 U	6 U	6 U
Lucile St.	IND	4/6/92	158125	NA	NA	NA	NA	NA	NA	NA	NA	NA
C-4	COM	7/24/92	308133	NA	NA	NA	7 U	NA	NA	NA	NA	14 U
C-5	COM	7/24/92	308134	NA	NA	NA	8 U	NA	NA	NA	NA	16 U
C-6	COM	7/25/92	308135	NA	NA	NA	7 U	NA	NA	NA	NA	14 U
C-7	COM	7/25/92	308136	NA	NA	NA	7 U	NA	NA	NA	NA	15 U

NA=Sample not analyzed for this parameter

U=Undetected

J=Estimated

Indicates analyte was detected

APPENDIX C

Volatile Organics in vactor sediment (ug/kg, dry).

Site Name	Land-Use	Date	Ecology Sample No.	Vinyl Chloride	Total Xylenes
R-1	RES	7/22/91	308130	13 U	7 U
R-2	RES	7/23/91	308131	14 U	9 J
R-3	RES	7/23/91	308132	15 U	18 J
R-16	RES	7/31/91	308142	17 U	61
21 Oaks-AM	RES	3/23/92	137000	NA	120
21 Oaks-PM	RES	3/23/92	137001	NA	1675 J
Casc. Hts.-AM	RES	3/30/92	138120	NA	3 U
Casc. Hts.-PM	RES	3/30/92	138121	NA	40
I-8	IND	7/29/91	308137	15 U	110
I-11	IND	7/29/91	308138	14 U	190 J
I-12	IND	7/30/91	308139	14 U	34 J
I-15	IND	7/30/91	308140	16 U	1400
I-15(Dup.)	IND	7/30/91	308141	14 U	1600
Bailey St.	IND	3/25/92	138107	NA	17
S. Brandon	IND	4/6/92	158122	5 U	1.8 J
S. Dawson	IND	4/6/92	158123	5 U	1.4 J
S. Dawson(Dup.)	IND	4/6/92	158124	6 U	0.4 J
Lucile St.	IND	4/6/92	158125	NA	NA
C-4	COM	7/24/92	308133	14 U	7 U
C-5	COM	7/24/92	308134	16 U	8 UJ
C-6	COM	7/25/92	308135	14 U	7 U
C-7	COM	7/25/92	308136	15 U	14 J

NA=Sample not analyzed for this parameter

U=Undetected

J=Estimated

Indicates analyte was detected

APPENDIX C

Semi-volatile organics in vector sediment (ug/kg, dry)

Site Name	Land-Use	Date	Ecology Sample No.	N-Nitroso-Diphenyl-amine	Phenol	Bis(2-chloro-ethyl) ether	2-Chloro-phenol	1,3-Di-chloro-benzene	1,4-Di-chloro-benzene	Benzyl Alcohol	1,2-Di-chloro-benzene	2-Methyl-phenol	Bis(2-Chloro-isopropyl) ether
R-1	RES	7/22/91	308130	890 U	890 U	890 U	890 U	890 U	890 U	890 U	890 U	890 U	890 U
R-2	RES	7/23/91	308131	7200 U	7200 U	7200 U	7200 U	7200 U	7200 U	7200 U	7200 U	7200 U	7200 U
R-3	RES	7/23/91	308132	3800 U	3800 U	3800 U	3800 U	3800 U	3800 U	3800 U	3800 U	3800 U	3800 U
R-16	RES	7/31/91	308142	2800 U	2800 U	2800 U	2800 U	2800 U	2800 U	2800 U	2800 U	2800 U	2800 U
21 Oaks-AM	RES	3/23/92	137000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
21 Oaks-PM	RES	3/23/92	137001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Casc. Hts.-AM	RES	3/30/92	138120	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Casc. Hts.-PM	RES	3/30/92	138121	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I-8	IND	7/29/91	308137	3900 U	3900 U	3900 U	3900 U	3900 U	3900 U	3900 U	3900 U	3900 U	3900 U
I-11	IND	7/29/91	308138	600 J	4600 U	4600 U	4600 U	4600 U	4600 U	4600 U	4600 U	4600 U	4600 U
I-12	IND	7/30/91	308139	4500 U	4500 U	4500 U	4500 U	4500 U	4500 U	4500 U	4500 U	4500 U	4500 U
I-15	IND	7/30/91	308140	4900 U	4900 U	4900 U	4900 U	4900 U	4900 U	4900 U	4900 U	4900 U	4900 U
I-15(Dup.)	IND	7/30/91	308141	300 J	2400 U	2400 U	2400 U	2400 U	2400 U	2400 U	2400 U	2400 U	2400 U
Bailey St.	IND	3/25/92	138107	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S. Brandon	IND	4/6/92	158122	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S. Dawson	IND	4/6/92	158123	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S. Dawson(Dup.)	IND	4/6/92	158124	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lucile St.	IND	4/6/92	158125	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C-4	COM	7/24/92	308133	900 U	900 U	900 U	900 U	900 U	900 U	900 U	900 U	900 U	900 U
C-5	COM	7/24/92	308134	4100 U	4100 U	4100 U	4100 U	4100 U	4100 U	4100 U	4100 U	4100 U	4100 U
C-6	COM	7/25/92	308135	890 U	890 U	890 U	890 U	890 U	890 U	890 U	890 U	890 U	890 U
C-7	COM	7/25/92	308136	3800 U	3800 U	3800 U	3800 U	3800 U	3800 U	3800 U	3800 U	3800 U	3800 U

U=Undetected

J=Estimated

600 J Indicates analyte was detected

NA=Sample not analyzed for this parameter

APPENDIX C

Semi-volatile organics in vector sediment (ug/kg, dry)

Site Name	Land-Use	Date	Ecology Sample No.	4-Methyl-phenol	N-Nitroso Di-n-propylamine	Hexa-chloro-ethane	Nitro-benzene	Iso-phorone	2-Nitro-phenol	2,4-Dimethyl phenol	Benzoic Acid	Bis(2-chloro-ethoxy) methane	2,4-Dichloro-phenol	1,2,4-Trichloro-benzene
R-1	RES	7/22/91	308130	310 J	890 U	890 U	890 U	890 U	890 U	890 U	120 J	890 U	890 U	890 U
R-2	RES	7/23/91	308131	7200 U	7200 U	7200 U	7200 U	7200 U	7200 U	7200 U	35000 U	7200 U	7200 U	7200 U
R-3	RES	7/23/91	308132	3800 U	3800 U	3800 U	3800 U	3800 U	3800 U	3800 U	18000 U	3800 U	3800 U	3800 U
R-16	RES	7/31/91	308142	1100 J	2800 U	2800 U	2800 U	2800 U	2800 U	2800 U	14000 U	2800 U	2800 U	2800 U
21 Oaks-AM	RES	3/23/92	137000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
21 Oaks-PM	RES	3/23/92	137001	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Casc. Hts.-AM	RES	3/30/92	138120	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Casc. Hts.-PM	RES	3/30/92	138121	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
I-8	IND	7/29/91	308137	1500 J	3900 U	3900 U	3900 U	3900 U	3900 U	3900 U	19000 U	3900 U	3900 U	3900 U
I-11	IND	7/29/91	308138	4600 U	4600 U	4600 U	4600 U	4600 U	4600 U	4600 U	22000 U	4600 U	4600 U	4600 U
I-12	IND	7/30/91	308139	540 J	4500 U	4500 U	4500 U	4500 U	4500 U	4500 U	22000 U	4500 U	4500 U	4500 U
I-15	IND	7/30/91	308140	980 J	4900 U	4900 U	4900 U	4900 U	4900 U	4900 U	24000 U	4900 U	4900 U	4900 U
I-15(Dup.)	IND	7/30/91	308141	1300 J	2400 U	2400 U	2400 U	2400 U	2400 U	2400 U	12000 U	2400 U	2400 U	2400 U
Bailey St.	IND	3/25/92	138107	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S. Brandon	IND	4/6/92	158122	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S. Dawson	IND	4/6/92	158123	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S. Dawson(Dup.)	IND	4/6/92	158124	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lucile St.	IND	4/6/92	158125	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C-4	COM	7/24/92	308133	260 J	900 U	900 U	900 U	900 U	900 U	900 U	92 J	900 U	900 U	900 U
C-5	COM	7/24/92	308134	1500 J	4100 U	4100 U	4100 U	4100 U	4100 U	4100 U	20000 U	4100 U	4100 U	4100 U
C-6	COM	7/25/92	308135	890 U	890 U	890 U	890 U	890 U	890 U	890 U	4300 U	890 U	890 U	890 U
C-7	COM	7/25/92	308136	430 J	3800 U	3800 U	3800 U	3800 U	3800 U	3800 U	500 J	3800 U	3800 U	3800 U

U=Undetected

J=Estimated

 Indicates analyte was detected

NA=Sample not analyzed for this parameter

APPENDIX C

Semi-volatile organics in vector sediment (ug/kg, dry)

Site Name	Land-Use	Date	Ecology Sample No.	Naphthalene	4-Chloro-aniline	Hexa-chloro-butadiene	4-chloro-3-Methyl phenol	2-Methyl Naphthalene	Hexa-chloro-cyclo-pendadiene	2,4,6-Trichloro-phenol	2,4,5-Trichloro-phenol	2-Chloro-Naphthalene	2-Nitro-aniline	Dimethyl phthalate
R-1	RES	7/22/91	308130	890 U	890 U	890 U	890 U	890 U	890 U	890 U	4300 U	890 U	4300 U	890 U
R-2	RES	7/23/91	308131	7200 U	7200 U	7200 U	7200 U	7200 U	7200 U	7200 U	35000 U	7200 U	35000 U	7200 U
R-3	RES	7/23/91	308132	480 J	3800 U	3800 U	3800 U	3800 U	3800 U	3800 U	18000 U	3800 U	18000 U	3800 U
R-16	RES	7/31/91	308142	2800 U	2800 U	2800 U	2800 U	2800 U	2800 U	2800 U	14000 U	2800 U	14000 U	2800 U
21 Oaks-AM	RES	3/23/92	137000	96	NA	NA	NA	120	NA	NA	NA	89 U	NA	NA
21 Oaks-PM	RES	3/23/92	137001	610	NA	NA	NA	970	NA	NA	NA	95 U	NA	NA
Casc. Hts.-AM	RES	3/30/92	138120	20 J	NA	NA	NA	22 J	NA	NA	NA	160 U	NA	NA
Casc. Hts.-PM	RES	3/30/92	138121	590 U	NA	NA	NA	74 J	NA	NA	NA	590 U	NA	NA
I-8	IND	7/29/91	308137	3900 U	3900 U	3900 U	3900 U	680 J	3900 U	3900 U	19000 U	3900 U	19000 U	3900 U
I-11	IND	7/29/91	308138	730 J	4600 U	4600 U	4600 U	2200 J	4600 U	4600 U	22000 U	4600 U	22000 U	4600 U
I-12	IND	7/30/91	308139	4500 U	4500 U	4500 U	4500 U	4500 U	4500 U	4500 U	22000 U	4500 U	22000 U	4500 U
I-15	IND	7/30/91	308140	660 J	4900 U	4900 U	4900 U	1000 J	4900 U	4900 U	24000 U	4900 U	24000 U	4900 U
I-15(Dup.)	IND	7/30/91	308141	510 J	2400 U	2400 U	2400 U	890 J	2400 U	2400 U	12000 U	2400 U	12000 U	2400 U
Bailey St.	IND	3/25/92	138107	84 J	NA	NA	NA	96 J	NA	NA	NA	480 U	NA	NA
S. Brandon	IND	4/6/92	158122	200	NA	NA	NA	250	NA	NA	NA	190 U	NA	NA
S. Dawson	IND	4/6/92	158123	62 J	NA	NA	NA	210 J	NA	NA	NA	210 U	NA	NA
S. Dawson(Dup.)	IND	4/6/92	158124	45 J	NA	NA	NA	120 J	NA	NA	NA	200 U	NA	NA
Lucile St.	IND	4/6/92	158125	63 J	NA	NA	NA	92 J	NA	NA	NA	200 U	NA	NA
C-4	COM	7/24/92	308133	900 U	900 U	900 U	900 U	900 U	900 U	900 U	4400 U	900 U	4400 U	900 U
C-5	COM	7/24/92	308134	4100 U	4100 U	4100 U	4100 U	4100 U	4100 U	4100 U	20000 U	4100 U	20000 U	760 J
C-6	COM	7/25/92	308135	890 U	890 U	890 U	890 U	890 U	890 U	890 U	4300 U	890 U	4300 U	890 U
C-7	COM	7/25/92	308136	3800 U	3800 U	3800 U	3800 U	3800 U	3800 U	3800 U	19000 U	3800 U	19000 U	3800 U

U=Undetected

J=Estimated

 Indicates analyte was detected

NA=Sample not analyzed for this parameter

APPENDIX C

Semi-volatile organics in vector sediment (ug/kg, dry)

Site Name	Land-Use	Date	Ecology Sample No.	Ace-naph-thylene	3-Nitro-aniline	Acenaph-thene	2,4-Dinitro-phenol	4-Nitro-phenol	Dibenzo-furan	2,4-Dinitro-toluene	2,6-Dinitro-toluene	Diethyl phthalate	4-Chloro-phenyl phenyl ether	Fluorene
R-1	RES	7/22/91	308130	890 U	4300 U	890 U	4300 U	4300 U	890 U	890 U	890 U	890 U	890 U	890 U
R-2	RES	7/23/91	308131	7200 U	35000 U	2400 J	35000 U	35000 U	7200 U	7200 U	7200 U	7200 U	7200 U	1100 J
R-3	RES	7/23/91	308132	3800 U	18000 U	3800 U	18000 U	18000 U	3800 U	3800 U	3800 U	3800 U	3800 U	470 J
R-16	RES	7/31/91	308142	2800 U	14000 U	2800 U	14000 U	14000 U	2800 U	2800 U	2800 U	2800 U	2800 U	2800 U
21 Oaks-AM	RES	3/23/92	137000	89 U	NA	150	NA	NA	140	NA	NA	NA	NA	300
21 Oaks-PM	RES	3/23/92	137001	95 U	NA	61 J	NA	NA	52 J	NA	NA	NA	NA	110
Casc. Hts.-AM	RES	3/30/92	138120	160 U	NA	10 J	NA	NA	11 J	NA	NA	NA	NA	17 J
Casc. Hts.-PM	RES	3/30/92	138121	590 U	NA	43 J	NA	NA	41 J	NA	NA	NA	NA	70 J
I-8	IND	7/29/91	308137	3900 U	19000 U	3900 U	19000 U	19000 U	3900 U	3900 U	3900 U	3900 U	3900 U	3900 U
I-11	IND	7/29/91	308138	4600 U	22000 U	820 J	22000 U	22000 U	710 J	4600 U	4600 U	4600 U	4600 U	4600 U
I-12	IND	7/30/91	308139	4500 U	22000 U	4500 U	22000 U	22000 U	4500 U	4500 U	4500 U	4500 U	4500 U	4500 U
I-15	IND	7/30/91	308140	4900 U	24000 U	4900 U	24000 U	24000 U	4900 U	4900 U	4900 U	4900 U	4900 U	4900 U
I-15(Dup.)	IND	7/30/91	308141	2400 U	12000 U	2400 U	12000 U	12000 U	2400 U	2400 U	2400 U	2400 U	2400 U	2400 U
Bailey St.	IND	3/25/92	138107	480 U	NA	130 J	NA	NA	110 J	NA	NA	NA	NA	250 J
S. Brandon	IND	4/6/92	158122	190 U	NA	230	NA	NA	210 U	NA	NA	NA	NA	410
S. Dawson	IND	4/6/92	158123	210 U	NA	72 J	NA	NA	74 J	NA	NA	NA	NA	160 J
S. Dawson(Dup.)	IND	4/6/92	158124	200 U	NA	51 J	NA	NA	67 J	NA	NA	NA	NA	150 J
Lucile St.	IND	4/6/92	158125	200 U	NA	42 J	NA	NA	42 J	NA	NA	NA	NA	100 J
C-4	COM	7/24/92	308133	900 U	4400 U	900 U	4400 U	4400 U	900 U	900 U	900 U	900 U	900 U	900 U
C-5	COM	7/24/92	308134	760 U	20000 U	760 U	20000 U	20000 U	760 U	4100 U	4100 U	4100 U	4100 U	550 J
C-6	COM	7/25/92	308135	890 U	4300 U	890 U	4300 U	4300 U	890 U	890 U	890 U	890 U	890 U	890 U
C-7	COM	7/25/92	308136	3800 U	19000 U	3800 U	19000 U	19000 U	3800 U	3800 U	3800 U	3800 U	3800 U	3800 U

U=Undetected

J=Estimated

 Indicates analyte was detected

NA=Sample not analyzed for this parameter

APPENDIX C

Semi-volatile organics in vector sediment (ug/kg, dry)

Site Name	Land-Use	Date	Ecology Sample No.	4-Nitro-aniline	2-Methyl 4,6-Di-nitro-phenol	4-Bromo-phenyl phenyl ether	Hexa-chloro-benzene	Penta-chloro-phenol	Phenan-threne	Anthracene	Di-n-butyl-phthalate	Fluor-anthene	Pyrene
R-1	RES	7/22/91	308130	4300 U	4300 U	890 U	100 J	4300 U	250 J	890 U	890 U	370	300 J
R-2	RES	7/23/91	308131	35000 U	35000 U	7200 U	7200 U	35000 U	4000 J	1900 J	7200 U	21000	43000
R-3	RES	7/23/91	308132	18000 U	18000 U	3800 U	3800 U	18000 U	5800	940 J	3800 U	8600	6900
R-16	RES	7/31/91	308142	14000 U	14000 U	2800 U	2800 U	14000 U	550 J	2800 U	2800 U	650 J	600 J
21 Oaks--AM	RES	3/23/92	137000	NA	NA	NA	NA	NA	3300	600	NA	3600 J	2700
21 Oaks--PM	RES	3/23/92	137001	NA	NA	NA	NA	NA	860	140	NA	1400 J	1000
Casc. Hts.--AM	RES	3/30/92	138120	NA	NA	NA	NA	NA	170 U	160 U	NA	487 J	358
Casc. Hts.--PM	RES	3/30/92	138121	NA	NA	NA	NA	NA	880 U	590 U	NA	890 J	950 U
I-8	IND	7/29/91	308137	19000 U	19000 U	3900 U	3900 U	19000 U	2600 J	3900 U	3900 U	4300	3300 J
I-11	IND	7/29/91	308138	22000 U	22000 U	4600 U	4600 U	22000 U	10000	1600 J	4600 U	13000	10000
I-12	IND	7/30/91	308139	22000 U	22000 U	4500 U	4500 U	22000 U	2300 J	640 J	4500 U	3200 J	2800 J
I-15	IND	7/30/91	308140	24000 U	24000 U	4900 U	4900 U	24000 U	1900 J	4900 U	4900 U	2500 J	1900 J
I-15(Dup.)	IND	7/30/91	308141	12000 U	12000 U	2400 U	2400 U	12000 U	1900 J	310 J	2400 U	2400	1900 J
Bailey St.	IND	3/25/92	138107	NA	NA	NA	NA	NA	1900	340 J	NA	3800 J	3000
S. Brandon	IND	4/6/92	158122	NA	NA	NA	NA	NA	1500	180 J	NA	1800	710
S. Dawson	IND	4/6/92	158123	NA	NA	NA	NA	NA	730 J	88 J	NA	670	680
S. Dawson(Dup.)	IND	4/6/92	158124	NA	NA	NA	NA	NA	810	91 J	NA	860	800
Lucile St.	IND	4/6/92	158125	NA	NA	NA	NA	NA	820	110 J	NA	1200	1000
C-4	COM	7/24/92	308133	4400 U	4400 U	900 U	900 U	4400 U	630 J	120 J	900 U	1300	820 J
C-5	COM	7/24/92	308134	20000 U	20000 U	4100 U	4100 U	20000 U	5700	660 J	4100 U	7500	5000
C-6	COM	7/25/92	308135	4300 U	4300 U	890 U	890 U	4300 U	160 J	890 U	890 U	190 J	140 J
C-7	COM	7/25/92	308136	19000 U	19000 U	3800 U	3800 U	19000 U	3200 J	450 J	3800 U	5000	3700 J

U=Undetected

J=Estimated

Indicates analyte was detected

NA=Sample not analyzed for this parameter

APPENDIX C

Semi-volatile organics in vector sediment (ug/kg, dry)

Site Name	Land-Use	Date	Ecology Sample No.	Butyl benzyl phthalate	3,3'-Dichloro-benzidine	Benzo(a) anthracene	Bis(2-ethyl-hexyl-phthalate	Chrysene	Di-n-octyl phthalate	Benzo(b) fluor-anthene	Benzo(k) fluor-anthene	Benzo(a) pyrene	Indeno (1,2,3-cd)-pyrene
R-1	RES	7/22/91	308130	260 J	1800 U	890 U	1700	190 J	890 U	150 J	160 J	150 J	890 U
R-2	RES	7/23/91	308131	7200 U	14000 U	6500 J	6500 J	11000	7200 U	15000	12000	13000	8100
R-3	RES	7/23/91	308132	4300	7500 U	3000 J	11000	4000	3800 U	2600 J	2600 J	3000 J	2300 J
R-16	RES	7/31/91	308142	2800 U	5600 U	330 J	4900	390 J	2800 U	290** J	290** J	290 J	2800 U
21 Oaks-AM	RES	3/23/92	137000	NA	NA	1800	NA	1000	NA	1800	460	640	710 J
21 Oaks-PM	RES	3/23/92	137001	NA	NA	290	NA	370	NA	330	140	250	170 J
Casc. Hts.-AM	RES	3/30/92	138120	NA	NA	160 U	NA	160 U	NA	160 U	160 U	160 U	160 U
Casc. Hts.-PM	RES	3/30/92	138121	NA	NA	590 U	NA	590 U	NA	590 U	590 U	590 U	590 U
I-8	IND	7/29/91	308137	550 J	7700 U	1600 J	5200	2200 J	3900 U	1500 J	1300 J	1500 J	1300 J
I-11	IND	7/29/91	308138	4600 U	9100 U	5100	6000	6700	4600 U	4300 J	4500 J	4300 J	3800 J
I-12	IND	7/30/91	308139	4500 U	9000 U	1300 J	10000	2000 J	4500 U	1100 J	1300 J	1100 J	800 J
I-15	IND	7/30/91	308140	4900 U	9800 U	980 J	11000	1400 J	4900 U	790 J	850 J	740 J	570 J
I-15(Dup.)	IND	7/30/91	308141	2400 U	4800 U	960 J	12000	1300 J	2400 U	1300 J	2400 U	830 J	460 J
Bailey St.	IND	3/25/92	138107	NA	NA	1300	NA	1500	NA	1500	630	1000	750 J
S. Brandon	IND	4/6/92	158122	NA	NA	360	NA	360	NA	570	190 U	190 U	190 U
S. Dawson	IND	4/6/92	158123	NA	NA	180 J	NA	310	NA	400	210 U	230	170 J
S. Dawson(Dup.)	IND	4/6/92	158124	NA	NA	270	NA	410	NA	540	160 U	270	240
Lucile St.	IND	4/6/92	158125	NA	NA	370	NA	500	NA	730	200	360	280
C-4	COM	7/24/92	308133	150 J	1800 U	420 J	4400	640 J	900 U	540 J	720 J	480 J	340 J
C-5	COM	7/24/92	308134	640 J	8200 U	2700 J	20000	3700 J	4100 U	5400**	5400**	3000 J	2400 J
C-6	COM	7/25/92	308135	890 U	1800 U	890 U	3100	890 U	890 U	100** J	100** J	90 J	890 U
C-7	COM	7/25/92	308136	1200 J	7700 U	1900 J	30000	2600 J	3800 U	2200 J	2500 J	1900 J	1500 J

U=Undetected

J=Estimated

Indicates analyte was detected

NA=Sample not analyzed for this parameter

** Sum of benzo(b)fluoranthene + benzo(k)fluoranthene

APPENDIX C

Semi-volatile organics in vector sediment (ug/kg, dry)

Site Name	Land-Use	Date	Ecology Sample No.	Dibenzo					Carbazole
				(a,h) anthracene	Benzo (g,h,i) perylene	1-Methyl-naphthalene	Retene		
R-1	RES	7/22/91	308130	890 U	110 J	NA	NA	NA	
R-2	RES	7/23/91	308131	7200 U	7200	NA	NA	NA	
R-3	RES	7/23/91	308132	620 J	2000 J	NA	NA	NA	
R-16	RES	7/31/91	308142	2800 U	2800 U	NA	NA	NA	
21 Oaks-AM	RES	3/23/92	137000	210 J	280	130	560	460 U	
21 Oaks-PM	RES	3/23/92	137001	95 U	120 U	930	110 U	95 U	
Casc. Hts.-AM	RES	3/30/92	138120	160 U	160 U	21 J	160 U	830 U	
Casc. Hts.-PM	RES	3/30/92	138121	590 U	590 U	88 J	740 U	3000 U	
I-8	IND	7/29/91	308137	3900 U	1100 J	NA	NA	NA	
I-11	IND	7/29/91	308138	1200 J	3600 J	NA	NA	NA	
I-12	IND	7/30/91	308139	4500 U	910 J	NA	NA	NA	
I-15	IND	7/30/91	308140	4900 U	650 J	NA	NA	NA	
I-15(Dup.)	IND	7/30/91	308141	2400 U	610 J	NA	NA	NA	
Bailey St.	IND	3/25/92	138107	480 U	480 U	120 J	480 U	2500 U	
S. Brandon	IND	4/6/92	158122	190 U	190 U	260	190 U	960 U	
S. Dawson	IND	4/6/92	158123	550 U	130 J	250	210 U	1100 U	
S. Dawson(Dup.)	IND	4/6/92	158124	500 U	200	150 J	200 U	1000 U	
Lucile St.	IND	4/6/92	158125	500 U	250	97 J	110 J	1000 U	
C-4	COM	7/24/92	308133	900 U	340 J	NA	NA	NA	
C-5	COM	7/24/92	308134	870 U	2000 J	NA	NA	NA	
C-6	COM	7/25/92	308135	890 U	890 U	NA	NA	NA	
C-7	COM	7/25/92	308136	510 J	1300 J	NA	NA	NA	

U=Undetected

J=Estimated

Indicates analyte was detected

NA=Sample not analyzed for this parameter

APPENDIX C

Pesticides and PCBs in vector sediment (ug/kg, dry)

Site Name	Land-Use	Date	Ecology Sample No.	Pesticides and PCBs										
				alpha-BHC	beta-BHC	delta-BHC	gamma-BHC (Lindane)	Heptachlor	Aldrin	Heptachlor Epoxide	Endosulfan I	Dieldrin	4,4'-DDE	
R-1	RES	7/22/91	308130	22 U	22 U	22 U	22 U	22 U	22 U	22 U	22 U	22 U	43 U	43 U
R-2	RES	7/23/91	308131	23 U	23 U	23 U	23 U	23 U	23 U	23 U	23 U	23 U	45 U	45 U
R-3	RES	7/23/91	308132	24 U	24 U	24 U	24 U	24 U	24 U	24 U	24 U	24 U	48 U	48 U
R-16	RES	7/31/91	308142	27 U	27 U	27 U	27 U	27 U	27 U	27 U	27 U	27 U	54 U	54 U
I-8	IND	7/29/91	308137	24 U	24 U	24 U	24 U	24 U	24 U	24 U	24 U	24 U	47 U	47 U
I-11	IND	7/29/91	308138	23 U	23 U	23 U	23 U	23 U	23 U	23 U	23 U	23 U	45 U	45 U
I-12	IND	7/30/91	308139	22 U	22 U	22 U	22 U	22 U	22 U	22 U	22 U	22 U	44 U	44 U
I-15	IND	7/30/91	308140	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	50 U	50 U
I-15(Dup.)	IND	7/30/91	308141	23 U	23 U	23 U	23 U	23 U	23 U	23 U	23 U	23 U	46 U	46 U
C-4	COM	7/24/92	308133	22 U	22 U	22 U	22 U	22 U	22 U	22 U	22 U	22 U	44 U	44 U
C-5	COM	7/24/92	308134	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	25 U	51 U	51 U
C-6	COM	7/25/92	308135	24 U	24 U	24 U	24 U	24 U	24 U	24 U	24 U	24 U	47 U	47 U
C-7	COM	7/25/92	308136	23 U	23 U	23 U	23 U	23 U	23 U	23 U	23 U	23 U	46 U	46 U

U=Undetected

APPENDIX C

Pesticides and PCBs in vector sediment (ug/kg, dry)

Site Name	Land-Use	Date	Ecology Sample No.	Pesticides and PCBs (ug/kg, dry)									
				Endrin	Endosulfan II	4,4'-DDD	Endosulfan Sulfate	4,4'-DDT	Methoxychlor	Endrin Ketone	alpha-Chlordane	gamma-Chlordane	Toxaphene
R-1	RES	7/22/91	308130	43 U	43 U	43 U	43 U	43 U	220 U	43 U	220 U	220 U	430 U
R-2	RES	7/23/91	308131	45 U	45 U	45 U	45 U	45 U	230 U	45 U	230 U	230 U	450 U
R-3	RES	7/23/91	308132	48 U	48 U	48 U	48 U	48 U	240 U	48 U	240 U	240 U	480 U
R-16	RES	7/31/91	308142	54 U	54 U	54 U	54 U	54 U	270 U	54 U	270 U	270 U	540 U
I-8	IND	7/29/91	308137	47 U	47 U	47 U	47 U	47 U	240 U	47 U	240 U	240 U	470 U
I-11	IND	7/29/91	308138	45 U	45 U	45 U	45 U	45 U	230 U	45 U	230 U	230 U	450 U
I-12	IND	7/30/91	308139	44 U	44 U	44 U	44 U	44 U	220 U	44 U	220 U	220 U	440 U
I-15	IND	7/30/91	308140	50 U	50 U	50 U	50 U	50 U	250 U	50 U	250 U	250 U	500 U
I-15(Dup.)	IND	7/30/91	308141	46 U 46 U	46 U	46 U	46 U	46 U	230 U	46 U	230 U	230 U	460 U
C-4	COM	7/24/92	308133	44 U	44 U	44 U	44 U	44 U	220 U	44 U	220 U	220 U	440 U
C-5	COM	7/24/92	308134	51 U	51 U	51 U	51 U	51 U	250 U	51 U	250 U	250 U	510 U
C-6	COM	7/25/92	308135	47 U	47 U	47 U	47 U	47 U	240 U	47 U	240 U	240 U	470 U
C-7	COM	7/25/92	308136	46 U	46 U	46 U	46 U	46 U	230 U	46 U	230 U	230 U	460 U

U=Undetected

APPENDIX C

Pesticides and PCBs in vector sediment (ug/kg, dry)

Site Name	Land-Use	Date	Ecology Sample No.	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
R-1	RES	7/22/91	308130	220 U	220 U	220 U	220 U	220 U	430 U	430 U
R-2	RES	7/23/91	308131	230 U	230 U	230 U	230 U	230 U	450 U	450 U
R-3	RES	7/23/91	308132	240 U	240 U	240 U	240 U	240 U	480 U	480 U
R-16	RES	7/31/91	308142	270 U	270 U	270 U	270 U	270 U	540 U	540 U
I-8	IND	7/29/91	308137	240 U	240 U	240 U	240 U	240 U	470 U	470 U
I-11	IND	7/29/91	308138	230 U	230 U	230 U	230 U	230 U	450 U	450 U
I-12	IND	7/30/91	308139	220 U	220 U	220 U	220 U	220 U	440 U	440 U
I-15	IND	7/30/91	308140	250 U	250 U	250 U	250 U	250 U	500 U	500 U
I-15(Dup.)	IND	7/30/91	308141	230 U	230 U	230 U	230 U	230 U	460 U	460 U
C-4	COM	7/24/92	308133	220 U	220 U	220 U	220 U	220 U	440 U	440 U
C-5	COM	7/24/92	308134	250 U	250 U	250 U	250 U	250 U	510 U	510 U
C-6	COM	7/25/92	308135	240 U	240 U	240 U	240 U	240 U	470 U	470 U
C-7	COM	7/25/92	308136	230 U	230 U	230 U	230 U	230 U	460 U	460 U

U=Undetected

APPENDIX C

Total petroleum hydrocarbons in vector sediment (mg/kg, dry)

Site Name	Land-Use	Date	Ecology Sample No.	Total Petroleum Hydrocarbons
R-1	RES	7/22/91	308130	440
R-2	RES	7/23/91	308131	750
R-3	RES	7/23/91	308132	910
R-16	RES	7/31/91	308142	830
21 Oaks-AM	RES	3/23/92	137000	1850
21 Oaks-PM	RES	3/23/92	137001	1375
Casc. Hts.-AM	RES	3/30/92	138120	580
Casc. Hts.-PM	RES	3/30/92	138121	1370
I-8	IND	7/29/91	308137	2200
I-11	IND	7/29/91	308138	2700
I-12	IND	7/30/91	308139	2300
I-15	IND	7/30/91	308140	2600
I-15(Dup.)	IND	7/30/91	308141	3400
Bailey St.	IND	3/25/92	138107	200
S. Brandon	IND	4/6/92	158122	2350
S. Dawson	IND	4/6/92	158123	3350
S. Dawson(Dup.)	IND	4/6/92	158124	3400
Lucile St.	IND	4/6/92	158125	2890
C-4	COM	7/24/92	308133	1200
C-5	COM	7/24/92	308134	4600
C-6	COM	7/25/92	308135	440
C-7	COM	7/25/92	308136	4400