REMEDIAL INVESTIGATION REPORT

Wide Beach Development Site
Town of Brant
Erie County, New York
August 1985

Prepared for:

New York State Department of Environmental Conservation

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REMEDIAL INVESTIGATION STUDY
WIDE BEACH DEVELOPMENT SITE
TOWN OF BRANT, ERIE COUNTY, NEW YORK

VOLUME I

Prepared for

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EXECUTIVE SUMMARY

This report presents the results of a remedial investigation (RI) conducted by EA Engineering, Science, and Technology, Inc. at the community of Wide Beach, Town of Brant, Erie County, New York. The objective of an RI is to determine the nature and extent of contamination and the need for remediation at the site. This study was funded through a cooperative agreement between the U.S. Environmental Protection Agency (EPA) and the State of New York.

Conclusions related to the extent of contamination:

- Polychlorinated biphenyls (PCBs), specifically Aroclor 1254, are the primary contaminants at the site. In general, some degree of contamination exists over the entire site.

- Site contamination resulted from the application of PCB-contaminated oils to the community roadways during 1968-1978.

- In ground water, observation wells screened in the sanitary sewer trenches onsite were most contaminated. Contamination associated with drinking water was sporadic, and in general, at less than microgram-per-liter levels.

- Surficial soils in the roadways, drainage ditches, driveways, and front yards or lots boardering the roadways are highly contaminated with Aroclor 1254. The greatest frequency of high levels of PCB (>50 mg/kg) occurs in the area of the Oval.

- Stormwater runoff from the site contained PCBs in both sorbed and free phases.

- Phthalate esters (12 incidences) and 1,2,4-trichlorobenzene (7 incidences) were also found in soil at the site.

- Soil selenium and ground-water nickel levels were elevated compared to United States averages.

- The wetland sediments south of the site are highly contaminated with PCBs (>50 mg/kg) in the immediate area of two storm sewer outfalls. Very low PCB levels were observed throughout the main stream channels.

- PCB concentrations in three surficial soil samples taken from an offsite recreational area on the south shore of the wetland were very low (<0.03 mg/kg).

Conclusions related to contaminant migration:

- Surface water transport is the most important route of onsite and offsite migration. Stormwater runoff directed south and west may result in PCB loadings to Lake Erie at the kilogram-per-year level.

- Surface water transport may also be resulting in PCB transport offsite to the north at the level of tenths of kilograms-per-year.

- PCBs are apparently migrating downward through the vadose zone at the low microgram-per-liter level.

- The soils will act as a long-term source of PCBs to the ground water.

- The sewer trench bedding material appears to be acting as a conduit for potential transport of PCBs to the bedrock aquifer.

- Current ground-water discharge to Lake Erie results in negligible PCB loadings. Potential loadings may be at the tenth of a kilogram-per-year level.

- The potential exists for offsite ground-water transport of PCBs at the level of 1-10 ug/L.

- Both mathematical modeling and ambient air measurements indicate that air transport of PCBs is occurring. Particulate and vapor phase transport are both important and result in ambient concentrations at the nanogram-per-cubic-meter to microgram-per-cubic-meter levels.

- Driving of vehicles on dusty roadways may result in increased PCB emissions in the form of soil-bound PCBs.

- Detailed chromatographic analysis indicates that ground-water samples are enriched with lower molecular weight PCB congeners; vacuum cleaner dust was enriched with higher molecular weight congeners.

Conclusions related to human health and environmental impact:

- Routes of human exposure to PCBs at Wide Beach include ingestion of contaminated vegetables, ingestion of soil (Pica), inhalation, and dermal absorption.

- The preponderance of evidence in the scientific literature indicates that Aroclor 1254 is carcinogenic in laboratory animals. The strength of evidence indicates that it should be classified as a possible human carcinogen.

- A human health risk assessment indicates excess cancer risks for Wide Beach residents would be at a higher rate than for the general rural population as a result of the current potential for exposure to PCBs at the site.

- Environmental effects may be anticipated from exposure of biota to soil and water containing PCBs at Wide Beach. These effects include phytotoxicity, reproductive and developmental toxicity in birds, and numerous adverse effects in mammals. Additionally, there is evidence of food-chain transport.

Based on the evidence collected and interpreted in this study, it may be concluded that danger to human health, welfare, and the environment exists from exposure to PCBs at Wide Beach. Areas to be evaluated for remediation in the feasibility study include the roadways and ditches, front yards and driveways, other surficial areas proximate to the roads and ditches, the sewer trench and associated ground-water transport to Lotus Point, the storm drain system and outfall areas, interior space of housing units, and the potable ground-water supply.

1. INTRODUCTION

EA Engineering, Science, and Technology, Inc. has prepared this Remedial Investigation (RI) Report for New York State Department of Environmental Conservation (NYSDEC). Federal funds for this investigation were allocated through the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 by means of a Cooperative Agreement between the United States Environmental Protection Agency (EPA) and the State of New York. EA, in association with Tighe and Bond, was selected to: (1) undertake this remedial investigation to further define the nature and extent of contamination at and emanating from the Wide Beach Development site in the Town of Brant, Erie County, New York; and (2) conduct a feasibility study to identify, evaluate, and select a cost-effective, environmentally sound, long-term remedial action.

This RI report presents the results of that first task. It is presented in the following sections. Section 2 presents a brief history of the problem definition and analyses conducted prior to the initiation of this study. These analyses are detailed in later sections.

Section 3 characterizes the existing site environment including geographical location, physiography, hydrogeology, surface-water hydrology and climatology, ecological setting, demography and land use, site and regional water supply, and the existing sewer system.

Section 4 presents the analytical results of all field sampling conducted during this investigation and summarizes the results of previous studies at the Wide Beach site for comparison. Extensive sampling was conducted by EA at the site during August - December 1984, and included selective offsite sampling. Environmental samples of drinking water, ground water, surface water, vacuum cleaner contents, soils, sediments, and biota were analyzed for polychlorinated biphenyls (PCB). Selected samples were also analyzed for 129 priority pollutants. An air monitoring program was conducted to evaluate PCB transport via wind-blown particles.

Section 5 evaluates the extent of contamination at Wide Beach and defines the most critically contaminated areas.

Section 6 assesses the existing contaminant migration pathways including ground water, surface water, air, direct contact, and food-chain routes. Mathematical modeling is used to evaluate the significance of these routes of exposure.

Section 7 evaluates the existing health risk to the residents of Wide Beach. A detailed literature review of PCB toxicology is presented and utilized in the assessment. Risk to the environment (flora and fauna) is also evaluated.

Section 8 presents EA's recommendations concerning areas of the site suggested for initial remedial measures and defines areas requiring inclusion in the subsequent feasibility study.

Details on field sampling methods, boring logs, analytical reports, and records search documentation are provided in appendixes to this report. Detailed base maps and plot plans are also provided in fold-out form.

2. SITE HISTORY

2.1 GENERAL

The community of Wide Beach was incorporated for tax purposes in 1920. The existing roadways throughout the community are constructed of graded native materials and gravel. Application of waste oil to these roadways as a dust suppressant dates back to the 1940s. For approximately 10 years, from 1968 through 1978, residents applied waste oil from an industrial source for dust control throughout the 1.1 mi of dirt roads in the community (NYSDEC 1983; ECDEP 1981).

On 29 July 1981, the Erie County Department of Environment and Planning (ECDEP) was contacted by a Wide Beach resident concerning the possibility that the applied waste oil was contaminated with PCBs. It was reported to ECDEP that approximately twenty-five 55-gal drums of oil were spread on the roads 2-3 times a year during the period 1968-1978. This would represent between 27,500 and 41,000 gal of oil applied to the roadways over a 10-year period.

ECDEP conducted a site investigation on 7 August 1981 during which nineteen 55-gal drums were observed in a wooded area off Fox Street. Six drums contained aqueous material; two contained oil, and four contained water (ECDEP 1981). The two drums containing oil were sampled and analyzed for PCBs. Results show that total PCB concentrations were 12 and 38 mg/L.

To determine if PCB contamination of soils and ground water was present in the Wide Beach development, ECDEP initiated a field sampling program in September 1981. Samples of residential drinking water, roadway soils, drainage ditch soils, yard soils, and residential dust were collected, and determinations for PCBs conducted. Results indicated high levels of PCBs in the Wide Beach soils; ground-water analysis showed very low levels of PCBs in a few wells.

To further define the degree and extent of PCB contamination, EPA Region II's Field Investigation Team (FIT) conducted another field sampling program in 1983 (NUS 1983a, 1984). Results of the ECDEP and FIT sampling and analyses are summarized in Section 4.

2.2 RESPONSE ACTIONS TO DATE

A listing of response actions taken to date is presented in Table 2-1. Included are site investigations listed in the Remedial Action Master Plan (RAMP) (NUS 1983b) and subsequent investigations prior to this report.

TABLE 2-1 CHRONOLOGY OF ACTIVITIES AT WIDE BEACH

Date	Action
1940s-1968	Waste crank case oil was applied to local roadways as a dust suppressant.
1968-1978	Waste oil, some containing PCBs, was applied to local roadways.
24 JUL 1981	Erie County received complaint from a local resident that PCB-laden oil was possibly used for dust control on local roads and that empty steel drums were located in a wooded area near Wide Beach.
7 AUG 1981	Field investigation conducted by Erie County Department of Environment and Planning (ECDEP) revealed nineteen 55-gal steel drums in wooded area. Drum markings indicated that they had contained different oils. ECDEP samples indicated that at least some drums contained PCB.
AUG 1981 - OCT 1982	Air, water, and soil sampling programs conducted in the Wide Beach area by ECDEP and the Erie County Department of Health.
9 NOV 1981	ECDEP letter to the president of the Wide Beach Homeowner's Association advised alternate drinking water supplies for certain residents.
FEB 1982	ECDEP Report: Wide Beach PCB Investigation--Ground-Water and Soil Contamination.
29 JUL 1982	Wide Beach receives a Hazard Ranking Score (HRS) of 56.58.
12 AUG 1982	New York State Department of Environmental Conservation (NYSDEC) submitted HRS forms and documentation to EPA for review.
NOV 1982	ECDEP Report: Wide Beach PCB Investigation Sampling Report.
20 DEC 1982	Wide Beach was included on the National Priorities List issued by EPA as a site that may receive remedial action pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA or SUPERFUND)
APR 1983	EPA Region II Field Investigation Team (FIT) conducted a soil and ground-water sampling program to confirm previous ECDEP findings and assess potential contamination from dioxin, TCDF, and priority pollutants.

TABLE 2-1 (Cont.)

Date	Action
12 AUG 1983	FIT Report: Evaluation of Analytical Chemical Data for Wide Beach Community, Brant Township, New York.
NOV 1983	Remedial Action Master Plan (RAMP) submitted to EPA by NUS Corporation.
14 FEB 1984	FIT Report: Presentation of Analytical Chemical Data from Drinking Water Samples Collected from Wide Beach Community, Brant Township, New York.
15 FEB 1984	EPA signs Cooperative Agreement with the State of New York, providing $448,628 to perform a Remedial Investigation/ Feasibility Study (RI/FS) at Wide Beach.
APR 1984	NYSDEC contracts with EA Engineering, Science, and Technology, Inc. to undertake the RI/FS.
AUG-DEC 1984	EA field teams undertake RI.
3 JAN 1985	Interim remedial measures recommended to NYSDEC.
6 MAR 1985	Draft RI report forwarded to NYSDEC.
28 AUG 1985	Final RI report forwarded to NYSDEC.

3. EXISTING SITE ENVIRONMENT

3.1 SITE LOCATION

The Wide Beach Development site is a 55-acre residential community on the southeastern shore of Lake Erie, approximately 30 mi south of Buffalo. Only about 40 of the 55 acres are developed. The remaining 15 acres are naturally wooded areas surrounding the main access road (Fox Street) to the community.

The community is located west of State Route 5 in the Town of Brant in southern Erie County, New York (Figure 3-1). It is bounded on the south by the Cattaraugus Indian Reservation, on the west by Lake Erie, on the north by Lotus Bay community (similar to Wide Beach) and on the east by old Lake Shore Road.

3.2 PHYSIOGRAPHY

The site lies within the Erie-Niagara Basin of the Central Lowlands Physiographic Province (Raisz 1957). This province is characterized by flat terrain of very low relief.

The Erie-Niagara Basin is underlain by a series of layered sedimentary rock of Paleozoic Age. These strata strike roughly eastward and dip gently to the south. The Paleozoic strata were formed of fine-grained sediment deposited in a shallow sea which covered the area during the Silurian and Devonian periods (roughly from 430 to 350 million years ago). Paleozoic bedrock is overlain by unconsolidated deposits of glacial origin. The till and glacial lake deposits were formed during the Pleistocene Epoch some 2 million years ago (LaSala 1968). The low relief of the area is the result of glacial scour and lacustrine deposition.

The site itself is virtually flat with surface elevations on the order of $\pm$ 587 ft msl along Fox Street and at the Oval (Plate 1). The land slopes gently southward to the wetland bordering the site at $\pm$579 ft msl. Along the lake shore, relief is on the order of $\pm$11 ft where the site upland drops sharply to the beach.

3.3 HYDROGEOLOGY

Bedrock at the site is the West Falls Formation (Upper Devonian), which is described as a black to gray shale with interbedded light gray siltstone and sandstone. LaSala (1968) reported the lower part of the formation to be petroliferous. Throughout the formation, zones of calcareous concretions are found which may also contain some pyrite and marcasite. The West Falls strata have a very gentle dip of $\pm$40 ft/mi in a southerly direction.

LaSala also reported a roughly orthogonal system of near vertical joints. In the Erie-Niagara Basin, these joints occur in two sets. The first set strikes northeasterly, the second northwesterly. These two sets produce a roughly diamond-shaped pattern in outcrop. A set of near horizontal joints are parallel to the bedding planes of the shale.

A discontinuous fracture zone also can be found in the upper surface of the bedrock. It consists of shallow tension cracks caused from the movement of the glacial ice sheet over the rock (LaSala 1968).

Ground-water flow in the type of rock found at the site is through the joints and fractures. Several gallons per minute can conceivably flow through these joints.

Based on boring data obtained during this investigation, the overburden at the site is predominantly till and glacial lake deposits. The till is composed of dark gray and brown silty clay with some rounded rock fragments. In several soil samples obtained at the site, fractures with oxidation staining of the surfaces were found. The staining can be associated with the percolation of surface water through the overburden to the bedrock.

The soil horizons can be considered laterally consistent (Plate 2). Near the lake edge and immediately next to the wetland area, the surficial soil is a silty sand with a thickness of 2-4 ft. This soil horizon was not found elsewhere onsite. In the remaining areas of the development, the surficial 0.0-6.0 ft of soil is composed of dark brown silty clay, with large amounts of varying grain sizes of sand and some gravel.

The surficial soils are underlain by a brown, clayey, fine-grained sand. This sand layer is found throughout the site except for the borings located near the wetlands. The thickness of this layer varies up to 3 ft. In some locations, thin lenses of this soil alternate with layers of a brown silty clay. This brown silty clay (classified as till) is the next significant soil horizon. It contains some small rounded rock fragments, and its consistancy is from stiff to very stiff. At an elevation of ~578-580 ft, there is a color change in this soil horizon. This change from brown to dark gray may be attributed to the weathering of the till in the near-surface layers. The basal, dark gray till has a higher content of rock fragments than the brown till.

The overburden at the site averages 11 ft. in thickness with the thinner areas in the vicinity of the farthest east borings (with a thickness of 5.5 ft) and the thickest overburden in the vicinity of borings MW-4 and OW-6 (with an average thickness of over 20 ft).

The weathered bedrock consists of a decomposing shale and angular shale fragments. This layer is generally only a few inches in thickness on the site, but locally it is as much as 3 ft thick. These thicker zones of weathering are found in the eastern portion of the site. Figure 3-2 illustrates the bedrock surface configuration at the site.

During this investigation, a water table was seldom encountered. Saturated split-spoon samples were sometimes found at 0.5-1.0 ft above bedrock. This indicates that, at least seasonally, the overlying till acts as a confining layer imparting on the bedrock aquifer a confined or semi-confined condition. On this basis, the aquifer of concern at the site is the shallow bedrock aquifer. This includes: (1) the basal 1-2 ft of till, locally where coarser grained, (2) weathered bedrock and the zone of shallow tension cracks, and (3) the upper few tens of feet of open

joints and fractures. Based on field observations and information provided in the RAMP (NUS 1983) and LaSala (1968), it can be concluded that recharge to the onsite wells occurs predominately through the weathered/fractured zone and open fractures in the shallow bedrock.

Figure 3-3 illustrates the potentiometric surface of the shallow bedrock aquifer on 27 December 1984 when water levels were highest with regard to measurements taken during this investigation. An overall average gradient for the site of 0.009 can be estimated on the basis of these contours. The wetlands at the south of the site appear to constitute a ground-water-discharge divide between the site and the land to the south of the wetlands. Based on the December 1984 contours, roughly 80 percent of the site's ground-water discharge is via the stream and wetlands with the remaining 20 percent discharging directly to Lake Erie. However, ground-water flow may be northward, as it crosses the site boundary, from a small portion of the site north of the Oval. Definitive data on northward ground water flow are not available, but will be obtained in a subsequent recommended study (Section 8).

3.4 HYDROLOGY AND CLIMATOLOGY

3.4.1 Precipitation

The Wide Beach site falls in the Erie-Niagara Basin in western New York State. The basin includes 2,000 mi^2 and extends from Cattaraugus Creek in the south to Tonawanda Creek in the north. The average annual snowfall depth in the basin ranges from 70 in. in the north to 150 in. in the south (Harding and Gilbert 1968). Most of the snowpack accumulation (70 percent) occurs from December through February. Based on a snow density of 0.1 in. of water per 1 in. of snow depth, the water storage in the snow cover is approximately 7-15 in. over the Basin.

Annual basin precipitation ranges from 32 in. in the north to 44 in. in the south (Harding and Gilbert 1968). Mean, maximum, and minimum monthly precipitation recorded at the U.S. Weather Bureau station in Buffalo, New York, over the period of 1951-1984 is provided in Figure 3-4 along with monthly precipitation data for 1984. In 1984, precipitation exceeded average historical values in four months (February, May, June, and September), equalled average historical value in one month (August), and fell below the historical level in the remaining seven months. In May and June 1984, precipitation at Buffalo was particularly high with the June rainfall of 6.86 in. representing a record level relative to data collected over the period 1951-1980. Rainfall at Fredonia, south of Wide Beach, was similarly high in these months with 6.8 in. in May and 6.49 in. in June.

A plot of daily precipitation recorded at the Wide Beach site and at Buffalo from 30 August through 26 September 1984 is provided in Figure 3-5. During this period, the highest recorded daily rainfall was 0.94 in. at Buffalo on 11 September and 0.74 in. at Wide Beach on the same day. These values are equivalent to average rainfall intensities of approximately 0.04 and 0.03 in./hr. Rainfall intensity/duration/frequency curves for the Buffalo site (Figure 3-6) indicate that such intensities are below the level associated with a 24-hour storm having

a recurrence interval of 2 years. Over the period illustrated in Figure 3-5, the maximum hourly precipitation recorded at the Wide Beach site was 0.38 in. on 2 September (2100-2200 hours) and 11 September (0300-0400 hours). As indicated in Figure 3-6 an average rainfall intensity of 0.38 in./hour is below the level associated with a 1-hour storm having a recurrence interval of 2 years.

3.4.2 Site Drainage and Runoff

For purposes of managing the Natural Water Data Network, drainage basins throughout the United States have been coded into Hydrologic Units. Wide Beach falls within Hydrologic Unit 04120103 which is bounded on the west by Hydrologic Unit 04120200 (Lake Erie), on the north and east by Hydrologic Unit 04120104 (Niagara River drainage) and on the south and east by Hydrologic Unit 04120102 (Cattaraugus Creek drainage).

Hydrologic Units 04120102, 04120103, and 04120104 constitute what is commonly referred to as "the Erie-Niagara Basin." Stream discharge from the Erie-Niagara Basin is approximately one-half of the precipitation input with streamflow averaging 18 in./year, precipitation averaging 38 in./year, and 20 in./year discharged almost entirely by evapotranspiration (USGS 1968). There is apparently a "negligible" amount of subsurface discharge to Lake Erie and the Niagara River due to the low permeability of rocks in the area (USGS 1968).

The topography of the Wide Beach site is quite flat making it difficult to define drainage patterns and divide the site into subbasins. Nevertheless, topographic surveys and knowledge of existing drainage ditch patterns have been used to delineate a subbasin which contributes drainage to Lake Erie, nine which drain to the wetland area at the south of Wide Beach Development and one which appears to drain to the north. These subbasins, shown in Figure 3-7, include 55 acres which are distributed as illustrated in Table 3-1.

The runoff from a particular subarea basin may be represented by the Soil Conservation Service (SCS) runoff equation:

$$Q = \frac{(P - Ia)^2}{(P-Ia) + S} \qquad \text{(Equation 3-1)}$$

where

- Q = volume of runoff (in inches depth over the drainage area)
- P = accumulated rainfall (in inches depth over the drainage area)
- I_a = abstraction including surface storage, interception by vegetation, and infiltration prior to runoff (in inches depth over the drainage area)
- S = potential maximum retention of water by the soil (in equivalent inches depth over the drainage area)

In Equation 3-1, the potential maximum water retention (S) ranges from zero for smooth impervious surfaces to infinity in deep gravel. For computational ease, the potential water retention term in converted to a runoff number (CN) which is defined as:

$$CN = \frac{1000}{10 + S} \qquad \text{(Equation 3-2)}$$

In Equation 3-2, the runoff curve number ranges from 100 when S is zero (completely impervious drainage) to 0 when S approaches infinity (deep sandy soils). Values of the runoff curve number as a function of soil type and land use are provided by SCS (e.g., Exhibit 2-2, SCS 1979). For the Wide Beach site, which contains soils having a slow infiltration rate (Group C soils), selected values of CN are as follows:

1. 50 for the beach area in Subbasin A
2. 70 for grassy areas/lawns
3. 74 for forested areas
4. 98 for roofs

Application of these values to the estimated land use composition within each of the subbasins (Table 3-2) indicates composite curve numbers ranging from 60 (Subbasin A) to 73 in several subbasins.

Tables summarizing runoff depth as a function of rainfall depth and runoff curve number are available from the Soil Conservation Service (Exhibits 2-7A and 2-7, SCS 1979). Using Figure 3-6 to define 24-hour rainfalls for the 2-, 5-, 10-, and 50-year storms at Wide Beach, the runoff depths associated with these storms have been estimated for each of the selected Wide Beach subbasins. These estimates, summarized in Table 3-3, indicate that runoff for the 50-year, 24-hour storm ranges from 0.72 in. (Subbasin A) to 1.46 in. in several subbasins. Total runoff from the subbasins ranges from 0.26 in. for a 2-year storm to 1.33 in. for a 50-year, 24-hour storm. Thus, total subbasin runoff ranges from 13 percent of rainfall for a 2-year, 24-hour storm to 34 percent of rainfall for a 50-year, 24-hour storm. Stated another way, the estimated site runoff ranges from 232×10^3 gal (31×10^3 ft^3) during a 2-year, 24-hour storm to 1.187×10^3 gal (158×10^3 ft^3) during a 50-year, 24-hour storm.

During EA's Wide Beach field program in August and September 1984, attempts were made to monitor runoff and sample runoff water quality at three locations:

1. a pipe draining areas east of the "Oval" to the north and south of Fox Street (Subbasins E1 and E2, Figure 3-7)

2. a pipe draining the areas enclosed by the Oval and limited drainage to the west of the Oval (Subbasins C1 and C2, Figure 3-7)

3. an open channel which drains toward the marsh to the south of the Wide Beach site and which would be expected to receive drainage from portions of Fox and South Streets (Subbasin G, Figure 3-7).

At the outlet draining Subbasins C1 and C2, it was not possible to measure flow because the discharge pipe was inaccessible. In the open channel draining Subbasin G, no measurable flows were noted due to the relatively low rainfall. However, at the pipe draining Subbasins E1 and E2, it was possible to obtain flow measurements on 30 August 1984 when a rainfall of 0.39 in. was recorded from 1000 to 1200 hours.

A summary of measured flow data at the outfall pipe draining Subbasins E1 and E2 during the rainfall event of 30 August 1984 is provided in Table 3-4. As indicated in the table, the total measured runoff was 863 gal or 115.4 ft^3. When divided by the drainage area for Subbasins E1 and E2 (4.4 acres or 191,664 ft^2), the result is equivalent to a runoff of 6.02×10^{-4} ft or approximately 0.007 in. Thus, the runoff for this particular event was only 1.8 percent of the rainfall. This is consistent with the rainfall-runoff depth tables presented by SCS which indicate a runoff depth <0.1 in. for a 0.39 in. rainfall in a basin having a runoff curve number of 71 (Exhibit 2-7A, SCS 1979). The relatively small runoff observed on 30 August 1984 reflects the fact that most of the rainfall was abstracted via depression, storage, etc. and did not leave the site. As indicated in Table 3-3 and in the discussion above, runoff during larger storms increases relative to rainfall and approaches 34 percent of the rainfall during 24-hour, 50-year events.

3.5 ECOLOGICAL SETTING

3.5.1 Regional Environment

The following general description of the Lake Erie Plain is based on a detailed environmental report prepared by Niagara Mohawk Power Corporation (1977).

The Lake Erie Plain lies in the Eastern deciduous forest biome of North America. Many changes have occurred in this type of biome since its evolution in the Cretaceous period. The most notable changes have been the result of glaciation during the Pleistocene epoch and due to cutting of the forest for lumber and agricultural use by European settlers.

The Lake Erie Plain belongs to the beech-maple forest region, which extends northeasterly along the Lake Ontario Plain, westerly into Ohio, Indiana, Michigan, and along the lake plain in Illinois and lower Wisconsin (Braun 1950). Local variations of this forest-type occur due to climatic differences over this large geographic area and to the different treatments imposed on the land by humans.

The present forests in the area are very heterogeneous, with few areas covered by distinct associations of the eastern deciduous forest. Because the better drained regions have been cleared for farming, forests are usually restricted to poorly drained areas. The forests have been further disturbed as a result of lumbering and disease. The most drastic recent change has resulted from the elimination of American elm as a canopy species by Dutch elm disease.

In a very general sense, the older forest tracts and those that are occasionally located on better drained soil approach a beech/maple/birch or a shagbark hickory/basswood/maple association. White ash, black cherry, red maple, basswood, hemlock, and shagbark hickory are among the codominants of the beech/maple type. Red oak is commonly mixed with basswood, shagbark hickory, and sugar maple. The forests on poorly drained soils, or in regions with a high seasonal water table, are usually dominated by nearly pure stands of red maple, although green ash and blackgum are common associates. The shrub community is composed of shrub-dominated areas that have been cleared, pastured, or farmed at one time. Two shrub associations can be discerned--the typical shrub association dominated by southern arrowwood and silky dogwood and a shrub variant dominated by hawthorn--although southern arrowwood and silky dogwood are also prevalent in the shrub layer of the variant. Both shrub areas are basically composed of aggregates of shrubs interspersed with open spaces dominated by grasses and perennial weeds. The shrub community will eventually be succeeded by a forest community. The most common tree invaders appear to be red maple, green ash, and white ash.

In addition to forest and shrub habitats, there are open field communities of primarily abandoned agricultural fields. Grasses and perennial weeds are the main constituents of this community, which appears very similar in plant composition to hayfields. Croplands and vineyards are also prevalent along the Lake Erie Plain.

3.5.2 Wide Beach Environment

The following characterization of the ecological setting at Wide Beach is based on walk-through surveys of major habitats in August 1984 and on interpretation of aerial photographs from March and October 1984.

3.5.2.1 Flora

Natural forest, shrub, and wetland communities are predominant along the low lake plain where the site is situated. Portions of each habitat have been modified by the Wide Beach Development where natural vegetative communities have been cleared to make way for roads and house lots (Figure 3-8). In addition, there are now relatively open areas around buildings and along roads that are groomed seasonally to suit the tastes of property owners. The manipulation of habitat has had the effect of creating discernible edges or borders between the natural and the manmade environments.

The forest community in the area is characterized by a high, full canopy of red maple (*Acer rubrum*), American beech (*Fagus grandifolia*), northern red oak (*Quercus rubra*), yellow birch (*Betula alleghaniensis*), yellow-poplar (*Liriodendron tulipifera*), ash (*Fraxinus* spp.), and eastern hemlock (*Tsuga canadensis*).

The equally dense forest subcanopy consists of saplings of each of those dominant species, as well as American hornbeam (*Carpinus caroliniana*) and southern arrowwood (*Viburnum dentatum*) in the interior of the forest.

Along the edges of this community, common elderberry (Sambucus canadensis), eastern cottonwood (Populus deltoides), and dogwood (Cornus spp.) invade.

Ground cover is not as thick or dense as the subcanopy of saplings and shrubs because competition for light and space is strong at this depth of cover. However, where the forest floor is moist and shady, May apple (Podophyllum peltatum), sensitive fern (Onoclea sensibilis), and trillium (Trillium spp.) are found. On the drier, more open fringes of the forest, wild grape (Vitis spp.), Virginia creeper (Parthenocissus quinquefolia), and raspberry (Rubus sp.) interwine with shrubbery. Poison ivy (Rhus radicans) grows throughout the area covering the ground and climbing trees.

The roadside shrub community is composed mainly of dogwood, southern arrowwood and common elderberry. This growth is so dense that it is almost impenetrable, and there is no significant ground cover beneath the closed shrub canopy.

The wetland community along the small stream to the south of the site features a dense ground cover of long-bristled smartweed (Polygonum caespitosum). This species grows so thickly that few other species penetrate the wetland. A few cattail (Typha latifolia) emerge above the smartweed near the center of the wetland where the soil is most often saturated. Swamp rose-mallow (Hibiscus palustris), swamp milkweed (Asclepias incarnata) and spotted touch-me-not (Impatiens capensis) also invade the edges of the wetland.

3.5.2.2 Fauna

Small mammals were live-trapped during August 1984 at the site and at nearby Evangola State Park to collect liver tissue samples for PCB analysis. Species collected during the environmental investigation included the white-footed mouse (Peromyscus leucopus), eastern chipmunk (Tamias striatus), meadow-jumping mouse (Zapus hudsonius), meadow vole (Microtus pensylvanicus), and the shorttail shrew (Blarina brevicauda). (Appendix Table A-1 indicates the distribution of the catch among various vegetative habitats.) These species are representative of small mammals inhabiting the Lake Erie Plain. For comparison, Table 3-5 lists the 46 mammalian species reported by Burt (1957) to be found in the region that includes the eastern shore of Lake Erie.

Considering the relative diversity of vegetative habitat at Wide Beach, many of the wildlife species which frequent the eastern shore of Lake Erie would be expected at the site. However, the site is not a large tract of land, and while it would probably support large numbers of small mammals (i.e., shrews, voles, and mice), it would only represent a stopover or a portion of the habitat required by larger mammals (i.e., red fox and white-tailed deer). Similarly, while the entire shoreline of Lake Erie in this area is considered a significant overwintering habitat for waterfowl by NYSDEC Significant Habitat Unit (Ozard 1985), the site offers only a small amount of nesting and overwintering habitat to waterfowl which frequent the area, and stopover habitat to many avian species. Nesting songbirds can be expected to utilize the study area

because of the diversity of habitat and available nest sties. These passerine species are likely to feed in the area during their nesting period.

3.6 DEMOGRAPHY AND LAND USE

There are 66 property owners and 59 residences in the community of Wide Beach. Approximately 120 people reside in the community during the summer months and 45 people live there year-round (NUS Corp. 1983). A number of the residences in Wide Beach are leased for seasonal and year-round use. For purposes of this field study, all Wide Beach residences were assigned station numbers. Figure 3-9 shows station numbers for each residence. Environmental samples collected at Wide Beach Development are referred to by station numbers.

Land use in Wide Beach is residential. An area called "the Grove" (Plate 1), located adjacent to the Helmich residence (Station No. 1), is community-owned property used for recreational activities. Regional land use is primarily agricultural and rural residential. Undeveloped acreage is largely forest and may be utilized for hunting (Figure 3-8).

Population is largely seasonal along the Lake Erie shoreline, west of Lakeshore Road in the site vicinity. North of the site, from Lotus Bay to Evangola State Park, ~1 mi north of Wide Beach, there are approximately 60 private housing units representing 106 year-round residents (1980 Census, Tract 156, Block 218). South of the site are shoreline developments on the Cattaraugus Reservation as far south as Cattaraugus Creek. The Snyder Beach Community, at the southern border of Wide Beach, includes approximately 150 housing units. There is also a Cattaraugus Reservation community at the mouth of Cattaraugus Creek (north shore) with 140-150 housing units.

In addition, there are approximately 14 housing units on both sides of Lake Shore Road just east and south of the Wide Beach Development. Eleven of these are on Reservation lands and probably represent the majority of the 39 residents estimated to be the year-round population of the entire Snyder Beach and vicinity south of Wide Beach (1980 Census, Tract 162, Block 804). Snyder Beach is also used by campers during the summer season.

The nearest year-round population center with respect to Wide Beach is the Village of Farnham. Located 1.25 mi east of the site, the Village supports a population of 404 (1980 Census, Tract 156).

3.7 DOMESTIC WATER SUPPLY AND SEWER SYSTEM

3.7.1 Wide Beach Site

A questionnaire prepared by EA was completed by 42 residents contacted during the residential water and dust sampling. Information pertaining to water supply and quality was obtained and is summarized in Table 3-6.

TABLE 3-1 SUMMARY OF DRAINAGE AREAS FOR SELECTED SUBBASINS WITHIN THE WIDE BEACH SITE

Subbasin	Total Area (acres)[a]
A	3.9
B	2.7
C1	3.0
C2	5.0
D	1.8
E1	2.6
E2	1.8
F	8.3
G	3.7
H	3.7
I	18.5
Total	55.0

(a) See Figure 3-7 for subarea boundaries.

TABLE 3-2 SUMMARY OF LAND USE AND RUNOFF CURVE NUMBERS FOR SELECTED SUBBASINS WITHIN THE WIDE BEACH SITE

Subbasin	Drainage Area (acres)	Percent Area				Runoff Curve Number
		Roofs	Lawns/ Grass	Forest	Beach	
A	3.9	--	50	--	50	60
B	2.7	10	90	--	--	73
C1	3.0	5	95	--	--	71
C2	5.0	5	65	30	--	73
D	1.8	5	95	--	--	71
E1	2.6	5	55	40	--	73
E2	1.8	10	90	--	--	73
F	8.3	5	55	40	--	73
G	3.7	5	65	30	--	73
H(a)	3.7	--	--	--	--	--
I(a)	18.5	--	--	--	--	--
Total	55.0					
Average Runoff Curve Number						71

(a) These subbasins are only partially located within the site and insufficient information is available to estimate total area.

TABLE 3-3 SUMMARY OF RUNOFF DEPTHS FOR SELECTED SUBBASINS WITHIN THE WIDE BEACH SITE DURING 24-HOUR STORMS HAVING RECURRENCE INTERVALS OF 2, 5, 10, AND 50 YEARS

Subbasin	Drainage Area (acres)	Curve Number	Runoff (inches)[a] 2-year (2.0)[b]	5-year (2.6)	10-year (3.1)	50-year (3.9)
A	3.9	60	0.06	0.2	0.37	0.72
B	2.7	73	0.32	0.62	0.92	1.46
C1	3.0	71	0.26	0.54	0.82	1.33
C2	5.0	73	0.32	0.62	0.92	1.46
D	1.8	71	0.26	0.54	0.82	1.33
E1	2.6	73	0.32	0.62	0.92	1.46
E2	1.8	73	0.32	0.62	0.92	1.46
F	8.3	73	0.32	0.62	0.92	1.46
G	3.7	73	0.32	0.62	0.92	1.46
H[c]	3.7					
I[a]	18.5					
Total	55.0					
Average		71	0.26	0.54	0.82	1.33

(a) From Exhibit 2-7A (SCS 1979).
(b) Numbers in parenthesis indicate rainfall depth for given recurrence intervals as obtained from Figure 3-6.
(c) Curve numbers and runoff not estimated.

TABLE 3-4 MEASURED FLOWS AND COMPUTED RUNOFF AT THE OUTLET OF SUBBASINS E1 AND E2 ON 30 AUGUST 1984

Time	Measured Flow (gpd)	Interval	Time (days)	Average Flow (gpd)	Runoff (gal)
1030	0		0		
1135	280	1030-1135	0.045	140	6.3
1205	10,000	1135-1205	0.021	5,140	107.9
1235	10,000	1205-1235	0.021	10,000	210.0
1335	5,700	1235-1335	0.042	7,850	329.7
1435	1,588	1335-1435	0.042	3,644	153.0
1535	570	1435-1535	0.042	1,079	45.3
1630	0	1535-1630	0.038	285	10.8
				Total	863.0

TABLE 3-5 MAMMALIAN SPECIES REPORTED BY BURT[a] (1957) TO BE NATIVE TO WESTERN NEW YORK

Opossum (*Didelphis marsupialis*)
Hairytail mole (*Parascalops breweri*)
Starnose mole (*Condylura cristata*)
Masked shrew (*Sorex cinereus*)
Smoky shrew (*Sorex fumeus*)
Longtail shrew (*Sorex dispar*)
Least shrew (*Cryptotis parva*)
Shorttail shrew (*Blarina brevicauda*)
Bats (*Chiroptera*) -- 9 species
Raccoon (*Procyon lotor*)
Shorttail weasel (*Mustela erminea*)
Longtail weasel (*Mustela frenata*)
Least weasel (*Mustela rixosa*)
Mink (*Mustela vison*)
Striped skunk (*Mephitis mephitis*)
Red fox (*Vulpes fulva*)
Gray fox (*Urocyon cinereoargenteus*)
Coyote (*Canis latrans*)
Woodchuck (*Marmota monax*)
Eastern chipmunk (*Tamias striatus*)
Red squirrel (*Tamiasciurus hudsonicus*)
Eastern gray squirrel (*Sciurus carolinensis*)
Eastern fox squirrel(*Sciurus niger*)
Southern flying squirrel (*Glaucomys volans*)
Beaver (*Castor canadensis*)
Deer mouse (*Peromyscus maniculatus*)
White-footed mouse (*Peromyscus leucopus*)
Southern bog lemming (*Synaptomys cooperi*)
Boreal red-backed vole (*Clethrionomys gapperi*)
Meadow vole (*Microtus pennsylvanicus*)
Pine vole (*Pitymys pinetorum*)
Muskrat (*Ondatra zibethicus*)
House mouse (*Mus musculus*)
Norway rat (*Rattus norvegicus*)
Meadow jumping mouse (*Zapus hudsonius*)
Woodland jumping mouse (*Napaeozapus insignis*)
Eastern cottontail (*Sylvilagus floridanus*)
White-tailed deer (*Odocoileus virginianus*)

(a) From Niagara Mohawk Power Corporation 1977.

TABLE 3-6 SUMMARY OF RESULTS OF RESIDENTIAL SURVEY, WIDE BEACH, ERIE COUNTY, NEW YORK, AUGUST 1984[a]

Station Number	Name of Resident	Wide Beach Address	Well Type	Water Pretreatment	Water Problems	Approximate Depth of Well(ft)	Pressure Tank
1	R. Helmich	21 Oval	Drilled[c]	--	--	50	--
2	M. Morgante	29 Oval	Drilled[c]	None	Sulfur	40	Yes
3[b]	Kalenda	Oval	--	--	--	--	--
4[b]	Horth	38 Oval	--	--	--	--	--
5	M. Franz	48 Oval	Drilled	None	None	40	Yes
6	A. Militello	60 Oval	Drilled	Tap Filter	None	60	Yes
	A. Militello	60 Oval	Beach	--	--	--	--
7	C. Miller	55 Oval	Drilled[c]	Tap Filter	None	45[b]	Yes
8	I. Allen	59 Oval	Drilled	None	None	--	Yes
9[b]	Barton	61 Oval	--	--	--	--	--
10[b]	F. Plewak	63 Oval	--	--	--	50	--
11	R. Hickey	65 Oval	Drilled	None	None	60	Yes
12	M. Schultz	67 Oval	Drilled	None	Well going dry	55	No
13[b]	Holmes	Oval	--	--	--	--	--
14	Major	73 Oval	Drilled	None	None	42	Yes
15	L. Militello	76 Oval	Dug	None	None	--	Yes
16[b]	Taylor	75 Oval	Drilled[c]	--	--	--	--
17[b]	J. Perhach	81 Oval	Drilled[c]	--	--	--	--
18	R. Grey	82 Oval		Tap Filter	None	50	Yes
19	A. Mason	85 Oval	Drilled	None	None	65	Yes
	A. Mason	85 Oval	Beach	--	--	--	--
20	Gillig	86 Oval	Drilled	None	None	30	Yes
21	E. Hockman	90 Oval	Drilled	None	None	>40	Yes
22[b]	Winnert	Oval	--	--	--	--	--
23	J. Aurelio	95 Oval	Beach	None	None	>25	Yes
24	F. Shanahan	96 Oval	Drilled	None	None	--	Yes
25	M. Lundberg	101 Oval	Drilled	None	Sulfur	42	Yes
26[b]	P. Murphy	108 Oval	--	--	--	--	--
27	H. Oehler	107 Oval	Drilled[c]	Yes[c]	--	--	--
	H. Oehler	107 Oval	Beach[c]	--	--	--	--
28	Prince	125 Oval	Drilled	None	Hardness/Rust	50	No
28[b]	Ball	Oval	Beach[c]	--	--	--	--
30	L. Miller	Oval	Drilled	Tap Charcoal Filter	None	45	Yes
31	S. Lojacono	109 Oval	Drilled	Tap Charcoal Filter	None	45	Yes

(a) A dashed line in a column (--) indicates that the information is not known.
(b) Residents were not available to respond to questionnaire. Information on type of well was obtained from Remedial Action Master Plan, 1983. EPA.
(c) Data obtained from RAMP 1983.

Note: Bauer residence is located on south side of South Street; Bowen residence located on north site of South Street.

TABLE 3-6 (Cont.)

Station Number	Name of Resident	Wide Beach Address	Well Type	Water Pretreatment	Water Problems	Approximate Depth of Well(ft)	Pressure Tank
32	Gajewski	118 Oval	Dug	None	Iron/Rust	--	Yes
33	N. Murphy	117 Oval	Drilled	None	None	--	Yes
34	E. Murphy	124 Oval	--	None	None	--	No
35	F. Plewak	128 Oval	Drilled(c)	None	None	49(c)	Yes
37(b)	Pronobis	135 Oval	--	--	--	60	--
38	Guerra	137 Oval	Drilled	None	None	30	Yes
39	R. Meyer	141 Oval	Drilled	None	None	35	Yes
40	Rusch	3 South	Drilled(c)	$KMNO_4$ Filter	Iron/Sulfur	50	Yes
41	Hellman	2 South	Drilled	None	Sulfur	60	Yes
42	Grabenstatter	1 Oval	Drilled	Yes	None	65	Yes
43(b)	Franz	6 Oval	--	--	--	--	--
44	Roe	11 Oval	Drilled	None	Hardness	62	Yes
45	P. Mueller	7 South	Drilled	None	Well going dry	50	Yes
46(b)	Bauer	9 South(d)	--	--	--	--	--
47	Rogers	17 South	Drilled	None	Sulfur	85	Yes
48	Burke	21 South	Drilled(c)	None	None	--	Yes
49	A. Speck	39 South	Drilled	None	None	50	Yes
50	F. Hansen	43 South	Drilled	None	Iron	50	Yes
51	Lyford	10870 Lakeshore	Drilled(c)	--	--	--	--
52	D. Murphy	35 Fox	Drilled	None	None	60	Yes
53	S. Newman	30 Fox	Drilled	None	Sulfur	--	Yes
54	M. Nosbisch	34 Fox	Drilled	Aquadyne Softener	Sulfur	54	Yes
55	Zender	26 South	Drilled(c)	None	None	--	Yes
56(b)	Persichini	South	--	--	--	--	--
57	F. Militello	20 South	Dug	Softener	None	40	Yes
58(b)	Egner	South	--	--	--	--	--
59	R. Canteline	18 Fox	Drilled	Imperial Softener	None	>40	Yes
60	D. Bowen	9 South	Drilled	WEC Water Softener	Iron	50	Yes

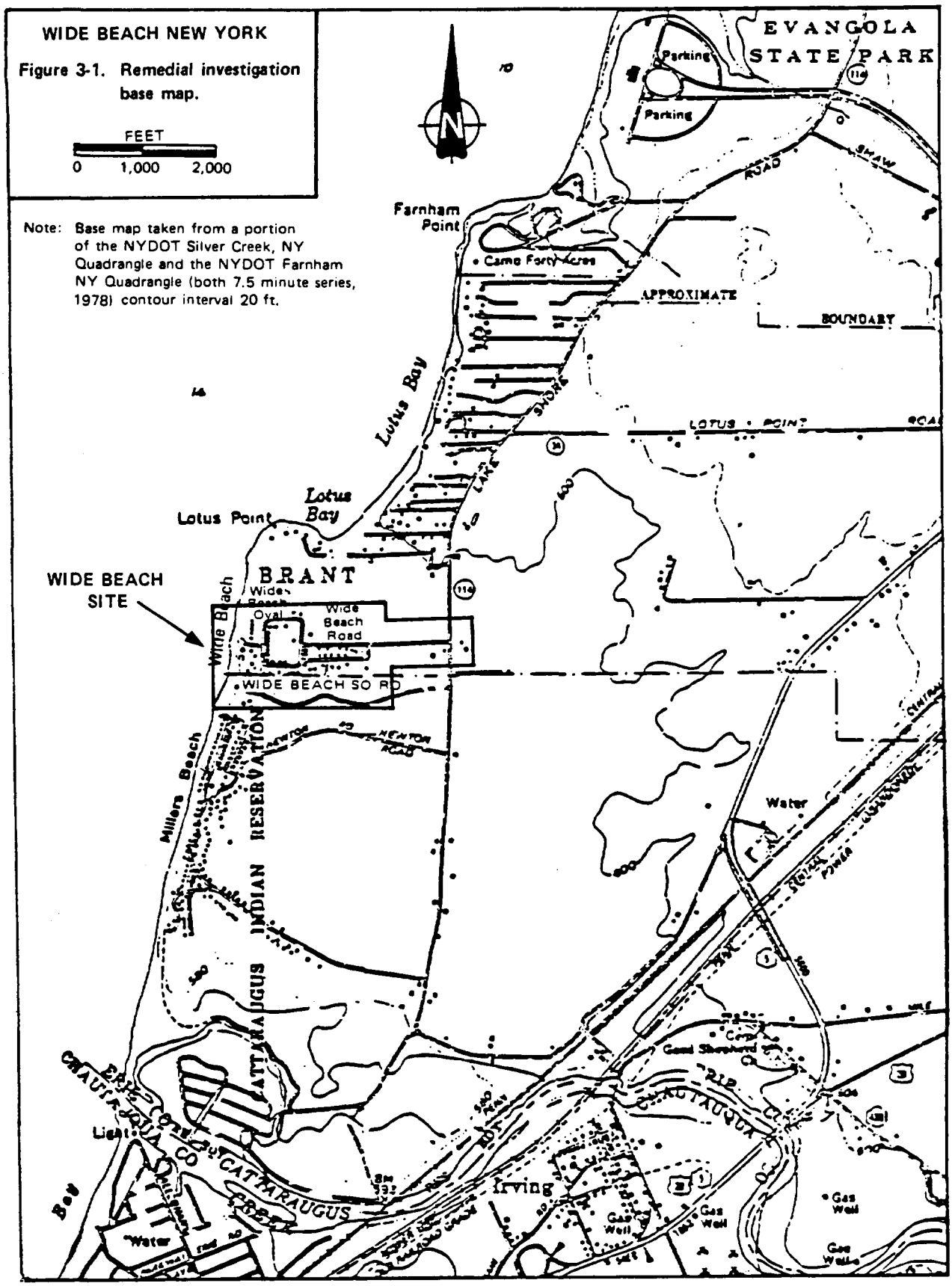

Figure 3-1. Wide Beach site location.

EPA REGION II
SCANNING TRACKING SHEET

DOC ID # 58132

DOC TITLE/SUBJECT:

EXHIBIT 3-3
WIDE BEACH DEVELOPMENT SITE
REMEDIAL INVESTIGATION
POTENTIOMETRIC CONTOUR MAP

THIS DOCUMENT IS OVERSIZED AND CAN BE LOCATED IN THE ADMINISTRATIVE RECORD FILE AT THE

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NEW YORK, NY 10007

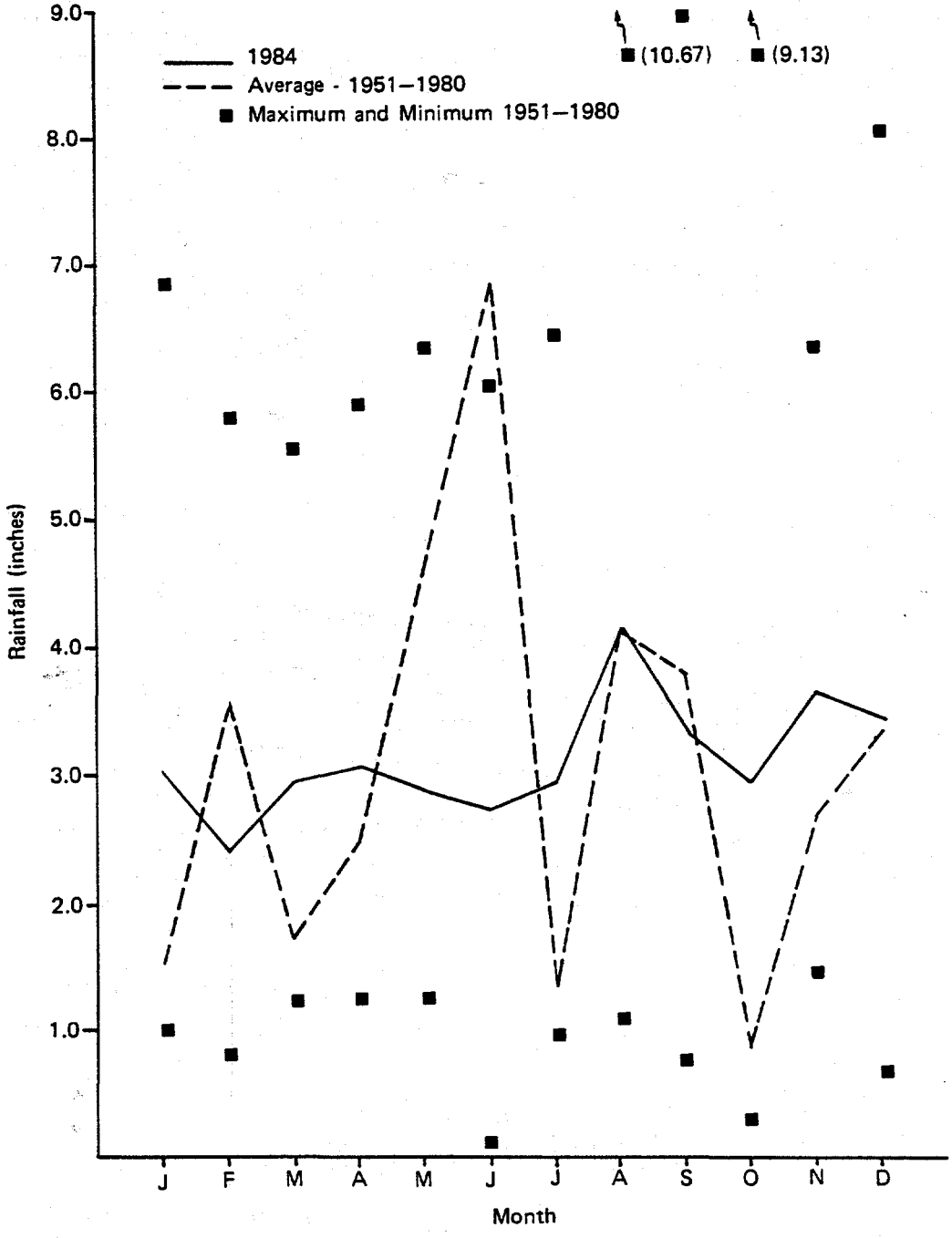

Figure 3-4. Recorded monthly rainfall at Buffalo, New York in 1984 and average/extreme monthly rainfall from 1951-1984.

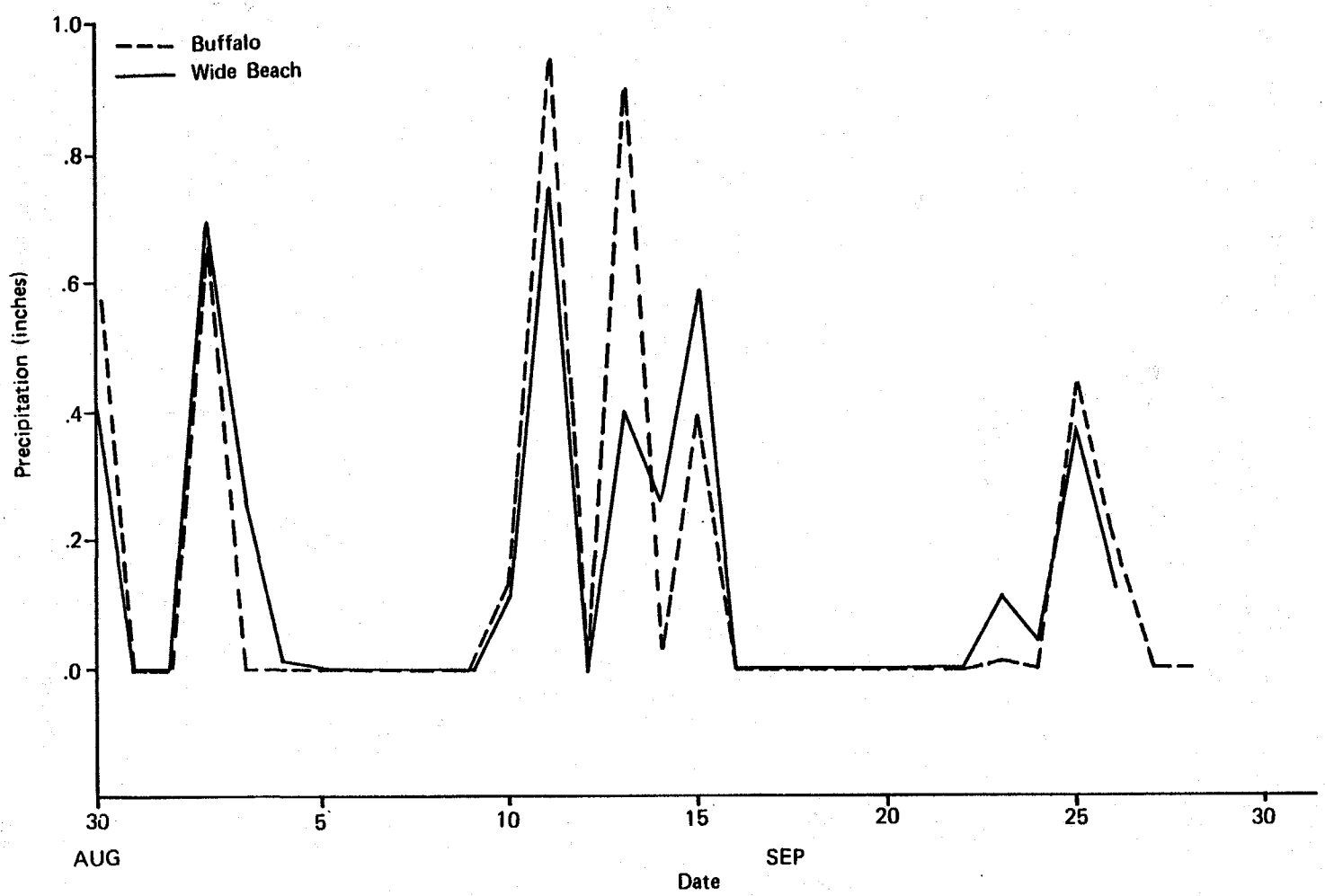

Figure 3-5. Recorded rainfall at Buffalo and Wide Beach, 30 August – 26 September 1984.

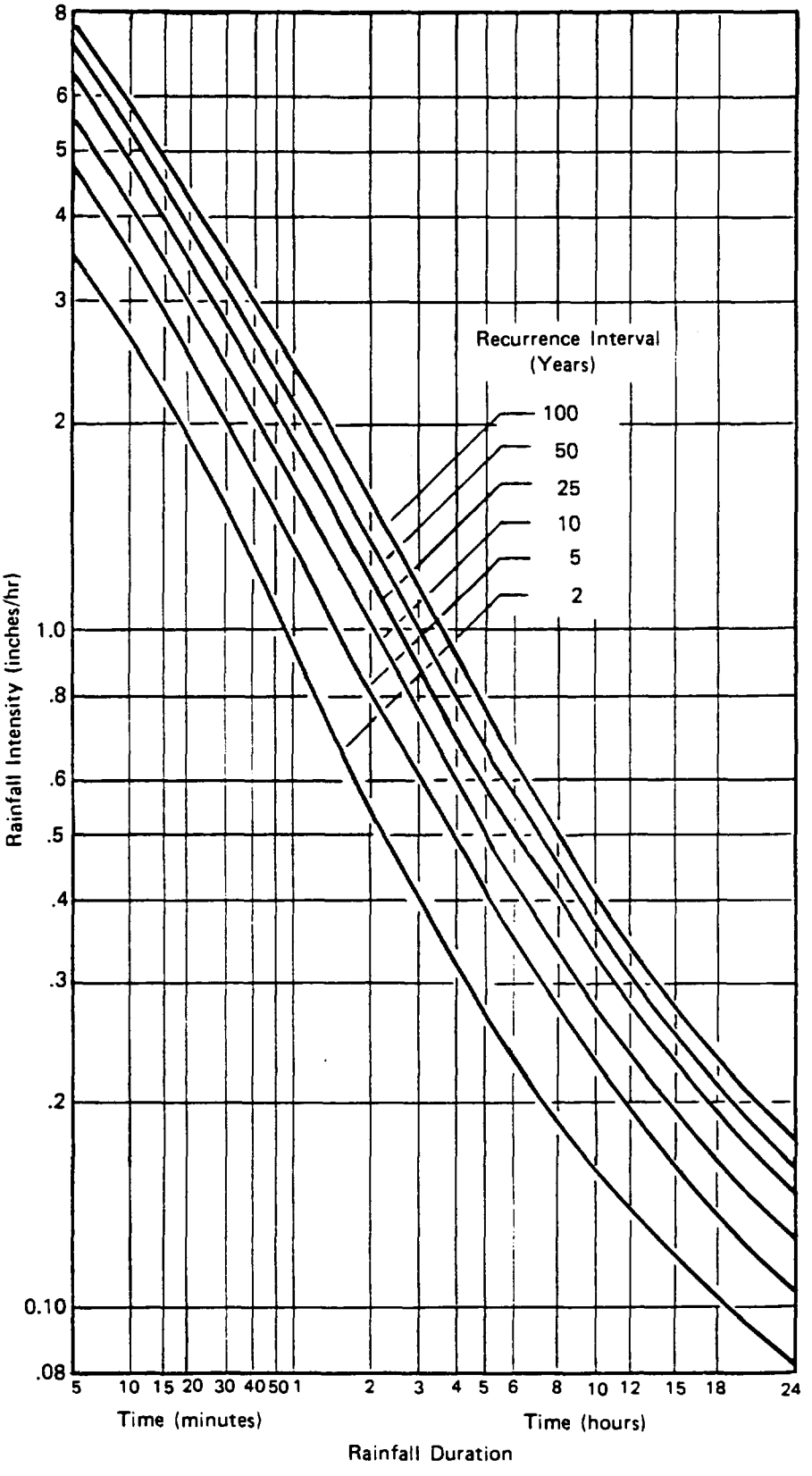

Figure 3-6. **Rainfall intensity duration-frequency curves, Buffalo (from USGS 1968).**

EPA REGION II
SCANNING TRACKING SHEET

DOC ID # 58132

DOC TITLE/SUBJECT:

EXHIBIT 3-7
WIDE BEACH DEVELOPMENT SITE
REMEDIAL INVESTIGATION
DRAINAGE AREAS

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DOC ID # 58132

DOC TITLE/SUBJECT:
WIDE BEACH DEVELOPMENT SITE
PHOTO MAY2, 1984

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EPA REGION II
SCANNING TRACKING SHEET

DOC ID # 58132

DOC TITLE/SUBJECT:

FIGURE 5-1
WIDE BEACH DEVELOPMENT SITE

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NEW YORK, NY 10007

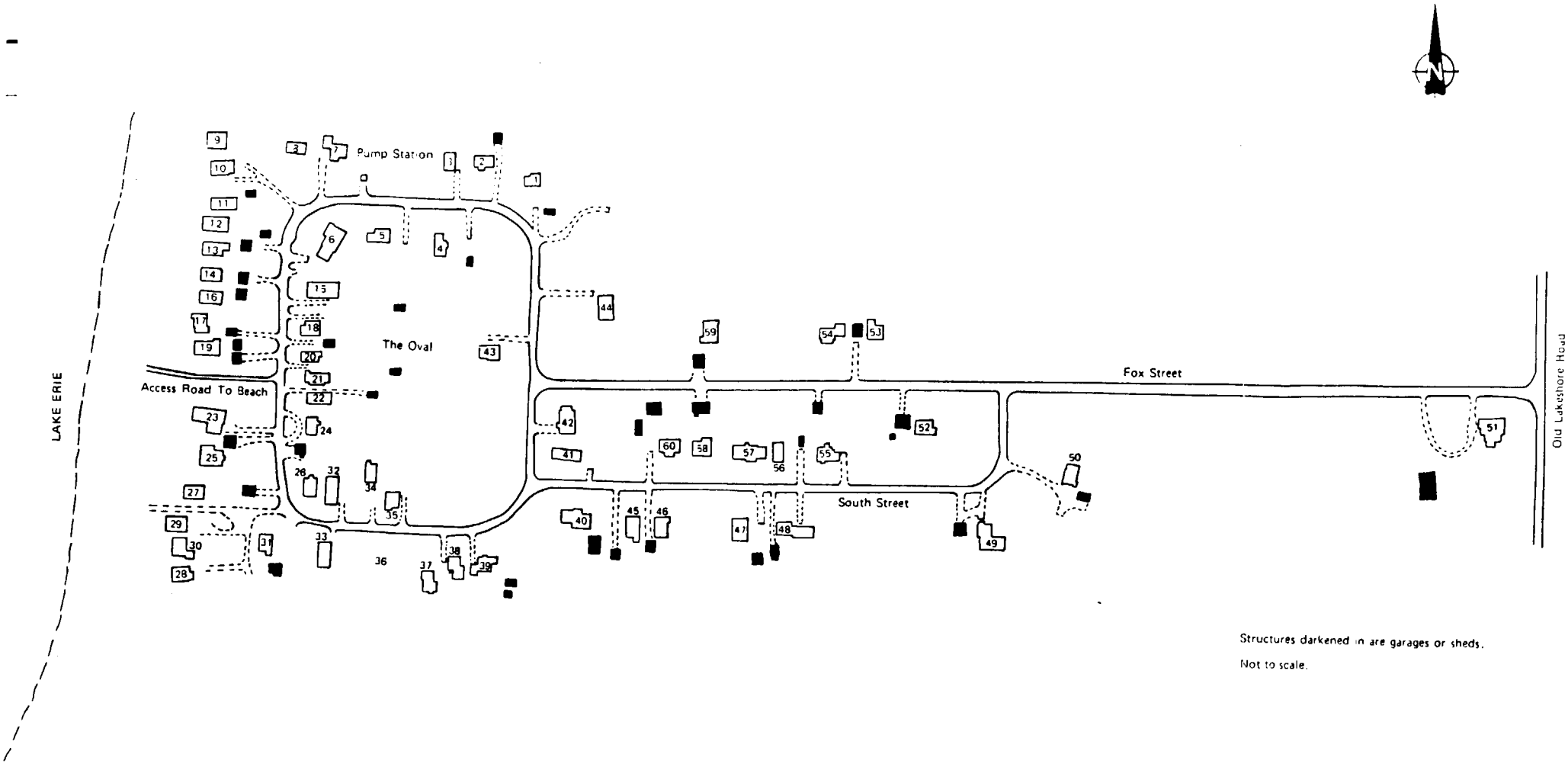


Figure 3-9. Station numbers assigned to residences of Wide Beach, New York.

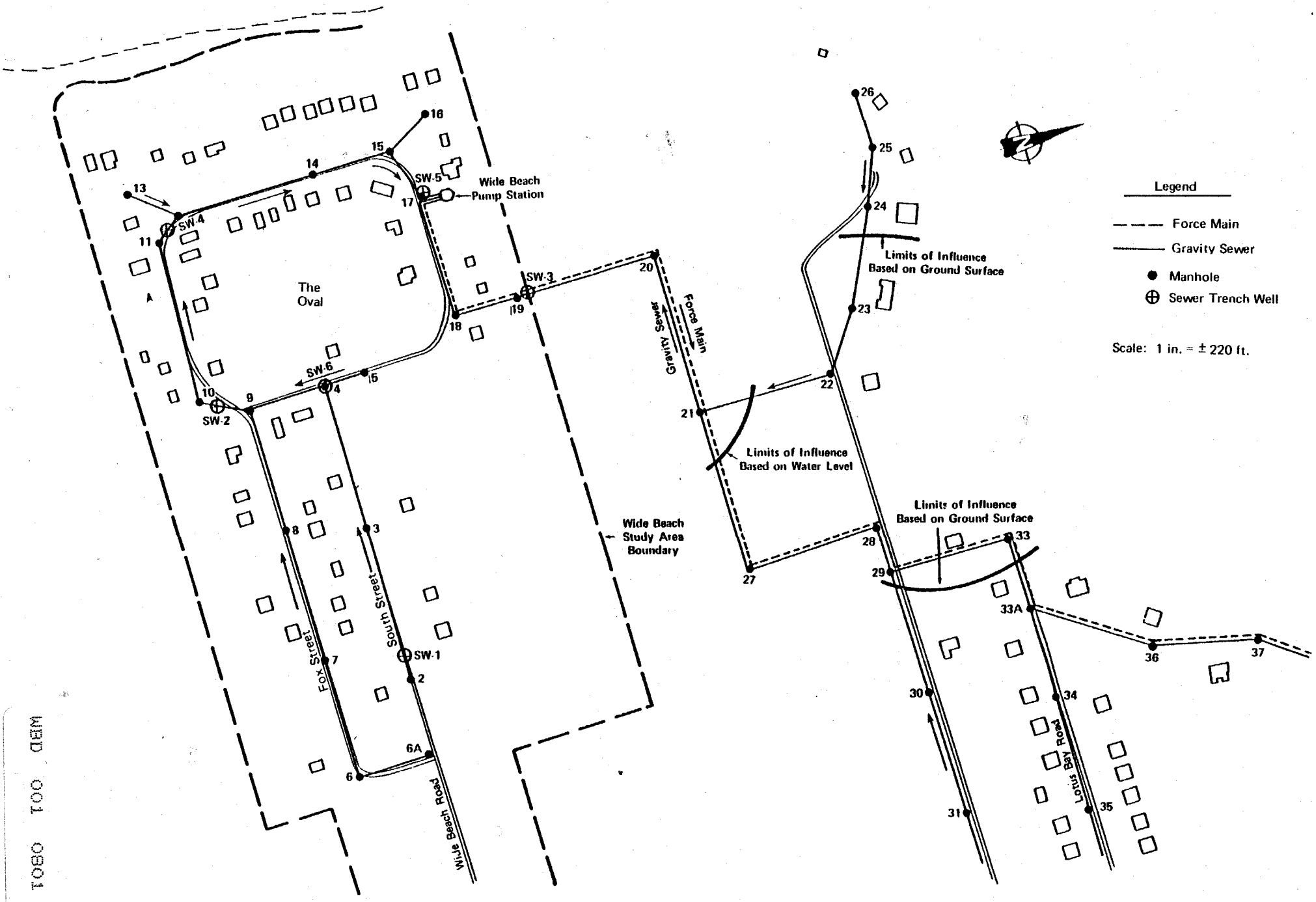


Figure 3-10. Sewer-line locations in the vicinity of Wide Beach (arrows indicate direction of flow).

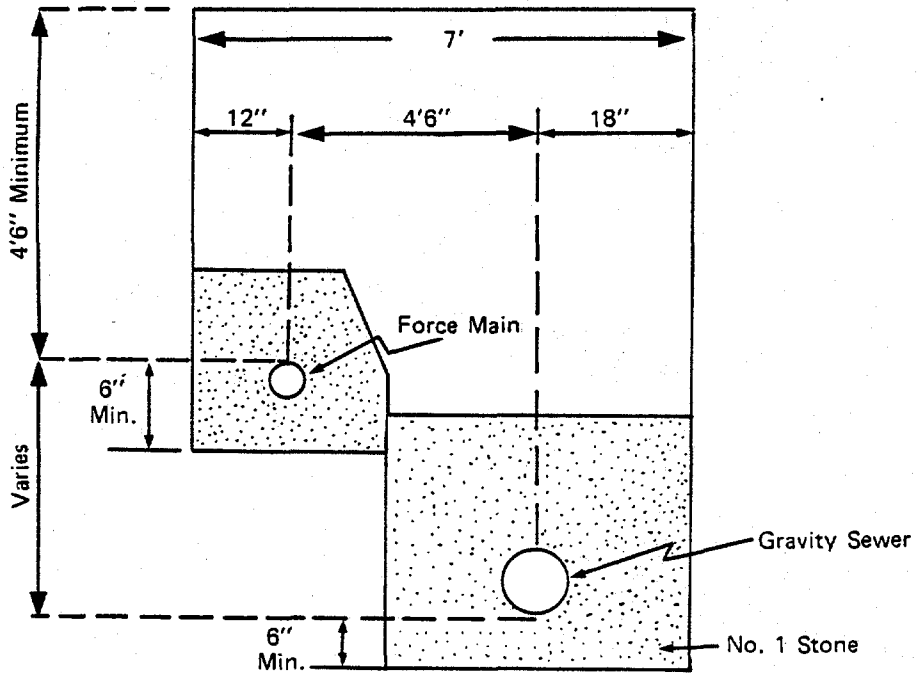


Figure 3-11. Sewer trench construction detail.

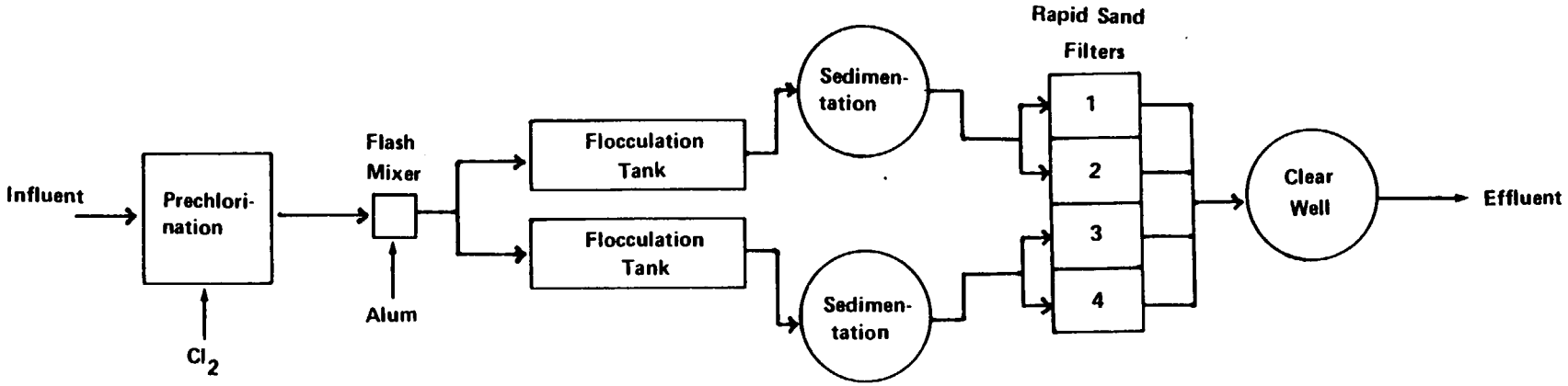


Figure 3-12. Angola Water Treatment Plant flow diagram.

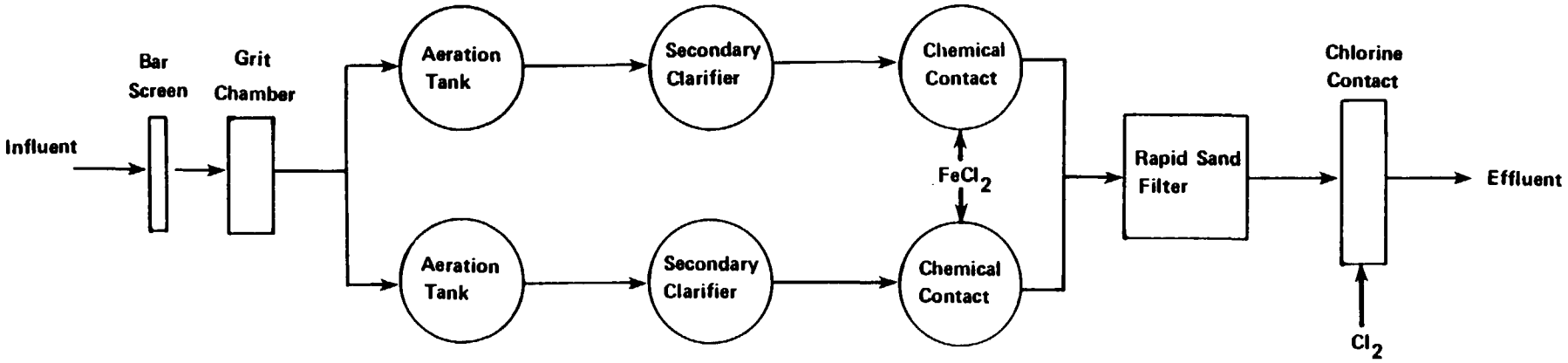


Figure 3-13. Big Sister Sewage Treatment Plant flow diagram.

4. DEFINITION OF CONTAMINATION

Results of water, soil, dust, and air sampling and analysis conducted at Wide Beach and the surrounding area are summarized in this section. Included are data from all previous sampling efforts conducted by Erie County Department of Environment and Planning (ECDEP) and the EPA Region II Field Investigation Team (FIT) contractor, NUS Corporation. Detailed descriptions of field methods used for sample collection are reported in Appendix A.

4.1 WATER SAMPLING AND ANALYSIS

4.1.1 Drinking Water

EA sampled and analyzed 48 residential drinking water supplies in Wide Beach. Access could not be obtained to the 11 houses, and therefore water samples were not collected at these locations. Background drinking water samples were collected from four Lotus Bay residences and from three Snyder Beach (formerly Millers Beach) residences. One potable water sample was obtained from the fire hall in Farnham, New York.

Seventy-three percent of the water samples were collected from the kitchen tap. The remainder were sampled in washrooms, basements, outdoors, or at the pressure tank. Prior to taking a sample, aerators were removed from the tap, if present, and the water was allowed to run at full flow for approximately 15 minutes. Water was sampled prior to passing through water filters or softening devices.

All water samples were analyzed for PCB Aroclors 1016, 1221, 1232, 1242, 1248, and 1254 concentrations. The only PCB detected in drinking water samples was Aroclor 1254. Table 4-1 summarizes results of determinations for PCB Aroclor 1254 in drinking water samples collected from the Wide Beach Development. Aroclor 1254 was detected in only six domestic wells. Concentrations ranged from 0.06 to 0.16 ug/L (mean $\pm$ standard deviation = 0.088 ± 0.042 ug/L). Analysis of water samples collected from the Farnham fire hall and from residences of Snyder Beach and Lotus Bay showed no detectable levels of Aroclor 1254 (Table 4-2), although trihalomethanes were found in the Farnham fire hall sample.

Drinking water samples were also analyzed for metals including antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc. Table 4-3 is a summary of results of metals determinations for drinking water samples collected from Wide Beach Development, Lotus Bay, Synder Beach, and the Farnham fire hall. Table 4-4 is a summary of the mean, maximum, and minimum values for all metals analysis conducted on samples collected onsite and offsite, as well as the standard deviations.

Domestic well water supplies in Wide Beach were previously sampled on three different occasions. Table 4-5 is a summary of the results of PCB Aroclor 1254 determinations for all sampling efforts conducted to date. Of a total of 244 determinations, Aroclor 1254 was detected in 34 samples. The mean positive result was 0.44 ug/L.

Table 4-6 is a summary of metals determinations for residential water samples collected by EPA Region II FIT, 7 April 1983. These same water samples were also analyzed for TCDD and TCDF, which were not detected in any of the samples.

Priority pollutant determinations were performed on the potable water sample obtained from the Farnham fire hall. The only volatile organics detected were chloroform, bromodichloromethane, and chlorodibromomethane at 24, 8, and 3 ug/L, respectively. These compounds are most likely present as byproducts of chlorination. No base-neutral compounds were detected. The only phenolic compound detected was phenol at 2.5 mg/L, which is 0.2 mg/L greater than the field blank concentration. Refer to Appendix D for detection limits and chromatograms.

4.1.2 Surface Water

EA collected surface-water samples during a storm event on 30 August 1984 at three locations (Plate 1): (1) at Outfall 1, located at the southeast end of the oval, (2) at Catch Basin 1, and (3) at a station located just inside the mouth of the wetland outlet to Lake Erie (Marsh 1) to the south of the site. Samples were collected beginning at the first sighting of water flow and at every hour thereafter until water flow ceased.

Results for total and dissolved PCB Aroclor 1254 determinations are summarized in Table 4-7. Six samples were collected from Outfall 1, and four samples each at the marsh and Catch Basin 1. Concentrations of dissolved Aroclor 1254 ranged from nondetectable to 1.50 ug/L (mean $\pm$ standard deviation of 0.76 ± 0.50 ug/L). Total Aroclor 1254 concentrations ranged from 0.28 to 93 ug/L (12.4 ± 23.7 ug/L).

4.1.3 Ground Water

EA collected aqueous samples from all eight monitoring wells using Teflon bailers (Plate 1). Determinations for PCBs, pesticides, priority pollutants, and metals were conducted. Table 4-8 is a summary of PCB and pesticide determinations. No pesticides were detected in any monitoring well aqueous samples. PCBs were only detected in one monitoring well (MW-3). Aroclor 1254 was detected in MW-3 at 0.2 ug/L.

Results of priority-pollutant determinations showed no detectable levels of base/neutrals or phenolic compounds present in any monitoring well samples. Two volatile organic compounds were detected in MW-3; methyl isobutyl ketone and acetone were present at 8 and 43 ug/L, respectively. No volatile organics were detected in the other monitoring wells.

Table 4-9 is a summary of metals determinations conducted on monitoring well aqueous samples. Concentrations of cyanide, mercury, selenium, and thallium were all below detection levels. Table 4-10 is a summary of the maximum, minimum, and mean concentrations for metals detected in aqueous samples.

Aqueous samples were also collected from the six sewer trench wells and determinations for PCBs conducted. Table 4-11 is a summary of results for PCB determinations. Aroclor 1254 was the only PCB detected. Concentrations ranged from 1.4 to 5.7 ug/L (mean ± standard deviation = 3.0±1.7 ug/L).

Water levels in monitoring and observation wells were recorded 28 September, 26 November, and 27 December 1984. Table 4-12 is a summary of the water level readings for all wells.

4.2 DUST AND AIR

4.2.1 Vacuum Cleaners

ECDEP first collected residential dust samples in 1982. Samples were collected from vacuum cleaners of three residences in Wide Beach Development and analyzed for PCBs. The results of this sampling effort are presented in Table 4-13. The highest value reported was 41.0 mg/kg, found at the Gillig residence (Station 20). Residential dust samples were again collected by EA from the Wide Beach community during August 1984. During this sampling effort, 47 of the 59 residences were sampled. The results of this investigation are reported in Table 4-14. Sample concentrations ranged from 0.25 to 770 mg/kg (mean ± standard deviation = 38.1±128 mg/kg).

4.2.2 Air Particulate Levels

An air quality investigation in the Wide Beach area was initiated by EA on 31 August 1984. Five high volume (hi-vol) samplers were setup at the locations shown in Plate 1. These locations were chosen because dust samples collected would be representative of the general Wide Beach area. The hi-vols operated 24 hours a day for a period of 2 weeks. The results are reported in Table 4-15, which lists total suspended particulate (TSP) levels. The maximum concentration was 0.453 mg/m^3 and the minimum value was 0.043 mg/m^3 (mean ± standard deviation = 0.116±0.055 mg/m^3).

Prior to this investigation, ECDEP conducted a similar sampling effort for TSP and PCB in March 1982. One hi-vol was set up at the Erie County Sewer District No. 2 pump station, located generally downwind of the Wide Beach area. The other hi-vol was located at the Erie County Big Sister Creek Sewage Treatment plant in Angola. These hi-vols operated for 24 hours every sixth day through the end of October. Results of the ECDEP sampling for TSP (Table 4-16) showed a maximum concentration of 0.160 mg/m^3 and a minimum concentration of 0.018 mg/m^3 (mean ± standard deviation = 0.046±0.032 mg/m^3). The results of the two sampling efforts are not directly comparable due to placement of samplers. The EA sampler was placed at about 4 ft above the ground, while the ECDEP sampler was placed on the pumphouse rooftop at about 10 ft above the ground. A higher concentration TSP would then be expected at the EA sampler.

4.2.3 Meteorologic Station

EA constructed a meteorologic station in the Wide Beach community and ran it for a period of 32 days. Meteorological data were obtained for the

Wide Beach area, including wind speed and direction, total rainfall, and temperature. These results can be seen in Table 4-17.

Although the station operated for 32 days, measurements were only taken for a 2-week period. A total of 314 measurements were taken during this time period (individual measurements for each direction are shown on the table). Wind velocities are listed in both miles per hour (mph) and meters per second (m/sec). Also, the number of measurements taken for a particular direction was compared to the total number of measurements taken for the 2-week period. This resulted in the percentage of time the wind was coming from a certain direction. Upon reviewing the data, it appears that, generally, the wind is coming from a southerly (SE-S-SW) direction (approximately 74 percent of the time).

4.2.4 Atmospheric PCB Levels

ECDEP conducted an air sampling program for PCBs at Wide Beach from March through October 1982. Samples were obtained from the Erie County Sewer District No. 2 Pump Station at Wide Beach (Plate 1) and from nearby Angola, which served as a control. The complete results are presented in Table 4-18. Aerosol PCBs were detected in 9 of 20 samples at Wide Beach with a mean $\pm$ standard deviation concentration of 0.0205 ± 0.0272 ug/m^3. No aerosol PCBs were detected at the Angola control. Volatile PCBs were detected at Wide Beach in four of four samples with a mean $\pm$ standard deviation level at 0.0051 ± 0.0015 ug/m^3.

4.3 SOILS

Results of sampling and analysis conducted at Wide Beach and vicinity on surficial and deep soils, roadways, marsh sediments, and driveways and yards of residences are presented here. Included are results of all previous sampling efforts conducted by ECDEP and EPA Region II FIT.

4.3.1 Summary of Other Sampling Efforts--Roadways and Ditches

ECDEP conducted soil sampling of drainage ditches in Wide Beach Development in 1981 and 1982. Drainage ditches run parallel to the roadways and are approximately 1 ft off to the side of the road. Eighteen onsite locations were sampled and one offsite sample was obtained. Table 4-19 is a summary of results of PCB determinations conducted on surficial and deep soils samples. PCB concentrations for onsite surficial soil samples ranged from 0.3 to 1,026 mg/kg (159.1 ± 247.4 mg/kg) and deep soil PCB concentrations ranged from 0.2 to 340 mg/kg (66.6 ± 97.4 mg/kg for 16 samples). The offsite sample showed very low levels of PCBs for both surficial and deep soil at 0.04 and 0.05 mg/kg, respectively.

Sampling of roadways in Wide Beach was conducted by ECDEP in May 1982 and EPA Region II FIT in April 1983. Tables 4-20 and 4-21 summarize results of PCB determinations conducted on roadway soil samples collected in 1982 and 1983, respectively. For the 1982 sampling, surficial PCB concentrations ranged from 2.37 to 258 mg/kg (71.4 ± 70.1 mg/kg for 12 samples); for the 1983 sampling, concentrations ranged from 1.63 to 226 mg/kg

(30.7±39.1 mg/kg for 71 samples). Figure 4-1 shows locations of roadway samples collected by EPA Region II FIT in 1983. The overall mean PCB concentration in surficial roadway soil was 36.6±47.2 mg/kg.

4.3.2 Yards

EA collected soil samples from all yards of residences in Wide Beach for PCB analysis. Samples were taken to a depth of 4 in. using a stainless steel hand-driven corer. Each yard sample consisted of three subsamples taken at a distance of 5, 15, and 25 ft from the road or from a drainage ditch, if present. Subsamples were composited in the field.

Table 4-22 is a summary of results of PCB determinations for yard soil samples. Fifty-nine composite yard samples were collected in addition to two composite soil samples (Stations 36A and 36B) obtained from the open lot adjacent to Station 37. The only PCB detected in yard samples was Aroclor 1254. Concentrations ranged from 0.05 to 600 mg/kg (29.9±82.9 mg/kg). The percentage of samples with a concentration less than 1, 50, and 100 mg Aroclor 1254 per kg soil is 4.9, 88.5, and 95.1 percent, respectively.

ECDEP had conducted sampling and analysis of soil samples collected from yards in Wide Beach in May 1982. Table 4-23 summarizes PCB determinations conducted on surficial and deep soil samples at 27 locations. Surficial sample concentrations ranged from <0.05 to 110.6 mg/kg (16.2±25.9 mg/kg for 26 samples) and deep sample concentrations ranged from <0.05 to 32.5 mg/kg (4.8±7.5 mg/kg for 20 samples).

Soil samples collected by EA from three yards (Stations 4, 30, and 49) were analyzed for total organic carbon content (TOC) and particle-size distribution. Tables 4-24 and 4-25 summarize TOC and particle-size results, respectively.

4.3.3 Driveways

EA collected soil samples from 53 Wide Beach residential driveways. Samples were not obtained at the other six residences because the driveways were paved. Each driveway sample consisted of a composite of six subsamples. Soil was collected to a depth of 4 in. using either a hand-auger or chrome-plated steel trowel and composited in the field.

Table 4-26 summarizes results of PCB determinations for driveway samples. Aroclor 1254 was the only PCB detected. All driveway soils contained detectable levels of Aroclor 1254 with the exception of Station 23. Concentrations ranged from 0.18 to 390 mg/kg (66.7±94.6 mg/kg). The percentage of samples having a concentration of Aroclor 1254 less than 1, 50, and 100 mg/kg is 3.8, 56.6, and 79.2 percent, respectively.

4.3.4 Open Lots

Core samples were taken by EA at four open lots at Wide Beach. Plate 1 shows the location of each lot. Open lots are areas where excavated sewer trench material had been used as fill. These include two lots where new homes have been built (Open Lots 3 and 4). The depth of fill

at each lot is unknown; however, Open Lot 4 was thought to contain the greatest fill depth. The depth of core sampling was selected based on an estimate of fill depth. Open Lots 1 and 2 were sampled down to 2 ft, Open Lot 3 to 1 ft, and Open Lot 4 to 4 ft. In each lot, five subsamples were composited in the field for each 1-ft depth interval.

Results of PCB determinations of open lot soil cores are summarized in Table 4-27. As indicated in the table, the only PCB detected was Aroclor 1254. Open Lot 4 showed the greatest concentration of PCBs (98 mg/kg) compared to the other lots. PCB levels decreased with increasing depth at Open Lot 4.

Open Lot 1 also showed high PCB levels (average of 33.5 mg/kg) with little difference in concentrations between the 1-ft and 2-ft depths. In Open Lot 2, PCB concentrations were higher in the second foot of soil than in the top foot (average of 7.3 mg/kg).

ECDEP obtained a surficial soil sample from the grove (Open Lot 2) on 1 October 1981. The sample location was in an area suspected to have contained fill material from the sewer trench. The concentration of PCB in this sample was 5.4 mg/kg.

4.3.5 Surficial Soils

EA collected surficial soil samples (0-6 in.) from all well sites (observation, monitoring, sewer trench) and boring sites, and determinations for PCBs conducted. Locations of wells and borings are shown in Plate 1. Soils were collected within approximately 2-3 ft of well and boring locations using a chrome-plated steel hand trowel.

Table 4-27 summarizes results of PCB determinations in surficial soils collected from well sites. Aroclor 1254 was the only PCB detected. Concentrations ranged from 0.03 to 670 mg/kg (61.3 ± 123.8 mg/kg for 33 samples).

Determinations for priority pollutants, pesticides, and metals were conducted on five surficial soil samples (Outfall 2, Boring 5, Boring 6, MW-5, and MW-6). Table 4-28 is a summary of volatile organic compounds detected in surficial soils. Methylene chloride was the compound most frequently detected and is probably due to laboratory contamination. The only other volatile organic detected in a surficial sample (Outfall 2) was tetrachloroethene at 27 mg/kg.

Table 4-29 is a summary of base-neutral compounds detected in surficial soils. Six compounds were detected in Boring 5 surficial soil, two compounds in Boring 6, and one compound in MW-6 surface soil. No phenolic compounds were detected in any surficial soil samples. Refer to Volume III Appendix D for chromatograms of priority pollutant analyses.

Table 4-30 is a summary of pesticide determinations in surficial soils, including the detection limits. No pesticides were detected in any surficial soils. Metal, phenol, and cyanide determinations for surficial soils are reported in Table 4-31.

4.3.6 Deep Soils

EA-obtained soils from split spoons for analysis--taken at two monitoring wells (MW-5 and MW-6) and at all six soil borings--were sampled and analyzed for PCB determinations. The location of monitoring wells and soil borings are shown on Plate 1. Split-spoon samples consisted of 0.5-ft soil sections collected at depths ranging from 8.0 to 11.0 ft below ground surface.

Table 4-27 summarizes results of PCB determinations of soil borings. No PCBs were detected in monitoring well deep soils. Only Aroclor 1254 was detected in soil borings. Concentrations ranged from 0.005 to 0.21 mg/kg (0.056±0.073 mg/kg for 10 samples).

Determinations for priority pollutants, pesticides, and metals were conducted on deep soils collected from 12 locations. Table 4-28 includes a summary of volatile organic compounds detected in deep soils. Similar to surficial soil results, the most frequently detected compound was methylene chloride, which is probably present due to laboratory contamination. Also detected were acetone and fluorotrichloromethane.

Results of base-neutral compounds detected in deep soils are presented in Table 4-29. Only two compounds were detected: di-n-butylphthalate and chrysene. Table 4-31 includes a summary of metal, phenol, and cyanide determinations for deep soil samples.

4.3.7 Catch Basins and Surficial Outfalls

EA collected surficial soil samples from five catch basins and two stormwater outfalls, as shown in Plate 1, for PCB determinations. Soils were obtained using a chrome-plated steel hand trowel. Table 4-27 includes a summary of PCB Aroclor 1254 results for soil samples collected at catch basins and surficial outfalls. No other PCB Aroclors were detected. Aroclor 1254 concentrations ranged from 64 to 5,300 mg/kg (912±1,937 mg/kg).

Grain size determinations were conducted on soil samples collected at catch basins and outfalls. Table 4-32 is a summary of results for percent sand, silt, and clay in soils. The mean values for percent sand, silt, and clay are 39.3±16.1, 40.3±15.1, and 20.4±6.8, respectively.

4.3.8 Wetland Sediments

In May 1982, ECDEP collected sediment samples from the intermittent stream that runs through the wetland to Lake Erie. Table 4-33 is a summary of PCB determinations conducted on five sediment samples and on one sand sample collected from the beach. PCB concentrations in five surficial sediments ranged from <0.05 to 155.8 mg/kg (48.2±73.5 mg/kg). Concentrations for the two deep sediment samples were 3.5 and 4.4 mg/kg. The beach sand showed <0.05 mg/kg PCB for both surficial and deep samples.

EA obtained sediment cores at 13 stations throughout the wetland. Samples were collected with a stainless steel corer with cellulose acetate butyrate (CAB) liners. A total of 13 cores were collected, sectioned, and analyzed for PCBs. Sampling locations are shown on Plate 1.

Results of PCB Aroclor 1254 determinations are summarized in Table 4-34. Aroclor 1254 concentrations ranged from nondetectable to 126 mg/kg (13.4±43.2 mg/kg). Generally, PCB levels were higher in the top sections of sediment cores. The only significant concentrations were found in the immediate vicinity of the outfalls (≤40 ft from both storm drain outfalls) at Stations 6 and 11, with 70 and 200 mg Aroclor 1254 per kg soil, respectively, in the top sections (0-7 in.) of the cores.

Determinations for percent sand, silt, and clay were also conducted on all sediment samples. Table 4-35 is a summary of the grain size determinations.

4.3.9 Biota

EA conducted the live-trapping of small mammals at three locations on the study site (Plate 1) and at two offsite locations (at Evangola State Park) to collect liver tissue for PCB determinations. The number of mammals collected varied with each trap location. Mammals were identified in the field and dissected in a field laboratory.

Table 4-36 is a summary of PCB Aroclor 1254 concentrations in mammal liver tissue and percent lipids. PCB values were normalized for percent lipids. Normalized PCB values ranged from 6.7 to 69.6 mg/kg (28.5±35.6 mg/kg) for onsite samples. The two control sample concentrations were not detectable and 0.1 mg/kg.

TABLE 4-1 RESULTS OF PCB DETERMINATIONS ON RESIDENTIAL WATER SAMPLES COLLECTED AT WIDE BEACH, NEW YORK

Name of Resident	Station No.	Sample Type	Collection Date	Aroclor 1254 (ug/l)	EA No.
Helmich	1	Water	22 AUG 84	ND	5822
Morgante	2	Water	25 AUG 84	ND	5893
Kalenda	3	Water		NS	
Horth	4	Water	27 AUG 84	ND	5901
Franz	5	Water	24 AUG 84	ND	5867
Militello(a)	6	Water	22 AUG 84	0.06	5812
Militello	6	Water	22 AUG 84	ND	5814
Miller	7	Water		NS	
Allen	8	Water	24 AUG 84	ND	5873
Barton	9	Water		NS	
Plewak	10	Water	25 AUG 84	ND	5809
Hickey	11	Water	22 AUG 84	0.16	5811
Schultz(b)	12	Water	22 AUG 84	0.07	5828
Holmes	13	Water		NS	
Major	14	Water	24 AUG 84	ND	5875
Militello	15	Water	22 AUG 84	ND	5824
Taylor	16	Water		NS	
Perhach	17	Water	28 AUG 84	ND	5988
Grey	18	Water	22 AUG 84	ND	5826
Mason	19	Water	22 AUG 84	ND	5820
Gillig	20	Water	22 AUG 84	ND	5801
Hockman(c)	21	Water	22 AUG 84	ND	5807
Winnert	22	Water		NS	
Aurelio(a)	23	Water	23 AUG 84	ND	5836
Shanahan	24	Water	22 AUG 84	ND	5803
Lundberg	25	Water	22 AUG 84	ND	5805
Murphy	26	Water	23 AUG 84	ND	5840
Oehler	27	Water	23 AUG 84	ND	5838
Prince	28	Water	23 AUG 84	ND	5844
Ball	29	Water		NS	
Miller(c)	30	Water	24 AUG 84	ND	5874
Lojacono	31	Water	23 AUG 84	ND	5842
Gajewski	32	Water	24 AUG 84	0.06	5876
Murphy	33	Water	24 AUG 84	ND	5872
Murphy	34	Water	4 SEP 84	ND	6059
Plewak	35	Water	24 AUG 84	ND	5877

(a) Sampled at basement tap.
(b) Sampled at washroom tap.
(c) Sampled at outside tap.
(d) Sampled at pressure tank.

NA = Not applicable.
ND = Not detected.
NS = Not sampled.
Note: All samples not footnoted were collected at the kitchen tap.

TABLE 4-1 (Cont.)

Name of Resident	Station No.	Sample Type	Collection Date	Aroclor 1254 (ug/l)	EA No.
Pronobis(c)	37	Water	24 AUG 84	ND	5869
Guerra	38	Water	27 AUG 84	ND	5900
Meyer	39	Water	23 AUG 84	ND	5845
Rusch(c)	40	Water	23 AUG 84	ND	5856
Hellman	41	Water	23 AUG 84	ND	5854
Grabenstatter(d)	42	Water	23 AUG 84	ND	5848
Franz	43	Water		NS	
Roe	44	Water	23 AUG 84	ND	5852
Mueller(c)	45	Water	23 AUG 84	ND	5859
Bauer	46	Water	24 AUG 84	ND	5866
Rogers	47	Water	23 AUG 84	ND	5830
Burke	48	Water	25 AUG 84	0.06	5871
Speck	49	Water	23 AUG 84	0.12	5834
Hansen	50	Water	23 AUG 84	ND	5832
Lyford	51	Water	25 AUG 84	ND	5870
Murphy	52	Water	25 AUG 84	ND	5891
Newman	53	Water	25 AUG 84	ND	5894
Nosbisch	54	Water		NS	
Zender	55	Water	25 AUG 84	ND	5892
Persichini	56	Water		NS	
Militello(d)	57	Water	25 AUG 84	ND	5890
Egner	58	Water		NS	
Canteline(d)	59	Water	23 AUG 84	ND	5850
Bowen(c)	60	Water	24 AUG 84	ND	5868
Field Blank	NA	Water	NA	ND	5863
Field Blank	NA	Water	NA	ND	6060

TABLE 4-2 SUMMARY OF RESULTS OF PCB DETERMINATIONS FOR RESIDENTIAL WATER SAMPLES COLLECTED OFFSITE, TOWN OF BRANT, ERIE COUNTY, NEW YORK, AUGUST 1984

Station	Location	Source	Sample Type	Collection Date	Aroclor 1254 (ug/l)	EA No.
35 Lotus Bay Road	Lotus Bay	Kitchen	Water	22 AUG 84	ND	5815
33 Lotus Bay Road	Lotus Bay	Basement	Water	22 AUG 84	ND	5816
84 Lotus Bay Road	Lotus Bay	Kitchen	Water	23 AUG 84	ND	5862
10750 Old Lakeshore	Lotus Bay	Kitchen	Water	23 AUG 84	ND	5861
25A Cottage	Snyder Beach	Kitchen	Water	22 AUG 84	ND	5817
18 Gravel Road	Snyder Beach	Outside	Water	22 AUG 84	ND	5818
21 Gravel Road	Snyder Beach	Outside	Water	22 AUG 84	ND	5819
Fire Hall	Farnham	Outside	Water	23 AUG 84	ND	5864

TABLE 4-3 SUMMARY OF METAL CONCENTRATIONS DETERMINED IN AQUEOUS SAMPLES COLLECTED FROM RESIDENCES OF THE TOWN OF BRANT, ERIE COUNTY, NEW YORK

Station	Location	Source	Collection Date	Sample Type	Antimony (ug/L)	Arsenic (ug/L)	Beryllium (ug/L)	Cadmium (ug/L)	Chromium (ug/L)	Copper (ug/L)	Lead (ug/L)	Mercury (ug/L)	Nickel (ug/L)	Selenium (ug/L)	Silver (ug/L)	Thallium (ug/L)	Zinc (ug/L)	EA No.
86 Oval	Gillig	Kitchen tap	22 AUG 84	Water	3	<2	<0.5	1.0	3	48	7	<0.25	36	<2	0.2	<1	0.61	5801
96 Oval	Shanahan	Kitchen tap	22 AUG 84	Water	3	<2	<0.5	0.2	2	28	3	<0.25	25	<2	<0.1	<1	0.04	5803
101 Oval	Lundberg	Kitchen tap	22 AUG 84	Water	3	<2	<0.5	0.4	2	10	2	<0.25	32	<2	<0.1	<1	0.06	5805
70 Oval	Hookman	Outside tap	22 AUG 84	Water	3	<2	<0.5	0.3	2	12	3	<0.25	31	<2	<0.1	<1	0.59	5807
63 Oval	Plewak	Kitchen tap	25 AUG 84	Water	3	<2	<0.5	0.4	1	11	5	<0.25	26	<2	0.2	<1	0.88	5809
65 Oval	Hickey	Kitchen tap	22 AUG 84	Water	2	<2	<0.5	0.4	2	7	3	<0.25	33	<2	0.2	<1	0.40	5811
60 Oval	Militello	Basement tap	22 AUG 84	Water	3	<2	<0.5	0.8	3	180	27	<0.25	41	<2	0.2	<1	2.8	5812
60 Oval	Militello Beach Well	Kitchen tap	22 AUG 84	Water	3	<2	<0.5	0.6	1	34	3	<0.25	17	<2	0.3	<1	0.40	5814
35 Lotus Bay Rd	Lotus Bay	Kitchen tap	22 AUG 84	Water	3	<2	<0.5	0.3	<1	4	1	<0.25	19	<2	0.2	<1	0.07	5815
35 Lotus Bay Rd	Lotus Bay	Basement tap	22 AUG 84	Water	4	<2	<0.5	0.3	<1	8	1	<0.25	22	<2	<0.1	<1	0.04	5816
25A Cottage	Snyder Beach	Kitchen tap	22 AUG 84	Water	4	<2	<0.5	0.2	<1	12	1	<0.25	10	2	<0.1	<1	0.15	5817
18 Gravel Rd	Snyder Beach	Outside tap	22 AUG 84	Water	4	<2	<0.5	0.7	<1	180	3	<0.25	28	<2	<0.1	<1	0.19	5818
21 Gravel Rd	Snyder Beach	Outside tap	22 AUG 84	Water	4	<2	<0.5	1.0	2	44	6	<0.25	22	2	0.3	<1	0.85	5819
85 Oval	Mason	Kitchen tap	22 AUG 84	Water	4	2	<0.5	0.2	<1	9	3	<0.25	28	3	0.2	<1	0.06	5820
21 Oval	Helmich	Kitchen tap	22 AUG 84	Water	4	<2	<0.5	0.3	3	12	2	<0.25	55	2	0.2	5	0.53	5822
76 Oval	Militello	Kitchen tap	22 AUG 84	Water	4	2	<0.5	0.2	<1	25	<1	<0.25	10	<2	0.2	<1	0.09	5824
82 Oval	Grey	Kitchen tap	22 AUG 84	Water	4	3	<0.5	0.3	<1	12	1	<0.25	27	<2	<0.1	<1	0.05	5826
67 Oval	Schultz	Washroom tap	22 AUG 84	Water	4	<2	<0.5	0.3	2	10	6	<0.25	26	2	<0.1	<1	0.10	5828
17 South	Rogers	Kitchen tap	23 AUG 84	Water	<2	<2	<0.5	<0.1	2	14	2	<0.25	48	<2	<0.1	<1	0.14	5830
43 South	Hansen	Kitchen tap	23 AUG 84	Water	2	<2	<0.5	0.3	1	31	3	<0.25	40	<2	<0.1	<1	0.17	5832
39 South	Spook	Kitchen tap	23 AUG 84	Water	<2	2	<0.5	<0.1	<1	11	<1	<0.25	32	<2	0.2	<1	0.02	5834
95 Oval	Auralio/Mach	Basement tap	23 AUG 84	Water	2	3	<0.5	0.2	2	48	12	<0.25	8	3	0.2	<1	0.26	5836
107 Oval	Oehler	Kitchen tap	23 AUG 84	Water	<2	2	<0.5	0.3	2	43	2	<0.25	32	<2	0.3	<1	0.29	5838
108 Oval	Murphy	Kitchen tap	23 AUG 84	Water	<2	3	<0.5	<0.1	2	8	2	<0.25	27	<2	0.2	<1	0.08	5840
109 Oval	Lojacomo	Kitchen tap	23 AUG 84	Water	3	<2	<0.5	<0.1	2	10	2	<0.25	29	<2	0.3	<1	0.02	5842
125 Oval	Prince	Kitchen tap	23 AUG 84	Water	<2	<2	<0.5	<0.1	1	19	2	<0.25	44	<2	0.3	1	0.05	5844
141 Oval	Meyers	Kitchen tap	23 AUG 84	Water	3	<2	<0.5	<0.1	2	14	2	<0.25	43	<2	<0.1	<1	0.08	5845
1 Oval	Grabenstatter	Tank	23 AUG 84	Water	3	<2	<0.5	<0.1	2	290	44	<0.25	48	<2	0.2	1	0.13	5848
18 Fox	Centoline	Tank	23 AUG 84	Water	<2	3	<0.5	0.7	2	69	4	<0.25	36	<2	0.2	<1	0.24	5850
11 Oval	Roe	Kitchen tap	23 AUG 84	Water	2	<2	<0.5	0.3	3	11	3	<0.25	50	<2	0.3	<1	0.02	5852
2 South	Hellman	Kitchen tap	23 AUG 84	Water	2	<2	<0.5	0.1	2	13	2	<0.25	43	<2	0.2	<1	0.19	5854
3 South	Busch	Outside tap	23 AUG 84	Water	2	3	<0.5	<0.1	2	200	12	<0.25	50	<2	0.6	1	0.05	5856
7 South	Mueller	Outside tap	23 AUG 84	Water	3	2	<0.5	0.2	2	300	16	<0.25	32	<2	<0.1	<1	0.16	5859
84 Lotus Bay Rd	Lotus Bay	Kitchen tap	23 AUG 84	Water	2	2	<0.5	0.2	<1	3	<1	<0.25	15	<2	<0.1	<1	0.04	5862
10750 Old Lakeshore	Lotus Bay	Kitchen tap	23 AUG 84	Water	3	<2	<0.5	0.4	<1	50	14	<0.25	27	<2	<0.1	<1	1.4	5861
Field blank	N/A	N/A	N/A	Deionized water	2	<2	<0.5	0.2	<1	61	2	<0.25	<1	<2	<0.1	<1	0.04	5863
Farnham	Fire Hall	Kitchen tap	23 AUG 84	Water	3	<2	<0.5	0.2	<1	15	2	<0.25	7	<2	<0.1	<1	0.01	5864
Field blank	N/A	N/A	N/A	Deionized water	2	<2	<0.5	0.3	<1	25	2	<0.25	3	<2	<0.1	<1	0.01	5865

TABLE 4-3 (Cont.)

Station	Location	Source	Collection Date	Sample Type	Antimony (ug/L)	Arsenic (ug/L)	Beryllium (ug/L)	Cadmium (ug/L)	Chromium (ug/L)	Copper (ug/L)	Lead (ug/L)	Mercury (ug/L)	Nickel (ug/L)	Selenium (ug/L)	Silver (ug/L)	Thallium (ug/L)	Zinc (ug/L)	EA No.
9 South	Bauer	Kitchen tap	24 AUG 84	Water	3	<2	<0.5	0.2	<1	4	4	<0.25	8	<2	<0.1	<1	0.05	5856
48 Oval	Frank	Kitchen tap	24 AUG 84	Water	3	3	<0.5	0.9	2	23	4	<0.25	32	<2	0.2	<1	1.3	5857
9 Wide Beach	Bowen	Kitchen tap	24 AUG 84	Water	3	<2	<0.5	0.3	4	160	14	<0.25	53	<2	0.2	<1	0.10	5858
135 Oval	Pronobis	Outside tap	25 AUG 84	Water	3	<2	<0.5	0.4	2	8	14	<0.25	23	<2	<0.1	<1	1.1	5859
10870 Lakeshore Rd	Lyford	Kitchen tap	25 AUG 84	Water	<2	<2	<0.5	0.1	3	30	17	<0.25	94	<2	0.2	<1	0.04	5870
21 South	Burke	Kitchen tap	25 AUG 84	Water	<2	<2	<0.5	<0.1	3	11	2	<0.25	56	<2	0.6	<1	0.07	5871
117 Oval	Murphy	Kitchen tap	24 AUG 84	Water	<2	<2	<0.5	<0.1	2	9	2	<0.25	32	3	<0.1	<1	0.04	5884
59 Oval	Allen	Kitchen tap	24 AUG 84	Water	<2	<2	<0.5	0.2	1	9	8	<0.25	20	3	0.2	<1	0.37	5873
Oval	Miller	Outside tap	24 AUG 84	Water	<2	<2	<0.5	0.2	2	10	6	<0.25	23	<2	<0.1	<1	0.09	5874
73 Oval	Major	Kitchen tap	24 AUG 84	Water	<2	<2	<0.5	35	2	61	31	<0.25	82	<2	0.3	<1	3.5	5875
18 Oval	Gajewski	Kitchen tap	24 AUG 84	Water	<2	3	<0.5	0.8	<1	15	5	<0.25	16	<2	0.3	<1	0.91	5876
128 Oval	Plewak	Kitchen tap	24 AUG 84	Water	<2	<2	<0.5	0.1	2	9	2	<0.25	32	<2	<0.1	<1	0.14	5877
20 South	Militello	Tank	25 AUG 84	Water	<2	<2	<0.5	0.2	3	160	24	<0.25	48	<2	1.2	<1	0.30	5890
35 Oval	Murphy	Kitchen tap	25 AUG 84	Water	<2	<2	<0.5	0.3	1	35	2	<0.25	27	<2	0.2	<1	0.41	5891
26 South	Zander	Kitchen tap	25 AUG 84	Water	<2	<2	<0.5	<0.1	2	8	2	<0.25	32	3	<0.1	<1	0.02	5892
29 Oval	Morgante	Kitchen tap	25 AUG 84	Water	<2	<2	<0.5	0.2	1	7	<1	<0.25	21	<2	<0.1	<1	0.25	5893
30 Fox	Newman	Kitchen tap	25 AUG 84	Water	<2	<2	<0.5	0.3	2	11	17	<0.25	24	<2	<0.1	<1	0.10	5894
37 Oval	Guerra	Kitchen tap	27 AUG 84	Water	<2	<2	0.7	0.3	2	39	3	<0.25	34	<2	<0.1	<1	0.04	5900
38 Oval	North	Kitchen tap	27 AUG 84	Water	<2	<2	<0.5	0.1	1	22	2	<0.25	23	<2	<0.1	<1	0.26	5901
81 Oval	Perhach	Kitchen tap	29 AUG 84	Water	<2	<2	0.5	0.7	2	37	7	<0.25	26	<2	<0.1	<1	2.1	5988
124 Oval	Murphy	Kitchen tap	4 SEP 84	Water	<2	<2	0.5	0.1	3	43	2	<0.25	23	<2	0.3	<1	0.04	6059
Field blank	N/A	N/A	N/A	Deionized water	<2	<2	<0.5	<0.1	<1	1	<1	<0.25	<1	<2	0.3	<1	<0.01	6060

TABLE 4-4 SUMMARY OF MEAN, MAXIMUM, AND MINIMUM VALUES (ug/L) FOR METALS DETERMINATIONS IN RESIDENTIAL WATER SAMPLES COLLECTED AT THE WIDE BEACH STUDY SITE AND OFFSITE, AUGUST 1984

Metal	Mean Value		Maximum Value		Minimum Value		Standard Deviation		n(a)	
	Onsite	Offsite	Onsite	Offsite	Onsite	Offsite	Onsite	Offsite	Onsite	Offsite
Antimony	3	3	4	4	2	2	0.7	1	56	8
Arsenic	2.6	2	3	2	2	2	0.5	0	12	1
Beryllium(b)	0.6	--	0.7	--	0.5	--	0.1	--	3	--
Cadmium	1.3	0.4	35	1.0	0.1	0.2	5.6	0.3	38	8
Chromium	2	2	4	2	1	2	1	0	43	1
Copper	45	40	300	180	4	3	68	60	49	8
Lead	7	4	44	14	1	1	9	5	46	7
Nickel	34	19	94	28	8	7	16	8	49	8
Selenium	3	2	3	2	2	2	1	0	7	1
Silver	0.3	0.3	1.2	0.3	0.2	0.2	0.2	0.1	29	2
Thallium(b)	2	--	5	--	1	--	2	--	4	--
Zinc	400	340	3,500	1,400	20	10	690	510	49	8

(a) Number of samples with values greater than detection limit.
(b) All values for offsite samples were below detection limit.

TABLE 4-5 SUMMARY OF ALL SAMPLING EFFORTS CONDUCTED TO DETERMINE PCB CONCENTRATIONS (ug/L) IN RESIDENTIAL WELL WATER

Name of Resident	Station No.	Erie County Dept. of Environment & Planning						EPA Region II FIT Sampling		EA Engineering
		3 SEP 81	17 SEP 81	1 OCT 81	19 MAY 82	21 JUL 82	15 SEP 82	6 APR 83	8-11 NOV 83	AUG 84
Helmich	1	0.66	0.50	ND	0.06	ND	ND		ND	ND
Morgaute	2				ND	ND	ND		ND	ND
Kalenda	3				ND	--	0.12			--
Horth	4				0.06	ND	ND			ND
Franz	5				ND	ND	ND		ND	ND
Militello	6				ND	ND	0.10		Beach well:ND Drilled well:ND(a)	0.06
Miller	7				ND	ND	ND	ND	ND	--
Allen	8				0.07	ND	ND			ND
Barton	9				ND	ND	--			--
Plewak	10	0.65	ND	ND	ND	0.16	ND	0.63	ND	ND
Hickey	11				ND	0.10	0.08			0.16
Shultz	12				ND	ND	0.16			
Holmes	13								ND	--
Major	14				--	ND	ND		ND	ND
Militello	15				--	ND	--		ND	ND
Taylor	16				--	ND	ND		ND	--
Perhach	17								ND	ND
Grey	18				ND	ND	ND			ND
Mason	19				ND	ND	ND		ND(a)	ND
Gillig	20				ND	ND	ND		ND	ND
Hockman	21	4.56	0.69	ND	ND	ND	ND	0.75/ND	ND	ND
Winnert	22									--
Aurelio	23				ND	--	--		ND	ND
Shanahan	24				ND	ND	ND		ND	ND
Lundberg	25				ND	ND	ND		ND	ND

(a) No PCBs were detected in pre- or post-treated water samples.
(b) Water sample collected post-filtered.

TABLE 4-5 (Cont.)

Name of Resident	Station No.	Erie County Dept. of Environment & Planning						EPA Region II FIT Sampling		EA Engineering
		3 SEP 81	17 SEP 81	1 OCT 81	19 MAY 82	21 JUL 82	15 SEP 82	6 APR 83	8-11 NOV 83	AUG 84
Murphy	26									ND
Oehler	27				ND	0.08	ND			
Prince	28				ND	ND	ND		ND	ND
Ball	29								ND	--
Miller	30									ND
Lajacono	31	ND	ND	ND	ND	ND	ND		ND(a)	0.06
Gajewski	32				--	0.80	--		ND	ND
Murphy	33				ND	ND	ND			--
Murphy	34				ND	ND	ND		ND	ND
Plewak	35				ND	ND	ND			ND
Pronobis	37	ND	ND	ND	ND	ND	ND			ND
Guerra	38				ND	ND	--		2.0	ND
Meyer	39				ND	ND	ND			ND
Rusch	40								ND	ND
Fein	41				ND	ND	ND		ND	ND
Grabbenstatter	42				ND	0.06	ND		ND(a)	ND
Franz	43									--
Roe	44				ND	ND	ND		ND	ND
Mueller	45				0.06	ND	ND		ND(a)	ND
Bauer	46								ND	ND
Rogers	47				ND	ND	ND	ND		ND
Burke	48				ND	ND	ND		ND	0.06
Speck	49				0.1	ND	0.11		ND	0.12
Hansen	50	ND	0.20	ND	ND	0.14	ND		ND	ND
Lyford	51				ND	ND	0.06		ND	ND
Murphy	52								ND	ND
Newman	53				ND	ND	ND		ND	ND
Nosbisch	54	1.32	0.21	ND				ND	ND	--
Zender	55				ND	ND	ND		ND	ND

TABLE 4-5 (Cont.)

Name of Resident	Station No.	Erie County Dept. of Environment & Planning						EPA Region II FIT Sampling		EA Engineering
		3 SEP 81	17 SEP 81	1 OCT 81	19 MAY 82	21 JUL 82	15 SEP 82	6 APR 83	8-11 NOV 83	AUG 84
Persichini	56				ND	ND	ND			--
Militello	57				ND	ND	ND	ND(b)		ND
Egner	58									--
Canteline	59							ND(a)		ND
Bowen	60	ND	ND	ND	ND	0.05	ND	ND		ND

TABLE 4-6 SUMMARY OF RESULTS OF METALS DETERMINATIONS (ug/l) FOR RESIDENTIAL DRINKING WATER SAMPLES COLLECTED BY EPA REGION II FIT AT WIDE BEACH, NEW YORK, 7 APRIL 1983

Station Number	Resident Name	Location	Aluminum	Chromium	Barium	Copper	Iron	Manganese	Zinc	Boron	Tin	Cadmium
7	Miller	Kitchen	368	--	--	50	915	38	336	104	--	13
10	Plewak	Kitchen	--	--	--	--	874	251	2,440	128	24	--
21	Hockman	Outside(a)	--	12	107	89	681	66	585	466	25	--
21	Hockman	Kitchen(b)	--	--	--	--	104	68	995	422	--	--
47	Rogers	Kitchen	--	--	--	--	1,020	72	301	217	--	5
54	Nosbisch	Garage(c)	--	--	--	--	113	--	94	158	--	--

(a) Taken before water filter.
(b) Taken after water filter.
(c) Taken after water softener.

TABLE 4-7 SUMMARY OF RESULTS OF TOTAL AND DISSOLVED PCB AROCLOR 1254 DETERMINATIONS ON STORM-WATER SAMPLES COLLECTED 30 AUGUST 1984, WIDE BEACH, NEW YORK

Station	Collection Time	Dissolved Aroclor 1254 (ug/l)	Total Aroclor 1254 (ug/l)	EA No.
Outfall 1	1135	0.92	93	6024
Outfall 1	1205	0.46	8.0	6015
Outfall 1	1235	0.47	6.4	6016
Outfall 1	1335	0.78	5.2	6017
Outfall 1	1435	1.0	4.0	6025
Outfall 1	1530	1.4	4.6	6014
Marsh 1	1215	0.08	0.28	6012
Marsh 1	1315	0.30	2.9	6021
Marsh 1	1415	ND	0.26	6013
Marsh 1	1515	0.04	0.20	6019
Catch Basin 1	1215	0.51	14	6023
Catch Basin 1	1315	0.95	13	6022
Catch Basin 1	1415	1.4	11	6018
Catch Basin 1	1515	1.5	11	6020
Field Blank	N/A	ND	ND	

TABLE 4-8 SUMMARY OF PRIORITY POLLUTANT COMPOUNDS DETERMINED IN AQUEOUS SAMPLES COLLECTED FROM MONITORING WELLS LOCATED IN THE VICINITY OF THE TOWN OF BRANT, ERIE COUNTY, NEW YORK

Compound	Unit	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	Field Blank	Bailer Wash	Distilled Water
Aldrin	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Alpha BHC	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Beta BHC	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lindane	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chlordane	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDD	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDE	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,4'-DDT	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dieldrin	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan I	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan Sulfate	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endrin	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endrin Aldehyde	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor Epoxide	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methoxychlor	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toxaphene	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 1016	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 1221	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 1232	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 1248	ug/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 1254	ug/l	ND	ND	0.2	ND	ND	ND	ND	ND	ND	ND	ND
PCB 1260	ug/l	ND	ND	ND.	ND	ND	ND	ND	ND	ND	ND	ND
EA No.		6162	6170	6163	6171	6172	6164	6165	6166	6173	6167	6168

ND = Not detected at established detection limits.

TABLE 4-9 SUMMARY OF METALS, CYANIDE, AND PHENOL DETERMINATIONS (mg/L) OF AQUEOUS SAMPLES COLLECTED FROM MONITORING WELLS, WIDE BEACH, ERIE COUNTY, NEW YORK

Parameter	Sample Type	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	Bailer Wash	Filter Wash	Filter Wash	Field Blank
Total Cyanide	Water	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	--	<0.01
Antimony	Water	0.034	0.025	0.030	0.007	0.031	0.025	<0.002	0.038	<0.002	<0.002	<0.002	<0.002
Arsenic	Water	<0.002	<0.002	0.005	0.006	<0.002	<0.002	<0.002	0.003	0.002	<0.002	<0.002	<0.002
Beryllium	Water	<0.0005	0.0019	<0.0005	0.0017	0.0017	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	Water	0.0037	0.0072	0.0062	0.0028	0.0023	0.0018	0.0020	0.0049	0.0013	0.0009	0.0004	<0.0003
Total Chromium	Water	0.002	<0.001	0.002	<0.001	<0.001	0.001	0.007	0.003	<0.001	<0.001	<0.001	<0.001
Copper	Water	0.004	0.005	0.003	0.003	0.003	0.010	0.014	0.042	0.096	0.002	<0.001	0.002
Lead	Water	0.003	0.007	0.004	<0.001	0.002	0.002	0.002	0.007	0.003	0.001	<0.001	0.006
Mercury	Water	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Nickel	Water	0.600	0.232	1.21	0.115	0.308	0.274	0.298	0.407	0.003	0.028	0.051	<0.001
Selenium	Water	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Silver	Water	<0.0001	0.0004	<0.0001	0.0003	0.0004	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Thallium	Water	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	Water	0.071	0.064	0.057	0.022	0.043	0.042	0.030	0.428	0.103	0.013	0.014	<0.005
Phenols	Water	0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	--	--	<0.01
EA No.		6162	6170	6163	6171	6172	6164	6165	6166	6167	6169	6174	6173

TABLE 4-10 SUMMARY OF THE MAXIMUM, MINIMUM, AND MEAN METALS AND PHENOL CONCENTRATIONS IN AQUEOUS SAMPLES COLLECTED FROM MONITORING WELLS, WIDE BEACH, NEW YORK

	Concentration (mg/l)				
Metal	Maximum	Minimum	Mean[a]	SD[b]	n
Antimony	0.038	0.007	0.027	0.010	7
Arsenic	0.006	0.003	0.005	0.002	3
Beryllium	0.0019	0.0017	0.0018	0.0001	3
Cadmium	0.0072	0.0018	0.0038	0.0020	8
Chromium	0.007	0.001	0.003	0.002	5
Copper	0.042	0.003	0.011	0.013	8
Lead	0.007	0.002	0.004	0.002	7
Nickel	1.21	0.115	0.431	0.345	8
Silver	0.0004	0.0003	0.0004	0.0001	3
Zinc	0.428	0.022	0.095	0.136	8
Phenols	0.06	0.01	0.04	0.04	2

(a) Arithmetic mean based on only those samples greater than the detection limit.
(b) Standard deviation for n-1.

TABLE 4-11 SUMMARY OF PCB CONCENTRATIONS DETERMINED IN AQUEOUS SAMPLES COLLECTED FROM SEWER TRENCH WELLS, WIDE BEACH, TOWN OF BRANT, NEW YORK

Station Location	PCB 1016 (ug/L)	1221 (ug/L)	1232 (ug/L)	1242 (ug/L)	1248 (ug/L)	1254 (ug/L)	1260 (ug/L)	EA Number
SW-1	ND	ND	ND	ND	ND	2.5	ND	6152
SW-2	ND	ND	ND	ND	ND	4.3	ND	6153
SW-3	ND	ND	ND	ND	ND	1.4	ND	6154
SW-4	ND	ND	ND	ND	ND	2.6	ND	6155
SW-5	ND	ND	ND	ND	ND	5.7	ND	6156
SW-6	ND	ND	ND	ND	ND	1.5	ND	6157
Field Blank	ND	ND	ND	ND	ND	ND	ND	6158

TABLE 4-12 WATER LEVELS (ft) IN OBSERVATION (OW) AND MONITORING (MW) WELLS RELATIVE TO TOP OF INSIDE WELL CASING, WIDE BEACH, NEW YORK

Location	Date of Reading		
	28 SEP 84	26 NOV 84	27 DEC 84
OW-1	8.20	6.04	5.61
OW-2	11.93	11.14	10.13
OW-3	8.91	7.45	6.81
OW-4	7.43	4.93	4.30
OW-5	6.80	5.10	4.48
OW-6	7.34	4.41	3.93
OW-7	6.92	4.20	4.04
OW-8	10.59	5.97	4.95
OW-9	3.60	2.13	1.78
OW-10	8.63	8.21	5.80
OW-11	5.01	4.07	3.67
OW-12	NC	2.46	2.18
OW-13	NC	4.00	2.44
MW-1	8.15	6.25	5.82
MW-2	8.59	7.63	7.52
MW-3	9.52	9.29	9.04
MW-4	8.10	5.19	4.68
MW-5	6.67	5.24	4.84
MW-6	9.17	7.21	6.15
MW-7	5.22	2.36	2.23
MW-8	NC	3.16	2.71

Note: NC = well not constructed.

TABLE 4-13 SUMMARY OF PCB DETERMINATIONS FOR RESIDENTIAL DUST SAMPLES COLLECTED BY ECDEP AT WIDE BEACH, NEW YORK

Station Number	Residence	Aroclor 1254 Concentration (mg/kg)
	Hansen	
50	43 South	36.0
	Gillig	
20	86 Oval	41.0
	Lyford	
51	10870 Old Lake Shore	4.0
	63 Oakgrove Drive	
Offsite	Williamsville	None Detected

TABLE 4-14 SUMMARY OF RESULTS OF PCB DETERMINATIONS ON VACUUM DUST SAMPLES COLLECTED FROM RESIDENCES, WIDE BEACH, NEW YORK, AUGUST 1984

Station Number	Residence	Collection Date	Aroclor 1254 (mg/kg)	EA No.
1	Helmich	22 AUG 84	22	5823
2	Morgante	25 AUG 84	35	5898
3	Kalenda	--	(a)	--
4	Horth	23 AUG 84	24	5902
5	Franz	--	(a)	--
6	Militello	22 AUG 84	20	5813
7	Miller	22 AUG 84	6.0	5886
8	Allen	24 AUG 84	21	5885
9	Barton	--	(a)	--
10	Plewak	22 AUG 84	3.3	5810
11	Hickey	--	(a)	--
12	Schultz	22 AUG 84	3.6	5829
13	Holmes	--	(a)	--
14	Major	24 AUG 84	4.0	5887
15	Militello	22 AUG 84	0.87	5825
16	Taylor	--	(a)	--
17	Perhach	29 AUG 84	0.60	5989
18	Grey	22 AUG 84	6.4	5827
19	Mason	22 AUG 84	3.4	5821
20	Gillig	22 AUG 84	3.5	5802
21	Hockman	22 AUG 84	4.0	5808
22	Winnert	--	(a)	--
23	Aurelio	23 AUG 84	2.0	5837
24	Shanahan	22 AUG 84	2.2	5804
25	Lundberg	22 AUG 84	25	5806
26	Murphy	23 AUG 84	1.6	5841
27	Oehler	23 AUG 84	460	5839
28	Prince	4 SEP 84	770	6062
29	Ball	--	(a)	--
30	Miller	--	(a)	--
31	Lojacono	23 AUG 84	1.6	5843
32	Gajewski	24 AUG 84	5.8	5878
32	Gajewski	24 AUG 84	3.5(b)	5888
33	Murphy	24 AUG 84	18	5884
34	Murphy	4 SEP 84	26	6061
35	Plewak	24 AUG 84	2.0	5889
37	Pronobis	25 AUG 84	43	5881
38	Guerra	--	(a)	--
39	Meyer	23 AUG 84	4.3	5846
40	Rusch	23 AUG 84	4.6	5857
41	Hellman	23 AUG 84	6.0	5855

(a) Sample was not collected.
(b) Sample was collected from an enclosed porch floor.

TABLE 4-14 (Cont.)

Station Number	Residence	Collection Date	Aroclor 1254 (mg/kg)	EA No.
42	Grabbenstatter	23 AUG 84	0.25	5849
43	Franz	--	(a)	--
44	Roe	23 AUG 84	3.5	5853
45	Mueller	23 AUG 84	1.3	5860
46	Bauer	24 AUG 84	150	5879
47	Rogers	23 AUG 84	9.0	5831
48	Burke	25 AUG 84	31	5883
49	Speck	23 AUG 84	20	5835
50	Hansen	23 AUG 84	2.5	5833
51	Lyford	25 AUG 84	4.7	5882
52	Murphy	25 AUG 84	2.8	5896
53	Newman	25 AUG 84	0.68	5899
54	Nosbisch	23 AUG 84	8.4	5847
55	Zender	25 AUG 84	3.5	5897
56	Persichini	--	(a)	--
57	Militello	25 AUG 84	8.2	5895
58	Egner	--	(a)	--
59	Canteline	23 AUG 84	1.9	5851
60	Bowen	24 AUG 84	9.3	5880

TABLE 4-15 SUMMARY OF RESULTS OF TOTAL SUSPENDED PARTICULATES COLLECTED AT WIDE BEACH, NEW YORK, AUGUST 1984

Date	Unit	Station 1 (Field Office)	Station 2 (Plewak)	Station 3 (Prince)	Station 4 (Rush)	Station 5 (Grabbenstatter)
31 AUG 84	mg/m^3	0.107	0.182	0.307	0.100	0.175
1 SEP 84	mg/m^3	--	0.216	0.099	0.090	0.132
2 SEP 84	mg/m^3	0.116	0.254	0.125	0.128	0.135
3 SEP 84	mg/m^3	0.057	0.107	0.056	0.056	0.060
4 SEP 84	mg/m^3	0.050	0.117	0.064	0.040	0.104
5 SEP 84	mg/m^3	0.075	0.108	0.061	0.056	0.165
6 SEP 84	mg/m^3	0.085	0.147	0.046	0.041	0.110
7 SEP 84	mg/m^3	0.128	0.301	0.121	0.102	0.145
8 SEP 84	mg/m^3	0.153	0.453	0.127	0.125	0.187
9 SEP 84	mg/m^3	0.111	0.247	0.092	0.091	0.117
10 SEP 84	mg/m^3	0.103	0.211	0.093	0.093	0.096
11 SEP 84	mg/m^3	0.045	0.086	0.047	0.044	0.044
12 SEP 84	mg/m^3	0.085	0.198	0.089	0.079	0.102
13 SEP 84	mg/m^3	0.073	0.149	0.071	0.067	0.066

TABLE 4-16 SUMMARY OF RESULTS OF TOTAL SUSPENDED PARTICULATES COLLECTED BY ECDEP AT WIDE BEACH, NEW YORK, 1982

Sampling Date	Wide Beach (mg/m^3)	Angola (mg/m^3)
30 MAR 82	0.034	(a)
5 APR 82	0.032	0.025
11 APR 82	0.018	0.019
17 APR 82	0.046	0.021
23 APR 82	0.050	0.042
29 APR 82	0.144	0.050
5 MAY 82	0.160	0.045
11 MAY 82	0.085	0.051
23 MAY 82	0.024	0.025
29 MAY 82	0.036	0.030
4 JUN 82	--	0.032
10 JUN 82	0.072	0.034
16 JUN 82	0.024	0.024
22 JUN 82	0.020	0.021
28 JUN 82	0.064	0.073
4 JUL 82	0.059	(a)
10 JUL 82	0.044	0.039
16 JUL 82	0.065	0.065
22 JUL 82	0.038	0.043
28 JUL 82	0.022	0.019
3 AUG 82	0.024	--
9 AUG 82	0.042	--
15 AUG 82	0.050	--
27 AUG 82	0.031	--
2 SEP 82	0.019	--
8 SEP 82	0.029	--
14 SEP 82	0.049	--
20 SEP 82	0.029	--
26 SEP 82	0.041	--
2 OCT 82	0.033	--
8 OCT 82	0.032	--
14 OCT 82	0.020	--
20 OCT 82	0.037	--
26 OCT 82	0.053	--

(a) No sample taken.

TABLE 4-17 SUMMARY OF METEOROLOGIC STATION DATA COLLECTED AT WIDE BEACH, NEW YORK, AUGUST 1984

Parameter	N	NE	E	SE	S	SW	W	NW
Average wind velocity (mph)	0.8	2.6	1.8	2.0	2.3	3.6	2.8	2.0
Average wind velocity (m/sec)	0.4	1.2	0.8	0.9	1.0	1.6	1.2	0.9
Number of measurements	3	11	4	78	76	77	30	35

TABLE 4-18 RESULTS OF ATMOSPHERIC PCB DETERMINATIONS CONDUCTED BY ECDEP AT WIDE BEACH, NEW YORK

Date	Wide Beach Pump Station Aerosol PCB_3 (ug/m^3)	Wide Beach Pump Station Volatile PCB_3 (ug/m^3)	Angola Sewage Treatment Plant Aerosol PCB_3 (ug/m^3)
30 MAR 82	NS	NS	NS
30 MAR 82	0.0093	NS	NS
05 APR 82	0.0130	NS	ND
11 APR 82	0.0085	NS	ND
17 APR 82	(a)	NS	ND
23 APR 82	0.0035	NS	ND
29 APR 82	0.0300	NS	ND
05 MAY 82	0.0240	NS	ND
11 MAY 82	0.0075	NS	ND
23 MAY 82	0.0047	NS	NS
29 MAY 82	ND	NS	NS
04 JUN 82		NS	NS
10 JUN 82	0.0005	NS	NS
16 JUN 82	ND	NS	NS
22 JUN 82	ND	NS	NS
28 JUN 82	ND	NS	NS
04 JUL 82		NS	NS
10 JUL 82	ND	NS	NS
22 JUL 82	ND	NS	NS
28 JUL 82	ND	NS	NS
03 AUG 82	ND	NS	NS
09 AUG 82	ND	0.0072	NS
15 AUG 82		NS	NS
21 AUG 82		NS	NS
27 AUG 82		0.0050	NS
02 SEP 82		0.0045	NS
08 SEP 82		0.0037	NS
14 SEP 82	ND	NS	NS

(a) PCBs detected but not quantified.

Note: ND = No PCB detected.
NS = No sample taken.

Blank indicates data not available.

TABLE 4-19 SUMMARY OF RESULTS OF PCB DETERMINATIONS ON SOIL SAMPLES COLLECTED BY ECDEP FROM DRAINAGE DITCHES AT WIDE BEACH, ERIE COUNTY, NEW YORK, 1981 AND 1982

Station Number	Station Location	Collection Date	Sample Type	Sample Depth[a]	Source[b]	Aroclor 1254 (mg/kg)
21	Hockman, 90 Oval	1 OCT 81	Soil	SU	Ditch	91.9
18	Grey, 82 Oval	19 NOV 81	Soil	SU	Ditch	1,026
				D		158
22	Winnert, Oval	19 NOV 81	Soil	SU	Ditch	162
				D		8
35	Plewak, 128 Oval	19 NOV 81	Soil	SU	Ditch	7.9
				D		217.5
42	Grabenstatter, 1 Oval	19 NOV 81	Soil	SU	Ditch	28
				D		46.4
53	Newman, 30 Fox St.	19 NOV 81	Soil	SU	Ditch	25
				D		22.5
60	Bowen, 9 South St.	19 NOV 81	Soil	SU	Ditch	179
				D		125
60	Bowen, Backyard on Fox St.	19 NOV 81	Soil	SU	Ditch	2.0
				D		4.67
Wide Beach	SE Corner of Fox & South St.	19 NOV 81	Soil	SU	Ditch	25.5
				D		5.0

(a) Surficial samples (SU) taken at 0-6 in.; deep samples (D) taken at 3 ft.
(b) Samples taken at drainage ditches located in front of residences.
(c) Sample taken at waste-oil barrel storage area.

TABLE 4-19 (Cont.)

Station Number	Station Location	Collection Date	Sample Type	Sample Depth[a]	Source[b]	Concentration (ppm)
Wide Beach	West side of Oval, NE corner	19 NOV 81	Soil	SU	Ditch	67.5
				D		340
Offsite	Genrack Estate	19 NOV 81	Soil	SU	Ditch	0.04
				D		0.05
18	Grey, 82 Oval	MAR 82	Soil	SU	Ditch	121
6	Militello, 60 Oval	19 MAY 82	Soil	SU	Ditch	205.9
				D		59.1
7	Miller, 50 Oval	19 MAY 82	Soil	SU	Ditch	4.4
				D		1.6
21	Hockman, 90 Oval	20 MAY 82	Soil	SU	Ditch	236.9
				D		56.0
35	Plewak, 128 Oval	20 MAY 82	Soil	SU	Ditch	0.3
				D		0.2
41	Hellman, 2 South St.	18 MAY 82	Soil	SU	Ditch	79.0
				D		2.2
53	Ditch on south side of Fox Rd.	18 MAY 82	Soil	SU	Ditch	114
				D		1.4
Wide Beach	Ditch north side of Fox Rd. on lot south of St. No. 44	18 MAY 82	Soil	Su	Ditch[c]	487
				D		18.4

TABLE 4-20 SUMMARY OF PCB DETERMINATIONS FOR SOIL SAMPLES COLLECTED FROM ROADWAYS IN WIDE BEACH COMMUNITY BY ECDEP, MAY 1982

Station Number	Station/Location	Collection Date	Sample Type	Sample Depth[a]	Source	Aroclor 1254 (mg/kg)
2	Morgante, 29 Oval	19 MAY 82	Soil	Surface	Road	60.5
7	Miller, 50 Oval	19 MAY 82	Soil	Surface	Road	6.0
18	Grey, 82 Oval	19 MAY 82	Soil	Surface	Road	71.5
20	Gillig, 86 Oval	18 MAY 82	Soil	Surface	Road	258.0
21	Hockman, 90 Oval	20 MAY 82	Soil	Surface	Road	51.0
34	Murphy, 124 Oval	20 MAY 82	Soil	Surface	Road	8.0
39	Meyers, 141 Oval	20 MAY 82	Soil	Surface	Road	2.37
42	Grabenstatter, 1 Oval	18 MAY 82	Soil	Surface	Road	153.6
51	Lyford, 10870 Lakeshore Rd.	19 MAY 82	Soil	Surface	Road	99.3
53	Newman, 30 Fox St.	18 MAY 82	Soil	Surface	Road	78.3
58	Egner, South St.	18 MAY 82	Soil	Surface	Road side	115.6
				Deep		19.8
Wide Beach	Intersection of Oval and Fox St. "Y" of road	18 MAY 82	Soil	Surface	Road	44.4
Wide Beach	Intersection of Oval and Access Rd. "Wideway"	20 MAY 82	Soil	Surface	Road	23.2
				Deep		1.0

(a) Surficial samples taken at 0-6 in.; deep samples taken at 3 ft.

TABLE 4-21 SUMMARY OF PCB DETERMINATIONS CONDUCTED ON SOIL SAMPLES COLLECTED FROM ROADWAYS OF WIDE BEACH AND ERIE COUNTY, NEW YORK, BY EPA REGION II FIT, APRIL 1983

Sample Number	Location	Aroclor 1254 (mg/kg)
1	A_{28-31} Center 0-6 in.	4.61
2	A_{28-31} South 0-6 in.	9.07
3	A_{28-31} North 0-6 in.	29.34
4	L_{01-04} Center 0-6 in.	5.20
5	L_{01-04} West 0-6 in.	7.41
6	L_{01-04} East 0-6 in.	11.97
7	E_{04-07} Center 3-6 in.	4.53
8	E_{04-07} Center 6-12 in.	5.48
9	E_{04-07} Center 0-3 in.	5.23
10	E_{04-07} East 0-3 in.	7.42
11	E_{04-07} East 3-6 in.	59.44
12	E_{04-07} East 6-12 in.	12.15
13	E_{04-07} West 0-3 in.	6.02
14	E_{04-07} West 6-12 in.	9.42
15	E_{04-07} West 3-6 in.	38.91
16	A_{36-39} North 0-3 in.	53.79
17	A_{36-39} North 3-6 in.	17.89
18	A_{36-39} South 0-3 in.	26.27
19	A_{36-39} South 3-6 in.	1.62
20	A_{36-39} Center 0-3 in.	30.37
21	A_{36-39} Center 3-6 in.	26.37
22	B_{00-03} West 0-3 in.	118.09
23	B_{00-03} Center 0-3 in.	24.15
24	B_{00-03} East 0-3 in.	16.19
25	G_{04-07} Center 0-3 in.	12.53
26	G_{04-07} South 0-3 in.	119.18
27	G_{04-07} North 0-3 in.	4.52
28	B_{00-03} East 3-6 in.	18.65
29	G_{04-07} Center 3-6 in.	11.01
30	B_{00-03} Center 3-6 in.	26.32
31	E_{08-11} East 3-6 in.	22.61

TABLE 4-21 (Cont.)

Sample Number	Location	Aroclor 1254 (mg/kg)
32	G_{04-07} South 3-6 in.	107.52
33	E_{08-11} Center 3-6 in.	2.94
34	A_{04-07} North 3-6 in.	17.96
35	A_{04-07} North 0-3 in.	6.87
36	A_{04-07} Center 0-3 in.	11.34
37	A_{04-07} South 0-3 in.	8.19
38	A_{04-07} Center 3-6 in.	4.97
39	K_{08-11} North 3-6 in.	41.05
40	C_{04-07} North 0-3 in.	3.48
41	E_{08-11} East 0-3 in.	2.40
42	E_{08-11} West 3-6 in.	40.14
43	Picnic Grove	3.80
44	K_{08-11} Center 0-3 in.	46.54
45	Hansen's Yard	3.73
46	A_{24-27} Center 0-6 in.	5.44
47	E_{08-11} East 0-3 in.	69.92
48	C_{04-07} Center 3-6 in.	36.36
49	K_{08-11} Center 3-6 in.	2.31
50	K_{08-11} South 0-3 in.	77.00
51	E_{08-11} Center 0-3 in.	9.85
52	K_{08-11} South 3-6 in.	7.96
53	C_{04-07} South 3-6 in.	58.80
54	A_{24-27} South 0-6 in.	57.54
55	C_{04-07} North 3-6 in.	226.00
56	A_{24-27} North 0-6 in.	31.10
57	C_{04-07} South 0-3 in.	42.24
58	K_{08-11} North 0-3 in.	8.09
59	C_{04-07} Center 0-3 in.	39.16
60	A_{04-07} South 3-6 in.	1.57
61	G_{04-07} North 3-6 in.	15.71
62	B_{00-03} West 3-6 in.	59.40
63	E_{00-03} East 6-12 in.	23.09

TABLE 4-21 (Cont.)

Sample Number	Location	Aroclor 1254 (mg/kg)
64	E_{00-03} East 3-6 in.	12.37
65	E_{00-03} East 0-3 in.	7.92
66	E_{00-03} West 6-12 in.	4.75
67	E_{00-03} West 3-6 in.	10.14
68	E_{00-03} West 0-3 in.	1.74
69	E_{00-03} Center 6-12 in.	114.48
70	E_{00-03} Center 3-6 in.	123.05
71	E_{00-03} Center 0-3 in.	85.59

TABLE 4-22 RESULTS OF PCB DETERMINATIONS ON SOIL SAMPLES COLLECTED FROM YARDS, WIDE BEACH, NEW YORK, AUGUST 1984

Station No.	Name of Resident	Collection Date	Sample Type	Aroclor 1254 (mg/kg)	EA No.
1	Helmich	28 AUG 84	Soil	48	5903
2	Morgante	28 AUG 84	Soil	23	5905
3	Kalenda	28 AUG 84	Soil	18	5907
4	Horth	28 AUG 84	Soil	3.4	5909
5	Franz	28 AUG 84	Soil	2.8	5911
6	Militello	28 AUG 84	Soil	6.0	5913
7	Miller	28 AUG 84	Soil	7.0	5916
8	Allen	28 AUG 84	Soil	5.2	5917
9	Barton	28 AUG 84	Soil	39	5919
10	Plewak	28 AUG 84	Soil	2.6	5921
11	Hickey	28 AUG 84	Soil	1.4	5923
12	Schultz	28 AUG 84	Soil	4.9	5925
13	Holmes	29 AUG 84	Soil	14	5927
14	Major	29 AUG 84	Soil	3.0	5928
15	Militello	29 AUG 84	Soil	100	5930
16	Taylor	29 AUG 84	Soil	1.5	5932
17	Perhach	29 AUG 84	Soil	25	5934
18	Grey	29 AUG 84	Soil	6.1	5935
19	Mason	29 AUG 84	Soil	1.7	5937
20	Gillig	29 AUG 84	Soil	13	5939
21	Hockman	29 AUG 84	Soil	16	5941
22	Winnert	29 AUG 84	Soil	14	5944
23	Aurelio/Mach	29 AUG 84	Soil	21	5945
24	Shanahan	29 AUG 84	Soil	1.1	5947
25	Lundberg	29 AUG 84	Soil	42	5949
26	Murphy	29 AUG 84	Soil	11	5950
27	Oehler	29 AUG 84	Soil	3.5	5953
28	Prince	29 AUG 84	Soil	0.05	5954
29	Ball	29 AUG 84	Soil	0.06	5957
30	Miller	29 AUG 84	Soil	1.8	5959
31	Lojacono	29 AUG 84	Soil	46	5962
32	Gajewski	29 AUG 84	Soil	230	5963
33	Murphy	29 AUG 84	Soil	120	5967
34	Murphy	29 AUG 84	Soil	1.1	5965
35	Plewak	29 AUG 84	Soil	12	5969
36A	Pronobis(a)	29 AUG 84	Soil	91	5973
36B	Pronobis(b)	29 AUG 84	Soil	0.64	5974
37	Pronobis	29 AUG 84	Soil	33	5971
38	Guerra	29 AUG 84	Soil	600	5975
39	Meyer	29 AUG 84	Soil	9.6	5977

(a) Sample collected in field next to Pronobis residence roadway.
(b) Sample collected in field next to Pronobis residence 65 ft from roadway.

TABLE 4-22 (Cont.)

Station No.	Name of Resident	Collection Date	Sample Type	Aroclor 1254 (mg/kg)	EA No.
40	Rusch	29 AUG 84	Soil	6.4	5979
41	Hellman	29 AUG 84	Soil	65	5980
42	Grabenstatter	29 AUG 84	Soil	9.0	5982
43	Franz	29 AUG 84	Soil	57	5094
44	Roe	29 AUG 84	Soil	20	5987
45	Mueller	30 AUG 84	Soil	1.9	5990
46	Bauer	30 AUG 84	Soil	5.7	5992
47	Rogers	30 AUG 84	Soil	2.7	5994
48	Burke	30 AUG 84	Soil	3.0	5996
49	Speck	30 AUG 84	Soil	13	5998
50	Hansen	30 AUG 84	Soil	1.8	6000
51	Lyford	30 AUG 84	Soil	9.3	6037
52	Murphy	30 AUG 84	Soil	7.7	6002
53	Newman	30 AUG 84	Soil	2.1	6004
54	Nosbisch	30 AUG 84	Soil	8.8	6006
55	Zender	31 AUG 84	Soil	1.3	6027
56	Persichini	31 AUG 84	Soil	6.3	6028
57	Militello	31 AUG 84	Soil	11	6030
58	Egner	31 AUG 84	Soil	3.7	6031
59	Canteline	31 AUG 84	Soil	5.8	6033
60	Bowen	31 AUG 84	Soil	1.1	6035

TABLE 4-23 SUMMARY OF RESULTS OF PCB DETERMINATIONS FOR SOIL SAMPLES COLLECTED BY ECDEP FROM YARDS AND OPEN LOTS IN WIDE BEACH, NEW YORK, MAY 1982

Station Number	Station Location	Collection Date	Sample Depth[a]	Source[b]	Aroclor 1254 (mg/kg)
2	Morgante, 29 Oval	19 MAY 82	SU	Yard-F	30.5
			D		0.4
4	Horth, 38 Oval - E. of house	19 MAY 82	SU	Yard-S	7.5
			D		1.5
6	Militello, 60 Oval	19 MAY 82	SU	Yard-S	110.6
			D		3.6
7	Miller, 55 Oval	19 MAY 82	SU	Yard-F	12.4
			D		0.8
17	Perhach, 81 Oval	19 MAY 82	SU	Yard-F	25.8
			D		1.8
18	Grey, 82 Oval	19 MAY 82	SU	Yard-F	6.4
			D		1.8
21	Hockman, 90 Oval	20 MAY 82	SU	Yard-F	2.2
			D		<0.05
21	Hockman, 90 Oval	20 MAY 82	SU	Yard-B	1.4
			D		2.0
34	Murphy, 124 Oval	20 MAY 82	SU	Yard-F	46.8
			D		3.7
36	Vacant Lot	20 MAY 82	SU	Lot	77.5
			D		32.5
39	Meyers, 141 Oval	20 MAY 82	SU	Yard-F	7.1
			D		1.2
40	Rusch, 3 South St.	18 MAY 82	SU	Yard-B	0.14
			D		<0.05
42	Grabenstatter, 1 Oval	18 MAY 82	SU	Yard-F	2.6
			SU		<0.05
42	Grabenstatter, 1 Oval	18 MAY 82	SU	Yard-B	0.4
			D		<0.05

(a) Surficial samples (SU) taken at 0-6 in.; deep sample (D) taken at 3-ft depth.
(b) B = back, F = front, S = side.

TABLE 4-23 (Cont.)

Station Number	Station Location	Collection Date	Sample Depth[a]	Source[b]	Aroclor 1254 (mg/kg)
43	Franz, 6 Oval	19 MAY 82	SU	Yard-B	0.5
			D		<0.05
47	Rogers, 17 South St.	18 MAY 82	SU	Yard-F	10.2
			D		2.8
48	Burke, 21 South St.	18 MAY 82	SU	Yard-B	<0.05
			D		0.9
50	Hansen, 43 South St.	18 MAY 82	SU	Yard-B	5.0
			D		14.0
50	Hansen, 43 South St.	18 MAY 82	SU	Yard-B	1.8
			D		0.4
51	Lyford, 10870 Lakeshore Rd.	19 MAY 82	SU	Yard-F	20.5
			D		12.0
53	Newman, 30 Fox St.	18 MAY 82	SU	Yard-F	12.0
			D		3.6
53	Newman, 30 Fox St.	18 MAY 82	SU	Yard-B	0.9
			D		ND
55	Zender, 26 South St.	18 MAY 82	SU	Yard-B	0.2
			D		<0.05
57	Militello, 20 South St.	18 MAY 82	SU	Yard-F	3.4
			D		1.8
Wide Beach	Wooded Area across from St. No. 42	18 MAY 82	SU	Soil	3.6
			D		0.5
Wide Beach	Lot West of St. No. 52	18 MAY 82	SU	Soil	8.1
			D		8.1
Wide Beach	Vacant Lot West of St. 59	18 MAY 82	SU	Soil	23.0
			D		2.8
Wide Beach	Wooded Area behind St. 35	20 MAY 82	SU	Soil	56.0
			D		1.45
Wide Beach	Lot across road from St. 39	20 MAY 82	SU	Soil	28.6
			D		18.2
Wide Beach	Lot across Fox Rd. from St. No. 51	19 MAY 82	SU	Soil	37.0
			D		1.1
Wide Beach	Grove	19 MAY 82	SU	Fill Dirt	11.8
			D (1 ft)		11.2
Wide Beach	Grove	OCT 81	SU	Fill Dirt	5.4

TABLE 4-24 SUMMARY OF RESULTS OF TOTAL ORGANIC CARBON (TOC) DETERMINATIONS CONDUCTED ON THREE YARD AND DRIVEWAY SOIL SAMPLES, WIDE BEACH, NEW YORK, 1984

Station Number	Location	Source	Collection Date	Sample Type	TOC Percent	EA Number
4	Horth	Yard	28 AUG 84	Soil	2.38	5909
4	Horth	Driveway		Soil	1.32	5910
30	Miller	Yard	29 AUG 84	Soil	1.28	5959
30	Miller	Driveway		Soil	0.65	5958
49	Speck	Yard	30 AUG 84	Soil	1.32	5998
49	Speck	Driveway		Soil	0.81	5999

TABLE 4-25 SUMMARY PARTICLE-SIZE DETERMINATION ON YARD AND DRIVEWAY SAMPLES COLLECTED FROM WIDE BEACH, TOWN OF BRANT, NEW YORK, 1984

Station Number	Location	Source	Aerodynamic Diameters 125-16 um (%)	16-4 um (%)	4-0.24 um (%)	EA Number
4	Yard	Soil	27.15	19.75	33.27	5909
4	Driveway	Soil	6.01	5.02	6.03	5910
30	Driveway	Soil	4.88	3.15	3.96	5958
30	Yard	Soil	19.02	15.14	28.00	5959
49	Driveway	Soil	5.06	2.42	4.61	5999
49	Yard	Soil	19.56	17.64	22.10	5998

TABLE 4-26 RESULTS OF PCB ANALYSIS ON SOIL SAMPLES COLLECTED FROM DRIVEWAYS AT WIDE BEACH, NEW YORK

Station No.	Name of Resident	Collection Date	Sample Type	Aroclor 1254 (mg/kg)	EA No.
1	Helmich	28 AUG 84	Soil	58	5904
2	Morgante	28 AUG 84	Soil	25	5906
3	Kalenda	28 AUG 84	Soil	180	5908
4	Horth	28 AUG 84	Soil	110	5910
5	Franz	28 AUG 84	Soil	89	5912
6	Militello	28 AUG 84	Soil	11	5914
7	Miller	28 AUG 84	Soil	120	5915
8	Allen	28 AUG 84	Soil	390	5918
9	Barton	28 AUG 84	Soil	16	5920
10	Plewak	28 AUG 84	Soil	16	5922
11	Hickey	28 AUG 84	Soil	24	5924
12	Schultz	28 AUG 84	Soil	11	5926
13	Holmes	29 AUG 84	Soil	NS(a)	--
14	Major	29 AUG 84	Soil	54	5929
15	Militello	29 AUG 84	Soil	390	5931
16	Taylor	29 AUG 84	Soil	NS(a)	--
17	Perhach	29 AUG 84	Soil	82	5933
18	Grey	29 AUG 84	Soil	50	5936
19	Mason	29 AUG 84	Soil	2.4	5938
20	Gillig	29 AUG 84	Soil	170	5940
21	Hockman	29 AUG 84	Soil	230	5942
22	Winnert	29 AUG 84	Soil	41	5943
23	Aurelio/Mach	29 AUG 84	Soil	ND	5946
24	Shanahan	29 AUG 84	Soil	0.18	5948
25	Lundberg	29 AUG 84	Soil	NS(a)	--
26	Murphy	29 AUG 84	Soil	12	5951
27	Oehler	29 AUG 84	Soil	2.8	5952
28	Prince	29 AUG 84	Soil	0.40	5955
29	Ball	29 AUG 84	Soil	13	5956
30	Miller	29 AUG 84	Soil	6.1	5958
31	Lojacono	29 AUG 84	Soil	130	5961
32	Gajewski	29 AUG 84	Soil	26	5964
33	Murphy	29 AUG 84	Soil	190	5968
34	Murphy	29 AUG 84	Soil	84	5966
35	Plewak	29 AUG 84	Soil	17	5970
37	Pronobis	29 AUG 84	Soil	370	5972
38	Guerra	29 AUG 84	Soil	87	5976
39	Meyer	29 AUG 84	Soil	18	5978
40	Rusch	29 AUG 84	Soil	NS(a)	--
41	Hellman	29 AUG 84	Soil	64	5981
42	Grabenstatter	29 AUG 84	Soil	26	5983
43	Franz	29 AUG 84	Soil	55	5985

(a) Not sampled because driveway is paved.

TABLE 4-26 (Cont.)

Station No.	Name of Resident	Collection Date	Sample Type	Aroclor 1254 (mg/kg)	EA No.
44	Roe	29 AUG 84	Soil	9.9	5986
45	Mueller	30 AUG 84	Soil	12	5991
46	Bauer	30 AUG 84	Soil	30	5993
47	Rogers	30 AUG 84	Soil	43.0	5995
48	Burke	30 AUG 84	Soil	8.4	5997
49	Speck	30 AUG 84	Soil	4.6	5999
50	Hansen	30 AUG 84	Soil	11	6001
51	Lyford	30 AUG 84	Soil	70	6038
52	Murphy	30 AUG 84	Soil	6.8	6003
53	Newman	30 AUG 84	Soil	12	6005
54	Nosbisch	30 AUG 84	Soil	NS(a)	--
55	Zender	31 AUG 84	Soil	72	6026
56	Persichini	31 AUG 84	Soil	23	6029
57	Militello	31 AUG 84	Soil	NS(a)	--
58	Egner	31 AUG 84	Soil	48	6032
59	Canteline	31 AUG 84	Soil	10	6034
60	Bowen	31 AUG 84	Soil	63	6036

TABLE 4-27 SUMMARY OF PCB DETERMINATIONS IN SOIL SAMPLES (SURFICIAL, SPLIT SPOON, AND BORINGS) COLLECTED AT WIDE BEACH, TOWN OF BRANT, ERIE COUNTY, NEW YORK, SEPTEMBER 1984

Station Number	Station Location	Collection Date	Sample Type	Aroclor 1254 (mg/kg)	EA No.
OW-1	Surficial (1-4 in.)	4 SEP 84	Soil	18	6079
OW-2	Surficial (1-4 in.)	5 SEP 84	Soil	670	6080
OW-3	Surficial (1-4 in.)	6 SEP 84	Soil	1.5	6081
OW-4	Surficial (1-4 in.)	6 SEP 84	Soil	99	6082
OW-5	Surficial (1-4 in.)	7 SEP 84	Soil	0.45	6083
OW-6	Surficial (1-4 in.)	10 SEP 84	Soil	17	6089
OW-7	Surficial (1-4 in.)	12 SEP 84	Soil	100	6102
OW-8	Surficial	11 SEP 84	Soil	22	6090
OW-9	Surficial (0-4 in.)	13 SEP 84	Soil	0.90	6104
OW-10	Surficial (0-4 in.)	17 SEP 84	Soil	5.7	6106
OW-11	Surficial (0-4 in.)	17 SEP 84	Soil	6.7	6107
OW-12	Surficial (0-6 in.)	29 NOV 84	Soil	0.027	6160
OW-13	Surficial (0-6 in.)	29 NOV 84	Soil	0.019	6161
	Catch Basin 3	8 SEP 84	Soil	190	6087
	Catch Basin 6	8 SEP 84	Soil	5,300	6084
	Catch Basin 7	8 SEP 84	Soil	370	6085
	Catch Basin 8	12 SEP 84	Soil	64	6099
	Catch Basin 12	8 SEP 84	Soil	120	6086
	Surficial Outfall 1	12 SEP 84	Soil	220	6101
	Surficial Outfall 2	12 SEP 84	Soil	120	6100
	Open Lot 1 (1 ft)	12 SEP 84	Soil	34	6093
	Open Lot 1 (2 ft)	12 SEP 84	Soil	33	6094
	Open Lot 2 (1 ft)	12 SEP 84	Soil	5.5	6091
	Open Lot 2 (2 ft)	12 SEP 84	Soil	9.1	6092
	Open Lot 3 (1 ft)	9 SEP 84	Soil	16	6088
	Open Lot 4 (1 ft)	12 SEP 84	Soil	98	6095
	Open Lot 4 (2 ft)	12 SEP 84	Soil	1.2	6096
	Open Lot 4 (3 ft)	12 SEP 84	Soil	1.4	6097
	Open Lot 4 (4 ft)	12 SEP 84	Soil	0.04	6098
MW-1	Surficial (0-4 in.)	13 SEP 84	Soil	13	6105
MW-2	Surficial (0-4 in.)	17 SEP 84	Soil	10	6108
MW-3	Surficial (0-4 in.)	24 SEP 84	Soil	15	6147

TABLE 4-27 (Cont.)

Station Number	Station Location	Collection Date	Sample Type	Aroclor 1254 (mg/kg)	EA No.
MW-4	Surficial (0-4 in.)	24 SEP 84	Soil	110	6148
MW-5	Surficial (0-6 in.)	24 SEP 84	Soil	0.71	6138
MW-5	Sample 4 (8.0-8.5 ft)	24 SEP 84	Soil	ND	6139
MW-6	Sample 5 (10.5-11.0 ft)	25 SEP 84	Soil	ND	6140
MW-6	Surficial (0-6 in.)	25 SEP 84	Soil	12	6141
MW-7	Surficial (0-6 in.)	26 SEP 84	Soil	0.03	6142
MW-8	Surficial (0-6 in.)	29 NOV 84	Soil	0.014	6159
SW-1	Surficial (0-4 in.)	18 SEP 84	Soil	120	6109
SW-2	Surficial (0-4 in.)	18 SEP 84	Soil	13	6110
SW-3	Surficial (0-4 in.)	19 SEP 84	Soil	0.88	6111
SW-4	Surficial (0-4 in.)	19 SEP 84	Soil	20	6112
SW-5	Surficial (0-4 in.)	27 SEP 84	Soil	34	6146
SW-6	Surficial (0-4 in.)	24 SEP 84	Soil	180	6145
B-1	Surficial (0-6 in.)	12 SEP 84	Soil	0.13	6113
B-1	Sample 9 (7.5-8.0 ft)	12 SEP 84	Soil	0.015	6114
B-1	Sample 10 (9.0-9.5 ft)	12 SEP 84	Soil	0.12	6115
B-2	Surficial (0-2 in.)	12 SEP 84	Soil	190	6116
B-2	Sample 4 (7.5-8.0 ft)	12 SEP 84	Soil	0.008	6117
B-2	Sample 5 (9.5-10.0 ft)	12 SEP 84	Soil	0.005	6118
B-3	Surficial (0-6 in.)	12 SEP 84	Soil	48	6119
B-3	Sample 5 (7.5-8.0 ft)	12 SEP 84	Soil	0.008	6120
B-3	Sample 6 (9.5-10.0 ft)	12 SEP 84	Soil	0.21	6121
B-4	Surficial (0-6 in.)	13 SEP 84	Soil	240	6122
B-4	Sample 4 (7.0-7.5 ft)	13 SEP 84	Soil	0.011	6123
B-4	Sample 5 (8.0-8.5 ft)	13 SEP 84	Soil	0.009	6124
B-5	Surficial (0-6 in.)	24 SEP 84	Soil	47	6136
B-5	Sample 5 (9.0-9.5 ft)	24 SEP 84	Soil	0.14	6137
B-6	Surficial (0-6 in.)	27 SEP 84	Soil	28	6143
B-6	Sample 5 (9.5-10.0 ft)	27 SEP 84	Soil	0.04	6144
	Field Blank	12 SEP 84	Soil	ND	6103
	Field Blank			ND	6150
	Field Blank			ND	6151

TABLE 4-28 SUMMARY OF VOLATILE ORGANICS DETERMINATIONS (ug/kg) FOR SOIL SAMPLES COLLECTED AT WIDE BEACH, ERIE COUNTY, NEW YORK, SEPTEMBER 1984

Location	Collection Date	Sample Depth	Sample Type	Methylene Chloride	Tetra-chloroethene	Acetone	Fluoro-trichloromethane	EA Number
Outfall 2	12 SEP 84	0-6 in.	Soil	60	27	--	--	6100
B-1	12 SEP 84	9-9.5 ft	Soil	160	--	260	--	6115
B-2	12 SEP 84	7.5-8 ft	Soil	60	--	--	12	6117
B-4	13 SEP 84	7-7.5 ft	Soil	--	--	--	48	6123
B-5	24 SEP 84	0-6 in.	Soil	260	--	--	--	6136
B-5	24 SEP 84	9-9.5 ft	Soil	40	--	--	--	6137
B-6	27 SEP 84	0-6 in.	Soil	300	--	--	--	6143
B-6	27 SEP 84	9.5-10 ft	Soil	230	--	--	--	6144
MW-5	24 SEP 84	0-6 in.	Soil	200	--	--	--	6138
MW-5	24 SEP 84	8-8.5 ft	Soil	350	--	--	--	6139
MW-6	25 SEP 84	0-4 in.	Soil	260	--	--	--	6141

Note: A dashed line indicates that compound was not detected in the sample.

TABLE 4-29 SUMMARY OF BASE/NEUTRAL COMPOUNDS DETECTED IN SOILS COLLECTED FROM MONITORING WELLS AND BORING LOCATIONS, WIDE BEACH, NEW YORK

Station	Location	Source	Collection Date	Sample Type	Parameter (ug/kg) Aldrin	Alpha BHC	Beta BHC	Delta BHC	Lindane	Chlordane	EA Number
B-1	Sample 9 (7.5 - 8.0)	Core	12 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6100
B-1	Sample 10 (9.0 - 9.5)	Core	12 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6114
B-2	Sample 4 (7.5 - 8.0)	Core	12 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6115
B-2	Sample 5 (9.5 - 10.0)	Core	12 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6117
B-3	Sample 6 (7.5 - 8.0)	Core	12 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6118
B-3	Sample 6 (9.5 - 10.0)	Core	12 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6120
B-4	Sample 4 (7.0 - 7.5)	Core	13 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6123
B-4	Sample 5 (8.0 - 8.5)	Core	13 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6124
B-5	Surficial (0-6 in.)	Core	24 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6136
B-5	Sample 5 (9.0 - 9.5)	Core	24 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6137
B6	Surficial (0-6 in.)	Core	27 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6143
B6	Sample 5 (9.5 - 10.0)	Core	27 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6144
MW-5	Surficial (0-6 in.)	Core	24 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6138
MW-5	Sample 4 (8.0 - 8.5)	Core	24 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6139
MW-6	Sample 5 (10.5 - 11.0)	Core	25 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6140
MW-6	Surficial (0-6 in.)	Core	25 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6141
Field Blank				Deionized Water							6151
Detection Limits					0.6	0.3	0.6	0.9	0.4	5.0	

TABLE 4-29 (Cont.)

Station	Location	Source	Collection Date	Sample Type	Parameter (ug/kg) P,P'-DDE	P,P'-DDD	P,P'-DDT	Dieldrin	Endosulfan I	EA Number
B-1	Sample 9 (7.5 - 8.0)	Core	12 SEP 84	Soil	ND	ND	ND	ND	ND	6100
B-1	Sample 10 (9.0 - 9.5)	Core	12 SEP 84	Soil	ND	ND	ND	ND	ND	6114
B-2	Sample 4 (7.5 - 8.0)	Core	12 SEP 84	Soil	ND	ND	ND	ND	ND	6115
B-2	Sample 5 (9.5 - 10.0)	Core	12 SEP 84	Soil	ND	ND	ND	ND	ND	6117
B-3	Sample 6 (7.5 - 8.0)	Core	12 SEP 84	Soil	ND	ND	ND	ND	ND	6118
B-3	Sample 6 (9.5 - 10.0)	Core	12 SEP 84	Soil	ND	ND	ND	ND	ND	6120
B-4	Sample 4 (7.0 - 7.5)	Core	13 SEP 84	Soil	ND	ND	ND	ND	ND	6123
B-4	Sample 5 (8.0 - 8.5)	Core	13 SEP 84	Soil	ND	ND	ND	ND	ND	6124
B-5	Surficial (0-6 in.)	Core	24 SEP 84	Soil	ND	ND	ND	ND	ND	6136
B-5	Sample 5 (9.0 - 9.5)	Core	24 SEP 84	Soil	ND	ND	ND	ND	ND	6137
B6	Surficial (0-6 in.)	Core	27 SEP 84	Soil	ND	ND	ND	ND	ND	6143
B6	Sample 5 (9.5 - 10.0)	Core	27 SEP 84	Soil	ND	ND	ND	ND	ND	6144
MW-5	Surficial (0-6 in.)	Core	24 SEP 84	Soil	ND	ND	ND	ND	ND	6138
MW-5	Sample 4 (8.0 - 8.5)	Core	24 SEP 84	Soil	ND	ND	ND	ND	ND	6139
MW-6	Sample 5 (10.5 - 11.0)	Core	25 SEP 84	Soil	ND	ND	ND	ND	ND	6140
MW-6	Surficial (0-6 in.)	Core	25 SEP 84	Soil	ND	ND	ND	ND	ND	6141
Field Blank				Deionized Water						6151
Detection Limits					2.0	2.0	2.0	1.0	1.0	

TABLE 4-29 (Cont.)

Station	Location	Source	Collection Date	Sample Type	Parameter (ug/kg) Endosulfan	Endrin	Heptachlor Aldehyde	Heptachlor	Heptachlor Epoxide	Toxaphene	Number
B-1	Sample 9 (7.5 - 8.0)	Core	12 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6100
B-1	Sample 10 (9.0 - 9.5)	Core	12 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6114
B-2	Sample 4 (7.5 - 8.0)	Core	12 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6115
B-2	Sample 5 (9.5 - 10.0)	Core	12 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6117
B-3	Sample 6 (7.5 - 8.0)	Core	12 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6118
B-3	Sample 6 (9.5 - 10.0)	Core	12 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6120
B-4	Sample 4 (7.0 - 7.5)	Core	13 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6123
B-4	Sample 5 (8.0 - 8.5)	Core	13 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6124
B-5	Surficial (0-6 in.)	Core	24 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6136
B-5	Sample 5 (9.0 - 9.5)	Core	24 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6137
B6	Surficial (0-6 in.)	Core	27 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6143
B6	Sample 5 (9.5 - 10.0)	Core	27 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6144
MW-5	Surficial (0-6 in.)	Core	24 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6138
MW-5	Sample 4 (8.0 - 8.5)	Core	24 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6139
MW-6	Sample 5 (10.5 - 11.0)	Core	25 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6140
MW-6	Surficial (0-6 in.)	Core	25 SEP 84	Soil	ND	ND	ND	ND	ND	ND	6141
Field Blank				Deionized Water							6151
Detection Limits					2.0	7.0	2.0	4.0	8.0	40.0	

TABLE 4-30 SUMMARY OF RESULTS OF PESTICIDE DETERMINATIONS CONDUCTED ON SOIL CORES COLLECTED AT WIDE BEACH, ERIE COUNTY, NEW YORK

Station Location	Source	Collection Date	Antimony (mg/kg)	Arsenic (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
Surficial Outfall 2		12 SEP 84	<0.1	25	0.52	0.30	27	21	22	0.073
B-1 Sample 9 (7.5-8.0 ft)	Core	12 SEP 84	<0.1	22	0.69	0.14	22	31	13	0.054
B-1 Sample 10 (9.0-9.5 ft)	Core	12 SEP 84	<0.1	21	0.65	0.16	22	31	6	0.044
B-2 Sample 4 (7.5-8.0 ft)	Core	12 SEP 84	<0.1	50	0.63	0.04	19	29	16	0.039
B-2 Sample 5 (9.5-10.0 ft)	Core	12 SEP 84	<0.1	49	0.62	0.15	20	30	17	0.035
B-3 Sample 5 (7.5-8.0 ft)	Core	12 SEP 84	<0.1	29	0.60	0.04	18	29	14	0.029
B-3 Sample 6 (9.5-10.0 ft)	Core	12 SEP 84	<0.1	21	0.73	0.16	20	30	15	0.048
B-4 Sample 4 (7.0-7.5 ft)	Core	13 SEP 84	<0.1	33	0.81	0.10	23	33	15	0.026
B-4 Sample 5 (8.0-8.5 ft)	Core	13 SEP 84	<0.1	24	0.75	0.20	20	35	14	0.039
B-5 Surficial (0-6 ft)	Core	24 SEP 84	5.2	17	0.50	0.30	11	19	76	0.038
B-5 Sample 5 (9.0-9.5 ft)	Core	24 SEP 84	6.5	19	0.43	0.14	9	18	30	0.047
B-6 Surficial (0-6 ft)	Core	27 SEP 84	4.7	12	0.42	0.24	10	14	94	0.042
B-6 Sample 5 (9.5-10.0 ft)	Core	27 SEP 84	11.8	14	0.59	0.30	16	29	36	0.050
MW-5 Surficial (0-6 ft)	Core	24 SEP 84	3.0	8	0.38	0.16	7	6	20	0.050
MW-5 Sample 4 (8.0-8.5 ft)	Core	24 SEP 84	9.4	22	0.62	0.21	18	55	34	0.055
MW-6 Sample 5 (10.5-11.0 ft)	Core	25 SEP 84	11.5	9	0.49	0.34	5	30	33	0.040
MW-6 Surficial (0-6 ft)	Core	25 SEP 84	10.6	19	0.58	0.25	14	23	49	0.046

TABLE 4-30 (Cont.)

Station Location	Source	Date	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Thallium (mg/kg)	Zinc (mg/kg)	Total Phenolics (mg/kg)	Total Cyanide (mg/kg)	EA No.
Surficial Outfall 2	Core	12 SEP 84	42	0.1	<0.01	1.4	73	<0.4	<0.06	6100
B-1 Sample 9 (7.5-8.0 ft)	Core	12 SEP 84	74	3.0	0.02	1.0	84	<0.4	<0.06	6114
B-1 Sample 10 (9.0-9.5 ft)	Core	12 SEP 84	74	1.9	0.02	0.9	79	<0.4	<0.07	6115
B-2 Sample 4 (7.5-8.0 ft)	Core	12 SEP 84	52	2.5	<0.01	0.7	88	<0.4	<0.06	6117
B-2 Sample 5 (9.5-10.0 ft)	Core	12 SEP 84	78	2.5	<0.01	0.8	94	<0.4	<0.07	6118
B-3 Sample 5 (7.5-8.0 ft)	Core	12 SEP 84	60	1.3	<0.01	0.7	81	<0.4	<0.08	6120
B-3 Sample 6 (9.5-10.0 ft)	Core	12 SEP 84	60	3.6	<0.01	0.8	91	<0.4	<0.07	6121
B-4 Sample 4 (7.0-7.5 ft)	Core	13 SEP 84	62	1.3	<0.01	0.8	91	<0.4	<0.08	6123
B-4 Sample 5 (8.0-8.5 ft)	Core	13 SEP 84	66	1.4	<0.01	1.0	103	<0.4	<0.08	6124
B-5 Surficial (0-6 ft)	Core	24 SEP 84	28	6.2	0.04	0.8	186	<0.4	<0.07	6136
B-5 Sample 5 (9.0-9.5 ft)	Core	24 SEP 84	32	9.9	0.03	1.1	96	0.4	<0.07	6137
B-6 Surficial (0-6 ft)	Core	27 SEP 84	20	0.5	0.02	0.6	122	<0.4	0.08	6143
B-6 Sample 5 (9.5-10.0 ft)	Core	27 SEP 84	37	2.0	0.03	0.9	149	0.5	0.07	6144
MW-5 Surficial (0-6 ft)	Core	24 SEP 84	15	0.7	0.03	0.8	98	0.4	0.08	6138
MW-5 Sample 4 (8.0-8.5 ft)	Core	24 SEP 84	48	0.3	0.04	0.6	162	<0.3	<0.08	6139
MW-6 Sample 5 (10.5-11.0 ft)	Core	25 SEP 84	41	10.2	0.05	1.6	168	0.5	<0.08	6140
MW-6 Surficial (0-6 ft)	Core	25 SEP 84	31	0.2	0.02	0.8	144	<0.4	<0.07	6141

TABLE 4-31 SUMMARY OF METAL, PHENOL, AND CYANIDE CONCENTRATIONS DETERMINED IN SOIL SAMPLES COLLECTED FROM THE VICINITY OF THE TOWN OF BRANT, ERIE COUNTY, NEW YORK

Station Location	Source	Collection Date	Antimony (mg/kg)	Arsenic (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)
Surficial Outfall 2		12 SEP 84	<0.1	25	0.52	0.30	27	21	22	0.073
B-1 Sample 9 (7.5-8.0 ft)	Core	12 SEP 84	<0.1	22	0.69	0.14	22	31	13	0.054
B-1 Sample 10 (9.0-9.5 ft)	Core	12 SEP 84	<0.1	21	0.65	0.16	22	31	6	0.044
B-2 Sample 4 (7.5-8.0 ft)	Core	12 SEP 84	<0.1	50	0.63	0.04	19	29	16	0.039
B-2 Sample 5 (9.5-10.0 ft)	Core	12 SEP 84	<0.1	49	0.62	0.15	20	30	17	0.035
B-3 Sample 5 (7.5-8.0 ft)	Core	12 SEP 84	<0.1	29	0.60	0.04	18	29	14	0.029
B-3 Sample 6 (9.5-10.0 ft)	Core	12 SEP 84	<0.1	21	0.73	0.16	20	30	15	0.048
B-4 Sample 4 (7.0-7.5 ft)	Core	13 SEP 84	<0.1	33	0.81	0.10	23	33	15	0.026
B-4 Sample 5 (8.0-8.5 ft)	Core	13 SEP 84	<0.1	24	0.75	0.20	20	35	14	0.039
B-5 Surficial (0-6 ft)	Core	24 SEP 84	5.2	17	0.50	0.30	11	19	76	0.038
B-5 Sample 5 (9.0-9.5 ft)	Core	24 SEP 84	6.5	19	0.43	0.14	9	18	30	0.047
B-6 Surficial (0-6 ft)	Core	27 SEP 84	4.7	12	0.42	0.24	10	14	94	0.042
B-6 Sample 5 (9.5-10.0 ft)	Core	27 SEP 84	11.8	14	0.59	0.30	16	29	36	0.050
MW-5 Surficial (0-6 ft)	Core	24 SEP 84	3.0	8	0.38	0.16	7	6	20	0.050
MW-5 Sample 4 (8.0-8.5 ft)	Core	24 SEP 84	9.4	22	0.62	0.21	18	55	34	0.055
MW-6 Sample 5 (10.5-11.0 ft)	Core	25 SEP 84	11.5	9	0.49	0.34	5	30	33	0.040
MW-6 Surficial (0-6 ft)	Core	25 SEP 84	10.6	19	0.58	0.25	14	23	49	0.046

TABLE 4-31 (Cont.)

Station Location	Source	Date	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Thallium (mg/kg)	Zinc (mg/kg)	Total Phenolics (mg/kg)	Total Cyanide (mg/kg)	EA No.
Surficial Outfall 2	Core	12 SEP 84	42	0.1	<0.01	1.4	73	<0.4	<0.06	6100
B-1 Sample 9 (7.5-8.0 ft)	Core	12 SEP 84	74	3.0	0.02	1.0	84	<0.4	<0.06	6114
B-1 Sample 10 (9.0-9.5 ft)	Core	12 SEP 84	74	1.9	0.02	0.9	79	<0.4	<0.07	6115
B-2 Sample 4 (7.5-8.0 ft)	Core	12 SEP 84	52	2.5	<0.01	0.7	88	<0.4	<0.06	6117
B-2 Sample 5 (9.5-10.0 ft)	Core	12 SEP 84	78	2.5	<0.01	0.8	94	<0.4	<0.07	6118
B-3 Sample 5 (7.5-8.0 ft)	Core	12 SEP 84	60	1.3	<0.01	0.7	81	<0.4	<0.08	6120
B-3 Sample 6 (9.5-10.0 ft)	Core	12 SEP 84	60	3.6	<0.01	0.8	91	<0.4	<0.07	6121
B-4 Sample 4 (7.0-7.5 ft)	Core	13 SEP 84	62	1.3	<0.01	0.8	91	<0.4	<0.08	6123
B-4 Sample 5 (8.0-8.5 ft)	Core	13 SEP 84	66	1.4	<0.01	1.0	103	<0.4	<0.08	6124
B-5 Surficial (0-6 ft)	Core	24 SEP 84	28	6.2	0.04	0.8	186	<0.4	<0.07	6136
B-5 Sample 5 (9.0-9.5 ft)	Core	24 SEP 84	32	9.9	0.03	1.1	96	0.4	<0.07	6137
B-6 Surficial (0-6 ft)	Core	27 SEP 84	20	0.5	0.02	0.6	122	<0.4	0.08	6143
B-6 Sample 5 (9.5-10.0 ft)	Core	27 SEP 84	37	2.0	0.03	0.9	149	0.5	0.07	6144
MW-5 Surficial (0-6 ft)	Core	24 SEP 84	15	0.7	0.03	0.8	98	0.4	0.08	6138
MW-5 Sample 4 (8.0-8.5 ft)	Core	24 SEP 84	48	0.3	0.04	0.6	162	<0.3	<0.08	6139
MW-6 Sample 5 (10.5-11.0 ft)	Core	25 SEP 84	41	10.2	0.05	1.6	168	0.5	<0.08	6140
MW-6 Surficial (0-6 ft)	Core	25 SEP 84	31	0.2	0.02	0.8	144	<0.4	<0.07	6141

TABLE 4-32 SUMMARY OF GRAIN-SIZE DETERMINATIONS OF SOIL SAMPLES COLLECTED AT CATCH BASINS AND OUTFALLS, WIDE BEACH, NEW YORK, 1984

Station Location	% Sand	% Silt	% Clay	EA Number
Catch Basin 3	58.9	26.0	15.1	6087
Catch Basin 6	23.4	64.3	12.3	6084
Catch Basin 7	14.9	57.4	27.7	6085
Catch Basin 8	50.7	25.7	23.6	6099
Catch Basin 12	52.4	30.0	17.6	6086
Surficial Outfall 1	35.5	34.2	30.3	6101
Surficial Outfall 2	39.5	44.2	16.3	6100

TABLE 4-33 SUMMARY OF RESULTS OF PCB DETERMINATIONS FOR SEDIMENT AND SAND SAMPLES COLLECTED BY ECDEP AT WIDE BEACH, NEW YORK, MAY 1982

Station Number	Station Location	Collection Date	Sample Depth[a]	Source	Aroclor 1254 (mg/kg)
Streambed	Stream behind Station 50	18 MAY 82	SU	Sediment	34.8
			D		4.4
Streambed	Stream southeast of Station 49	18 MAY 82	SU	Sediment	0.2
Streambed	Stream north of Fox St. and east of intersection with Fox and South streets	18 MAY 82	SU	Sediment	1.8
			D		3.5
Marsh	At end of Outfall 2	19 MAY 82	SU	Sediment	155.8
Marsh	Stream outlet at Beach	19 MAY 82	SU	Sediment	<0.05
Beach	South of Access Road to Beach	19 MAY 82	SU	Sand	<0.05
			D		<0.05

(a) Surficial samples (SU) taken at 0-6 in.; deep samples (D) taken at 3-ft depth.

TABLE 4-34 SUMMARY OF RESULTS OF PCB DETERMINATIONS ON MARSH SEDIMENT CORES COLLECTED AT WIDE BEACH SITE, ERIE COUNTY, NEW YORK

Number	Station Location	Collection Date	Overall Core Length (in.)	Segment Length (in.)	Segment Designation	Aroclor 1254 (mg/kg)	EA Number
C1	Wide Beach Wetland	30 AUG 84	4.25	4.25	All	0.08	6063
C2	Wide Beach Wetland	30 AUG 84	2.87	2.87	All	0.02	6064
C3	Wide Beach Wetland	30 AUG 84	14.0	7.0	Top	0.07	6065A
C3	Wide Beach Wetland	30 AUG 84		7.0	Bottom	0.13	6065B
C4	Wide Beach Wetland	30 AUG 84	18.75	6.25	Top	0.17	6066A
C4	Wide Beach Wetland	30 AUG 84		6.25	Middle	ND	6066B
C4	Wide Beach Wetland	30 AUG 84		6.25	Bottom	ND	6066C
C5	Wide Beach Wetland	30 AUG 84	17.37	5.87	Top	2.4	6067A
C5	Wide Beach Wetland	30 AUG 84		5.87	Bottom	0.02	6067B
C5	Wide Beach Wetland	30 AUG 84		5.87	Middle	0.01	6067C
C6	Wide Beach Wetland	30 AUG 84	13.87	6.94	Top	70	6068A
C6	Wide Beach Wetland	30 AUG 84		6.94	Bottom	1.8	6068B
C7	Wide Beach Wetland	30 AUG 84	14.12	7.06	Top	3.7	6069A
C7	Wide Beach Wetland	30 AUG 84		7.06	Bottom	0.01	6069B
C8	Wide Beach Wetland	30 AUG 84	10.75	4.37	Top	13	6070A
C8	Wide Beach Wetland	30 AUG 84		4.37	Bottom	0.70	6070B
C9	Wide Beach Wetland	30 AUG 84	10.87	5.44	Top	1.4	6071A
C9	Wide Beach Wetland	30 AUG 84		5.44	Bottom	0.12	6071B
C10	Wide Beach Wetland	30 AUG 84	11.37	5.69	Top	6.4	6072A
C10	Wide Beach Wetland	30 AUG 84		5.69	Bottom	0.40	6072B
C11	Wide Beach Wetland	30 AUG 84	6.75	6.75	All	200	6073
C12	Wide Beach Wetland	30 AUG 84	9.63	4.81	Top	5.5	6074A
C12	Wide Beach Wetland	30 AUG 84		4.81	Bottom	0.09	6074B
C13	Wide Beach Wetland	30 AUG 84	14.63	7.31	Top	2.2	6075A
C13	Wide Beach Wetland	30 AUG 84		7.31	Bottom	0.02	6075B

TABLE 4-35 SUMMARY OF GRAIN-SIZE DETERMINATIONS OF SOIL CORE SAMPLES COLLECTED FROM THE MARSH, WIDE BEACH, NEW YORK, 1984

Station Number	Station Location	% Sand	% Silt	% Clay	EA Number
C1	Marsh	41.5	21.4	37.1	6063
C2	Marsh	89.1	1.3	9.6	6064
C3	Marsh	87.8	0.6	11.6	6065A
C3	Marsh	85.0	4.2	10.8	6065B
C4	Marsh	55.2	12.4	32.4	6066A
C4	Marsh	27.2	31.2	41.6	6066B
C4	Marsh	23.5	25.9	50.6	6066C
C5	Marsh	68.5	3.3	28.2	6067A
C5	Marsh	43.4	18.9	37.7	6067B
C5	Marsh	13.9	33.6	52.5	6067C
C6	Marsh	67.4	11.7	20.9	6068A
C6	Marsh	6.5	28.1	65.4	6068B
C7	Marsh	17.1	23.9	59.0	6069A
C7	Marsh	5.1	34.2	60.7	6069B
C8	Marsh	17.3	43.3	39.4	6070A
C8	Marsh	38.3	21.4	40.3	6070B
C9	Marsh	8.7	40.7	50.6	6071A
C9	Marsh	4.1	46.8	49.1	6071B
C10	Marsh	11.9	28.6	59.5	6072A
C10	Marsh	17.9	32.6	49.5	6072B
C11	Marsh	24.1	41.4	34.5	6073
C12	Marsh	23.9	34.6	41.5	6074A
C12	Marsh	32.9	27.7	39.4	6074B
C13	Marsh	33.4	27.5	39.1	6075A
C13	Marsh	16.0	42.0	42.0	6075B

TABLE 4-36 SUMMARY OF RESULTS OF PCB DETERMINATIONS ON ANIMAL TISSUE COLLECTED AT WIDE BEACH, ERIE COUNTY, NEW YORK

Station[a]	Location	Collection Date	Sample Type	Number[b] of Subsamples	Concentration Aroclor 1254 (mg/kg)	% Lipids	Concentrations Normalized for % Lipids (mg/kg)
1	Roadside shrub	28 AUG 84	Liver tissue	8	15.0	1.64	9.2
2	Backyard	28 AUG 84	Liver tissue	8	220.0	3.16	69.6
3	Wetland	30 AUG 84	Liver tissue	9	9.5	1.42	6.7
4	Wetland, Control	29 AUG 84	Liver tissue	5	0.27	2.72	0.1
5	Roadside, Control	30 AUG 84	Liver tissue	4	ND[c]	2.12	ND

(a) Refer to Plate 1 and Figure A-2 (in Appendix A) for actual location of trap lines.
(b) Liver samples from organisms captured were composited.
(c) ND = not detected.

5. EXTENT OF CONTAMINATION AND DEFINITION OF CRITICAL AREAS

In general, inspection of the data reveals the presence of Aroclor 1254 contamination over the majority of the site in all environmental media. In view of the numerous opportunities for transport (windborne dust, vehicles, runoff), this widespread distribution pattern is to be expected.

Ground-water data collected in this RI study (Section 4.1) indicate that one of eight monitoring wells and all six sewer trench wells were contaminated with Aroclor 1254. Based on the drinking water sampling and past studies, 21 of 60 residential wells have been contaminated at some point in time. The sewer trench well samples had the highest PCB values of all ground-water samples. The surficial soils from the sewer trench wells were also found to be contaminated with Aroclor 1254 although there is no correlation between levels in the soil and those in the wells. Levels of Aroclor 1254 in residential wells are both low and sporadic in occurrence. Of the different types of ground-water samples, only sewer trench water may be considered to be a critical area. This is discussed in more detail in Section 6.1.

With regard to soils (Section 4.3), contamination was found in 52 of 53 driveway samples, all yards, all roadway samples, and all drainage ditch and roadway soil samples. There were no immediately obvious patterns of PCB distribution observed at the site. Linear correlation analysis between PCB levels in vacuum cleaner dust, yard soil, driveway soil, and roadway soils revealed no statistically significant associations.

To assess the extent of contamination more accurately, a Soil Removal Criterion of 10 mg PCB/kg soil, which had been recommended by NYSDEC was used as a decision criterion to illustrate significance of contamination. Each occurrence of soil (>10 mg/kg) or dust from EA's investigation, the FIT investigations, and the ECDEP 1982 report was plotted on the same map (Figure 5-1). Other criteria used were the TSCA incineration level of 500 mg/kg and the presence of detectable Aroclor 1254 at less than 10 mg/kg levels. This analysis indicates that there is an observable elevation in the number of high concentrations (>10 mg/kg) in the area of the oval, north and south outside of the oval, and adjacent to the roadways. The eastern portion of the oval showed the largest cluster of high concentrations.

Several soil areas had very high concentrations (>500 mg/kg) of Aroclor 1254. These include the Guerra yard (Station No. 38) (600 mg/kg), catchbasin No. 6 (5,300 mg/kg), OW-2 surficial soil (670 mg/kg), and the Prince (Station No. 28) dust sample (770 mg/kg). These samples bear no spatial relationships to each other. NUS (1983a) also identified a roadway sample of 3,860 mg/kg adjacent to catchbasin No. 6. These two values indicate that the northeast portion of the oval has the greatest soil contamination.

Runoff from the site is contaminated with Aroclor 1254, as indicated in samples from the outfall discharges, wetland surface water, and storm water in the catchbasins. In all cases, the majority of the PCBs were

associated with the particulate fraction. For example, the first storm-water sample from Outfall 1 had 93 ug/L total PCBs of which only 0.92 ug/L were dissolved PCBs. At Outfall 1, PCB concentrations in the runoff dropped by an order of magnitude within one-half hour. Even with the limited storm-event data, it is evident that surface water is one of the primary routes of transport off the site. This was indicated not only by PCB concentrations in storm water, but also by sediment PCB concentrations in the wetland. The highest levels in the sediment were proximate to the storm drain outfalls. The majority of PCBs were concentrated in the surficial sediments, as evidenced by analysis of shallow and deep sediment core sections. Throughout the remainder of the wetland, PCB concentrations in the sediments were low.

Several other organic priority pollutants were found at the site (Table 5-1). Methylene chloride and acetone have been eliminated from this analysis as they are probably laboratory or sampling artifacts. Most of the remaining organic compounds are probably from common consumer products or every-day activities. Tetrachloroethene has been used as a degreaser, dry cleaning fluid, septic tank cleaner, and soil fumigant. Fluorotrichloromethane (Freon-11) has been used as aerosol propellent and is still used as a refrigerant. Xylene is a common component of gasoline. The polyaromatic hydrocarbons (chrysene, fluoranthene, pyrene, benzo(a)-anthracene, and benzo(a)pyrene) are very common in soils. Deposits of these materials may result from burning trash or draining crank case oil. In addition to the compounds found on Table 5-1, which are probably unrelated to the PCB contamination, bis(2-ethylhexyl)phthalate and di-n-butylphthalate were found in five different samples at part-per-million levels. Bis(2-ethylhexyl)phthalate was reported in seven samples in the FIT investigation (NUS 1983a). 1,2,4-trichlorobenzene was reported in eleven samples in the FIT investigation. These base/neutrals may be associated with the PCB contaminated oil applied to the roads. Most PCB found in the environment originated from dielectric fluids associated with transformers and capacitors. 1,2,4-trichlorobenzene has been used as a dielectric fluid (EPA 1980b) with 5-10 percent of production being used in this application. Trichlorobenzenes have been used in conjunction with 60-70 percent PCBs in transformers. Phthalates are also used as dielectric fluids. Additionally, Bis(2-ethylhexyl)phthalate is a common plasticizer and rather ubiquitious in the environment, and a frequent contaminant in environmental samples. A currently manufactured dielectric contains both bis(2-ethylhexyl)phthalate and 1,2,4-trichlorobenzene (Addison 1982).

No evidence of significant inorganic contamination was found in water samples at Wide Beach. With respect to metals, nickel was somewhat elevated compared to national averages; however, this is probably natural in origin. Metals were also within average values for U.S. soils. With respect to semi-metals, selenium was found at soil levels outside the range of typical values (NAS 1976). This phenomenon was also noted in the FIT investigation (NUS 1983a). The origin of the selenium is not known.

It may be concluded that some degree of PCB contamination exists over the entire site. The most significant levels of contamination were found in the sewer trench well samples (relative to other ground-water

samples), soils adjacent to the roadways, and wetlands sediments in the vicinity of stormwater outfalls. Soil contamination is primarily surficial. The distribution of PCBs indicates that transport may be occurring by pedestrian and vehicular traffic, by stormwater runoff, by atmospheric dispersion, and in the past by excavation and relocation.

TABLE 5-1 ORGANIC COMPOUNDS FOUND AT WIDE BEACH

Compound	Concentration	Location	Possible Source
Tetrachloroethene	27 ug/kg	Surficial Outfall 2	Consumer Products
Fluorotrichloromethane	12 ug/kg 48 ug/kg	Boring 2 Boring 4	Consumer Products
Xylene	8 ug/L	MW-3	Gasoline
Total trihalomethanes	35 ug/L	Farnham Fire Hall	Water chlorination
Chrysene	0.1 mg/kg	Boring 4	Combustion, crankcase oil
Fluoranthene, pyrene, benzo(a)anthracene, benzo(a)pyrene	Each 0.2 mg/kg	Boring 5	Combustion, crankcase oil

6. ASSESSMENT OF CONTAMINATION MIGRATION PATHWAYS

6.1 MIGRATION VIA THE WATER ROUTE

The PCBs at the Wide Beach Development Site are located primarily in surficial soils. PCBs may migrate via surface water, ground water, or both. Surface-water migration may result from either solubilization and runoff or erosion and sediment transport of PCBs adsorbed to soils. Ground-water migration will be in a dissolved form.

6.1.1 Surface Water

Surface water is a significant transport mechanism on the site. As indicated in Table 4-7, PCBs were found to be present in stormwater runoff from the site in the concentration range of 4-93 ug/L as Aroclor 1254. These PCBs appear to be primarily associated with the particulate fraction in the runoff. The variation in PCB distribution in the runoff water with time is indicative of erosion with highest concentrations appearing initially. Surface-water erosion is most likely partially responsible for the contaminant redistribution observed onsite. High PCB concentrations observed in the wetland area south of the site area no doubt result from stormwater runoff with the wetland marsh acting as a sediment trap. The deposited sediment thus constitutes at least a temporary reservoir for PCBs. PCBs may be released from this reservoir by re-equilibration with water or by resuspension of the sediment during a storm event. The ultimate sink for waterborne PCB is Lake Erie. This whole process in the wetland would vary seasonally owing to the intermittent nature of discharge to Lake Erie through the wetland/stream outlet.

The PCB loading to the stream/wetland system and to Lake Erie may be estimated based on estimated runoff volumes and PCB concentrations. If the concentrations reported for Outfall No. 1 in Table 4-7 are taken to be typical of runoff, representative PCB concentrations in runoff are 19.34 and 0.86 ug/L for particulate and dissolved fraction, respectively, with a total value of 20.20 ug/L. If the total site acreage is estimated to be 55 acres, as indicated in Table 3-2, the drainage directly to Lake Erie is 3.9 acres. Drainage to the stream/wetland system can be estimated to be 47.4 acres. Additionally, 3.7 acres appear to drain offsite to the north.

If it is assumed that all of the 18 in./yr of storm runoff (Section 3.4.2) is surface flow, the average surface water flow can be estimated to be 1.9×10^6 and 23×10^6 gal/yr (7.2×10^6 and 8.5×10^7 L/yr) to the lake and stream/marsh, respectively. This represents a maximum potential loading of 0.14 and 1.7 kg of PCBs to the lake and stream/marsh systems, respectively. If it is further assumed that the total PCBs discharged to the stream/marsh will reach Lake Erie, it can be estimated that a maximum loading of 1.8 kg/yr to Lake Erie can be expected via stormwater runoff. It should be noted that this is a worst-case scenario which assumes year-round discharge to Lake Erie and continuous suspension of particular material. Utilizing the same rationale, it can be estimated that a maximum of 0.13 kg/yr of PCBs are transported offsite to the north in storm runoff.

6.1.2 Ground Water

PCB ground-water contamination on the site is possible through a variety of routes, its origin being the contaminated soils. Contamination may occur either by leaching of PCBs from the surficial soils via infiltration or migration from disturbed soil where contaminated surficial soils have been buried at deeper levels. The second mechanism of primary concern is in the sanitary sewer trenches where contaminated soils may have been utilized as backfill.

6.1.2.1 Leaching of PCBs from Surficial Soils to Ground Water

Contamination of the soil was caused by the spreading of waste oils containing PCBs on the roads as a dust control measure. Following application of oil contaminated with PCBs to the ground surface, the PCBs migrate through the unsaturated zone toward the water table. Initially, this movement may be in the bulk oil; however, as this mixture moves into the soil PCBs will become tightly bound by adhesion to the soil particles. This generally appears to have happened within the top 6 in. of soil at the Wide Beach site. Further migration of the PCBs occurs via solubilization into water infiltrating through the vadose zone. This solubilization is controlled by the physicochemical nature of both the PCBs and the soils. The controlling factors typically are the soil organic carbon - water partition coefficient (Koc = 4.25×10^4 for Aroclor 1254) and the soil organic content (OC = approximately 1.3 percent at Wide Beach).

The concentrations of PCBs in ground water associated with soils can be estimated by calculating the equilibrium state of a water/soil mixture from soil PCB concentration, the Koc and OC, and the soil water content. Assuming typical and high soil PCB concentrations of 50 and 500 ug/L, respectively, the resulting ground-water concentration of PCBs can be expected to be from 3.2 to 32 ug/L at equilibrium.

As the water moves through the soils, the PCBs are adsorbed and desorbed by organic matter. This results in a slowing or retardation of the PCB movement through the soils. The phenomenon was described mathematically by Bear (1972) as:

$$\frac{\partial c}{\partial t} + \rho/n \frac{\partial s}{\partial t} = D \frac{\partial^2 c}{\partial x^2} - V \frac{\partial c}{\partial x}$$

where

- c = aqueous concentration (M/L^3)
- t = time (t)
- ρ = soil bulk density (M/L^3)
- n = porosity (dimensionless)
- s = sorbed concentration (dimensionless)
- D = dispersion coefficient (L^2/t)
- x = distance (L)
- V = fluid velocity (L/t)

By assuming linear retardation, the relationship between adsorbed and aqueous solubility may be written as:

$$S = Koc\ OC\ C$$

differentiating with respect to time

$$\frac{\partial s}{\partial t} = Koc\ OC\ \frac{\partial c}{\partial t}$$

substituting

$$\frac{\partial c}{\partial t} = D/Rf\ \frac{\partial^2 c}{\partial x2} - V/Rf\ \frac{\partial c}{\partial x}$$

where

$$Rf = 1 + (\ell/n)\ Koc\ Oc$$

The average PCB velocity relative to ground water may be written as:

$$V_{PCB}/V = 1/Rf$$

Utilizing the above equations and assuming both an average vadose zone water content of 20 percent based on field observations and an average infiltration rate of 0.2 million gal/mi^2/day (Erie and Niagara Counties Regional Planning Board 1978), the vertical PCB velocity may be estimated to be 0.0011 ft/yr. Assuming an average depth to ground water of 10 ft based on site conditions, it can be calculated that the average PCB travel time from surface soils is approximately 9,000 years to the water table at Wide Beach.

These calculations represent only the average transport time through the soil matrix. The situation is complicated by several factors. PCB transport may occur through fractures either micro or macro in the soil, thereby accelerating ground-water velocity and reducing retardation, resulting in greatly increased PCB velocity. This phenomenon is described in detail by Grisak and Cherry (1975) and Roberts et al. (1982) The effects of fracturing on ground-water movement are to reduce the effective porosity. Grisak and Cherry's results indicate that effective porosity may be reduced by more than two orders of magnitude. This would result in a reduction in the average PCB travel time to ground-water estimate to less than 90 years.

The estimate is further complicated by the use of an average retardation factor based on average OC and Koc values. As discussed elsewhere, Aroclor 1254 is a mixture of chemically similar but not identical congeners. These congeners have varying affinities for soil organic material; therefore the lighter congeners which are more soluble will migrate more rapidly than the average molecular weight congeners. Additionally, organic carbon content of deeper soils may be less than 1.3 percent. Assuming an OC of 0.25 percent, the vadose zone ground-water velocity of the lighter congener may be estimated as 0.017 ft/yr. At some points

on the site, depth to ground water may be as low as 5 ft. This would result in a PCB travel time to ground water on the order of 300 years. Again assuming some of this transport may be through soil fractures, some PCBs can be expected to have migrated to the ground water in less than 3 years following surface application.

As is apparent from the above discussion, it is very difficult to fix a precise value to the PCB migration rate through the unsaturated soils on site. It is, however, possible to draw the following conclusions:

1. PCBs will and have migrated downward through the vadose zone in the one to tens of ug/L range.

2. The surficial soils will act as a long-term (possibly thousands of years) source of PCBs.

3. Migration via this route may have already resulted in low level ground-water contamination in the saturated zone.

4. The potential exists for more significant ground-water contamination via this route in the future.

6.1.2.2 PCB Leaching from Disturbed Soils

Installation of a sewer system resulted in backfilling of the sewer trench excavation with PCB-contaminated soils. The sewer trench construction includes a bedding material of Number 1 stone (Figure 3-11). The as-built drawings (Edwards and Moncrieff 1977) do not indicate any flow blockage in this bedding material. As a result, this backfill may serve as a highly permeable conduit for rapid ground-water flow. Additionally, the low specific surface area and organic carbon content of the backfill will result in relatively little retardation of PCB transport. Therefore, the sewer trenches represent a potential conduit for rapid PCB transport. This transport may either be into the bedrock or offsite to Lotus Point down the sewer trench.

The results of ground-water analysis of samples from the sewer trench wells confirm this (Table 4-11). Of particular importance is the relatively high level of PCBs in SW-3 (1.4 ug/L). SW-3 is situated approximately 140 ft north of the loop road and in an area of low surfical PCB contamination (0.88 mg/kg). The PCBs found in the SW-3 water sample most probably migrated through the bedding from a point near the road.

As indicated in Figure 6-1, perched water is found in the sewer trench. This water may be discharging into bedrock in the northwest portion of the site. PCB concentrations and occurrences to date in either the monitoring wells or in previous and current samplings of the domestic wells do not indicate higher levels of contamination at this portion of the site. This may, however, indicate only that the PCBs migrating via this route have not yet reached the wells.

Another potential PCB migration direction in the bedding is offsite. Figure 3-10 is a map illustrating the sewer line location on and adjacent to the site. Figure 6-2 is a schematic diagram illustrating the relative elevation and linear distances between manholes in the sewer line, based on the assumption that the bottom of the bedding material is 6 in. beneath the sewer inlets. The numbers indicate manhole numbers. The sewer is a gravity sewer feeding into the pump station from both onsite and offsite. There is a force main from the pump station in the same trench, above the gravity main (Figure 3-11) from the pump station offsite. The "limits of influence" illustrated in Figures 3-10 and 6-1 are based on water levels and ground levels at SW-3. The assumptions are that water will not travel offsite down the sewer trench beyond the points at which the elevation of the bottom of the bedding material exceeds the elevation of the water level measured 27 November 1984 and the ground surface at SW-3. Based on the water level limits of influence, substantial offsite migration is possible. Based on ground-water surface limits, migration to the vicinity of neighboring homes with water supply wells is possible.

Based on the above evaluation of potential PCB ground-water transport in the sewer trench, the following is concluded:

1. The sewer trench bedding material appears to be acting as a pathway for ground water contaminated with PCBs in the 1-10 ug/L range.

2. The discharge of this contaminated water appears to be to bedrock ground water onsite, offsite, or both.

3. Ground-water PCB concentrations and occurrences observed to date do not indicate current contamination via this pathway. However, this may only be indicative that the PCBs migrating via this route have not yet arrived in the wells.

4. The potential exists for PCB contamination of offsite drinking water wells in the 1-10 ug/L range as a result of flow in the sewer trench.

6.1.2.3 Other Potential Migration Pathways to Ground Water

Migration of PCBs to saturated ground water is possible through other pathways including from septic leachfields, unsecured (improperly grouted) wells, and in solvent spills. The septic tanks were in use when the PCBs were applied to the site and may still be in use at some of the residences. As indicated in Section 4.2, high levels of PCBs are present in house dust. It is therefore to be expected that PCB-contaminated soils and other materials would have been rinsed into the septic systems through laundering and cleaning. Most older and many new drinking water wells may not be properly grouted; this could result in a rapid conduit from the surface for PCBs to be carried by surface water into ground water. Compared to the other more obvious transport pathways, migration via these pathways is difficult to quantify. However, its possibility cannot be neglected.

6.1.2.4 Contaminant Transport in Saturated Ground Water

After reaching the ground-water table, transport of much the same nature as described above will occur in the saturated zone as in the unsaturated zone; however, migration will be primarily in a horizontal direction. Retardation of PCB movement in the saturated overburden will be much the same as in the unsaturated zone. In the fractured bedrock, however, transport is far less likely to be retarded due to lower surface area and organic matter available for adsorption.

In bedrock, the PCB velocity is highly dependent on the nature of the fracturing. It is conceivable that in some fractures water velocities in the feet-per-day range are possible, and little if any PCB retardation is occurring. Under such a condition, transport of PCBs would be quite rapid.

Contouring of ground-water elevations (Figure 3-3) indicates discharge is either to the stream/wetland directly south and southeast of the site or to Lake Erie. Offsite migration of ground water appears unlikely, with the exception of the potential for some movement to the north. Based on estimates of area of ground-water drainage from the site into Lake Erie and the stream/wetland system (10 and 45 acres, respectively), an average annual ground-water discharge of 4.2 million L directly to Lake Erie and 19.7 million L to the stream/wetland system can be calculated. Current ground-water concentrations of PCBs are generally nondetectable. If a typical concentration of 0.1 ug/L is assumed, the current ground-water PCB discharge directly to the lake is approximately 0.00093 lb/yr and 0.0042 lb/yr to the stream/wetland. This represents a total ground-water discharge of 0.0052 lb/yr. Assuming an average PCB concentration of 50 mg/kg across the site, the ultimate maximum PCB ground-water discharge will be approximately 0.030 and 0.13 lb/yr to the lake and stream/wetland, respectively, for a total of 0.16 lb/yr (0.07 kg/yr).

6.1.3 Summary and Conclusions

Surficial soils, surface water (stormwater) and some ground water onsite are contaminated to some degree with PCBs. The pathways of PCB migration are complex and difficult to quantify. Based on this evaluation of the data, the following is concluded relative to PCB migration from surface water to ground water:

1. Storm-induced surface water flow is a significant transport mechanism resulting in the migration of PCBs away from the roadway source and ultimately offsite.

2. In the absence of remediation, intermittent PCB loadings to Lake Erie are predicted to occur at the kilogram-per-year level.

3. Migration of PCBs to ground water onsite is occurring. The following are considered likely pathways:

Major

- Infiltration from surficial contamination
- Discharge from PCB-contaminated perched water in the sewer trench

Minor

- Infiltration from septic tank leach fields
- Infiltration from ungrouted water wells

4. In the absence of remediation, concentrations of PCBs currently in ground water are likely to increase, assuming little or no biodegradation, to the one-to-tens of ug/L range.

5. Left in place, the surficial soils will serve as an extremely long-term source to ground water of PCBs (perhaps for thousands of years).

6. PCB migration of concentrations in the 1-10 ug/L range offsite in the sewer trench bedding material into Lotus Point water supply wells is possible.

7. Ground-water discharge of PCBs is most likely to Lake Erie and the stream/wetland system south and east of the site. PCB discharge by ground water is estimated to be currently occurring at approximately 0.0041 lb/yr. It is estimated to increase to a maximum of approximately 0.13 lb/yr.

6.2 MIGRATION VIA THE AIR ROUTE

The partitioning of Aroclor 1254 in the vapor phase compared to the particulate phase may be assessed by consideration of the relevant equilibrium. Kenaga and Goring (1980) present an organic carbon based partition coefficient (Koc) for Aroclor 1254 of 42,500. Since the average soil organic carbon at Wide Beach is 1.3 percent, the soil-water partition coefficient is

$$K_{sw} = 42500 \times \frac{1.3}{100} = 548$$

The Henry's Law constant for Aroclor 1254 is given as 2×10^{-4} atm-m^3/mol which yields a dimensionless Henry's Law constant (H') of 8.3×10^{-3} (Murphy et al. 1983). Since the Henry's Law constant is defined as the ratio of PCB concentration in air to that in water (Ca/Cw) and the soil partition coefficient is the ratio of the compound's concentration in soil to that of water, the ratio of the compound in air to that in soil is given by

$$\frac{Ca}{Cw} \times \frac{Cw}{Cs} = \frac{Ca}{Cs} = \frac{H'}{K_{sw}} = K_{as}$$

For Aroclor 1254 at Wide Beach, this air-soil partition coefficient K_{as} may be evaluated as 1.5×10^{-5}. Thus, there is little tendency for PCBs to exist in the vapor phase in the presence of soil sorbant. It should be noted that this value is itself probably too high. Weber et al. (1983) investigated the sorption of Aroclor 1254 on various materials and found it to be at least an order of magnitude higher than that determined with Kenaga and Goring's values, probably due to the ability of PCBs to bind to the soil inorganic fraction in addition to the organic. Thus, although particulate concentrations in the air may be very low, adsorbed PCBs must be considered along with volatilized PCBs in assessing human exposure.

There are numerous techniques for evaluating the volatilization rate of a compound from the soil (Lyman et al. 1982). The method of Shen (1982) has been used to estimate PCB emissions from soil. This involves calculating the volumetric emission rate

$$\frac{dV}{dt} = 2\, C_e\, W\, (DLv/\, F_v)^{1/2}\, W_i$$

where

dV/dt = emission rate (cm^3/sec)

C_e = VP/Patm = $1.1 \times 10^{-4}/760 = 1.4 \times 10^{-7}$

W = site width = 3.66×10^4 cm (NUS 1983)

L = site length = 8.23×10^4 cm (NUS 1983)

D = diffusivity = 3.99×10^{-2} cm^2/sec

v = wind speed = 120 cm/sec

F_v = 1 (Shen 1982)

W_i = 5.3×10^{-3} (worst-case mass fraction of PCB in soil)

The ambient concentration may then be calculated by a modified box model for a point source:

$$C = \frac{E}{vHW}$$

where

H = mixing height

If a mixing height of 200 cm (breathing zone) is assumed

$$C = \frac{250}{120 \times 200 \times 3.66 \times 10^4}$$

$$= 2.8 \times 10^{-7}\ ug/cm^3$$

$$= 0.28\ ug/m^3$$

For the average driveway soil PCB concentration of 68 mg/kg, the corresponding concentration is 3.6×10^{-3} ug/m^3. This value approaches those actually measured at the site (Section 4.2.4), thus validating the model. Both measured and modeled values are considerably less than the NYSDEC Acceptable Ambient Level of 1.67 ug/m^3.

The high affinity of Aroclor 1254 for soil indicates that wind entrainment of dust particles should be considered as a transport process. The following model is proposed by Thibodeaux (1983):

$$E = A\ V_d\ W_i\ C_d$$

where

A = site area (3.24×10^6 cm^2)

W_i = 5.3×10^{-3} (worst case)

C_d = dust concentration (12.0×10^{-4} ug/cm^3) (worst-case)

V_d = deposition velocity (assumed 2 cm/sec)

This model yields emission rates as follows:

$E = (3.24 \times 10^6)\ (2)\ (5.3 \times 10^{-3})\ (2.0 \times 10^{-4})$
= 6.9 ug/sec for the worst case under undisturbed conditions

$E = (3.2 \times 10^6)\ (2)\ (6.8 \times 10^{-4})\ (2.0 \times 10^{-4})$
= 0.88 ug/sec for average PCB concentration

By the box model, this translates to an ambient concentration of 7.9×10^{-3} ug/m^3 for the worst-case and 1.0×10^{-3} ug/m^3 for the average scenario. The combined concentrations for the vapor and particulate phases are 0.29 ug/m^3 for the worst-case and 4.6×10^{-3} ug/m^3 for the average scenario. The vapor phase:particulate ratio is 78 percent vapor phase compared to 22 percent sorbed, which is typical of rural areas (Eisenreich 1981). The modeled concentrations are similar to the measured value of 5.2×10^{-3} ug/m^3 (ECDEP 1982). This report also noted vapor phase:particulate ratios of about 1:1, similar to those defined by the model.

Once the Aroclor 1254 becomes airborne, it will rapidly become transported offsite and dispersed whether it is in the vapor or sorbed phase. For example, Lotus Point is about 2.7 km from the center of Wide Beach. Using the model of Turner (1970) with the site assumed to be a point source, neutral atmospheric stability, and the average wind speed measured at the site, concentrations of 6.3×10^3 ug/m^3 for the worst-case and 1.7×10^{-3} ug/m^3 for the average scenario may be calculated. (The offsite distribution of Aroclor 1254 is shown in Figure 6-3).

An assumption which underlies the atmospheric modeling at Wide Beach is that the wind speeds measured during the site investigations are representative of average conditions. In fact, they are rather low--average

1.14 m/sec compared to 5.54 m/sec from historical data (NOAA 1974). The effect of wind speed on air dispersion is complex; however, the net effect is to decrease concentration at the receptor site.

The concentrations of airborne particulates described above are time averaged and do not necessarily represent the worst-case scenario. The history and soil conditions at the site indicate a high potential for added dust emission from the roads especially during the high use summer months. This phenomenon may be modeled using the work of Cowherd and Guenther (1976) as a basis.

The total road length at the site is approximately 1.1 mi. We assume that each car travels 0.5 mi/day based on traffic patterns. We also assume 1 car per household used every day. The vehicle miles traveled (VMT) may then be estimated as

$$VMT = (365 \text{ days})\ (60 \text{ cars/day})\ (0.5 \text{ mi})$$

$$= 1.1 \times 10^4 \text{ mi/yr}$$

NOAA (1974) notes an average of 200 dry days per year at Buffalo. The speed limit at Wide Beach is 15 mph. The soil at the site ranges from 0.6 to 64.3 percent silt with an average of 28.9 percent. The emission factor (EF) may be calculated

$$EF = 0.49\ (\text{silt percent})\ \left(\frac{\text{speed}}{30}\right)\ \left(\frac{\text{dry days}}{365}\right)$$

This yields an average value of 3.9 lb per vehicle mile and a maximum of 8.6 lb per vehicle mile. The average annual emissions are then 1.9×10^4 kg dust and the maximum is 4.3×10^4 kg, based on average and maximum silt levels.

The average road PCB concentration (NUS 1983a) was 76 mg/kg. Driving of cars on the roadway could thus result in emissions of up to 3.3 kg PCBs per year.

Summary and Conclusions--Based on ambient dust measurements and meteorological conditions, the concentrations of airborne PCBs, both vapor and sorbed phase, have been modeled. For the worst-case scenario, the onsite concentration is 0.29 ug/m^3 and the concentration at Lotus Point is 6.3×10^{-3} ug/m^3. For an average case scenario, the concentration onsite is 4.6×10^{-3} ug/m^3 and at Lotus Point is 1.7×10^{-3} ug/m^3. These levels will be raised considerably by vehicular traffic dust dispersion.

The implications of PCB sorption to the Wide Beach site are primarily concerned with the fact that the soil is acting as a reservoir.

6.3 ENVIRONMENTAL FATE OF PCBs

The purpose of this section is to present an overview of the physicochemical behavior of PCBs in the environment with emphasis placed on potential chemical changes. This material will be viewed in the context of both migration pathways and health or environmental effects. In order

to accurately assess the chemodynamic behavior of PCBs in the environment, a set of accurate and consistent parameters is required. A literature review was conducted, the parameters obtained critically evaluated, and the results shown in Table 6-1. With respect to physical processes, the primary fate of PCBs is related to sorption.

The sorption properties of PCBs have been extensively studied (Griffin and Chou 1981; Weber et al. 1983). These investigators report strong binding between PCBs and soils and high capacity of soils for PCBs. Whole soil capacities (such as Freundlich constants K_f) ranged from 0.14 ug/g to 4.2 ug/g depending on the organic carbon content of the soil. Aroclor 1254 was also found to bind to clay (Kaolinite K_f = 0.32 ug/g), river sediment (K_f = 7.7 to 17.4), algae (K_f = 270), and bacteria (K_f = 420 to 605). For comparison, the capacity of activated carbon for PCBs is >200 mg/g (Dobbs and Cohen 1980).

It has recently been found (DiToro and Horzempa 1983) that adsorption of PCBs is not totally reversible, i.e., some finite residual quantity will always remain in the sorbed phase.

Problems associated with soil binding of PCBs are also complicated by the composition of the matrix which was the source of the PCBs. A typical Aroclor 1254-based transformer dielectric contains tri- and tetrachlorobenzenes in addition to 45 percent PCBs plus organic stabilizers (NIOSH 1977). The RAMP additionally notes that the PCBs at Wide Beach were originally applied as a fraction of road oil. Thus their mobility in either the air or water phase may be related to the mobility of the oil. Oil hydrocarbons are typically more mobile, volatile, and degradable than PCBs.

PCBs are not subject to hydrolysis, oxidation, or thermal degradation at environmentally significant rates (EPA 1980a; Callahan 1979). This leaves photolysis and biodegradation as the only chemical routes for PCB decay. Most PCB congeners will undergo photolysis to some extent. The rates of these processes are very slow ($\sim 10^{-9}$ M s^{-1} in cyclohexane) and quantum yields low (≤ 0.1) (Zabik 1983). Taken in conjunction with the fact that sorbed PCBs may not be available for absorption of solar energy, photolysis will probably not be important at Wide Beach. Additionally, photolysis does not result in complete degradation of the PCB molecule. Reaction products may be more toxic than PCBs themselves, a fact which is addressed in greater detail below.

PCBs with four or fewer chlorines are biodegradable; however, again the rates are slow. Tucker and co-workers (1975) found that only 19 percent of Aroclor 1254 was degraded in 48 hours of treatment with activated sludge. The rates for biodegradation in sediment range between 10^{-10} to 10^{-13} ng/ml-hr (NAS 1979). Under controlled conditions, Aroclor 1254 can be degraded by soil microorganisms. A half-life of 140 days may be calculated from the data of Hankin and Sawhney (1984). Their conditions, however, cannot be obtained in the natural environment. Thus, although it is unlikely that biodegration will be significant at Wide Beach, there may ultimately be some removal of congeners with four or less chlorines.

The by-products of PCB metabolism by soil microorganisms are largely unknown. However, studies of mammalian metabolism (Matthews 1983) and aquatic microorganisms (Shiarls and Sayler 1982) have identified several classes of metabolic products. These studies have generally been done with individual PCB congeners rather than mixtures and with PCBs of low to moderate degrees of chlorination; yet extrapolation from these studies to soil systems still gives the best indication of potential soil metabolites. The major chemical classes of metabolites are chlorinated benzoic acids, hydroxychlorobiphenyls, and dihydrodiolchlorobiphenyls. Shiarls and Sayler (1982) identified chlorobenzoyl formic acid (chlorophenylglyoxylic acid) as a product of aquatic degradation; thus substituted glyoxylic acids may also be a soil metabolite.

The fate and effects of the metabolites are very difficult to predict because the chemical characteristics and toxicities of these compounds are ill defined. Table 6-2 presents some of the chemical characteristics of chlorinated benzoic acids.

PCB metabolites will be more mobile in ground water than PCBs due to their greater water solubilities and diminished lipophilicity. For example, o-chlorobenzoic acid will be 10^4 times more mobile than Aroclor 1254 based on octanol-water partition coefficients. Thus, it is likely that, if microbial degradation is occurring at the site, the ground water could become contaminated with metabolites. Generally, the higher water solubilities and biodegradability of the monochlorobenzoic acids suggests they will not pose an environmental threat or health hazard.

The toxicities of representative chemicals from the chlorinated biphenyldiol and benzoic acid classes are in Tables 6-3 and 6-4. The dichlorobenzoic acids appear to be more acutely toxic than Aroclor 1254, but there is no information to indicate their chronic toxicity, mutagenicity or carcinogenesis relative to PCBs.

A potential problem associated with the environmental fate of PCBs is the formation of polychlorinated dibenzofurans (PCDF). These compounds have been found to be considerably more toxic than PCBs (Bandiera 1984); their levels have not been extensively monitored in the environment.

It has been demonstrated that PCDF may be formed from PCBs by heat (Rappe et al. 1983) and photolytic processes (EPA 1980). A reasonable biochemical mechanism may be formulated for the transformation of PCBs to PCDFs using demonstrated chemical reactions (Figure 6-4). It is thus possible that biodegradation is resulting in the formation of small quantities of PCDFs at Wide Beach. The mobilities of PCDFs are similar to those of PCBs; thus, it may be expected that if PCBs are controlled by remediation, PCDFs will be also.

In order to investigate the fate of PCBs at Wide Beach in detail, a series of chromatograms was examined in greater depth than in usual quantitative analysis. The basis for this examination was chromatographic profiling--a technique whereby complex chromatograms are normalized and compared to each other by retention time patterns. Profiles

were prepared for samples extracted from vacuum cleaner dust, surface water, ground water, driveway soil, yard soil, deep soil, a sediment core, and Aroclor 1254 standards (Figures 6-5 and 6-6).

With regard to the samples chromatographed on OV-1, the surface water sample showed the closest resemblance to the standard. The vacuum cleaner dust sample showed a sharp difference compared to the standard with the earlier eluting peaks being greatly attenuated. The groundwater sample revealed the opposite phenomenon, i.e., it was enriched with lower molecular weight materials. The samples which were chromatographed on SP-2250 did not show as dramatic differences as those on OV-1; however, this is probably due to their matrix similarity rather than the chromatography. For this set, the sediment core most closely resembled the Aroclor 1254 standard, followed by the driveway, deep soil, and yard. The driveway and deep soils were extremely close in their profiles.

In chromatography of PCBs, the earlier eluting peaks contain the congeners with fewest chlorine atoms (Webb and McCall 1973). In general, they are of lower molecular weight, more volatile, more water soluble, and less lipophilic. The peaks which elute later are of higher molecular weight, less volatile, less water soluble, and more lipophilic. It is quite probable that the two predominant mechanisms underlying the change in congener profiles are volatilization and sorption. In the case of the vacuum cleaner samples, the lower molecular weight congeners appear to have volatilized. Based on the data from Mackay et al. (1983), calculated values of soil-air partition coefficients indicate that tetrachlorobiphenyls are on the average 5.5 times more volatile than heptachloro congeners. In the case of ground water, it is probable that the higher molecular weight congeners are more attenuated by soil adsorption than the lower molecular weigh congeners. The heptachloro congeners have an affinity for adsorbtion approximately 7 times greater than the tetrachloro congeners. The smaller difference noted on the SP-2250 chromatograms are also probably caused by the combined effects of volatilization and adsorption.

There are several ramifications of this analysis of PCB fate at Wide Beach. First, while sorbed to the soil, there is no reasonable mechanism for rapid environmental degradation. Second, the potential exists for the formation of PCDF through microbially mediated processes. Last, some samples are being enriched in various molecular weight fractions due to various environmental processes. This may have the net effect of altering toxicities and/or bioaccumulation potential of Wide Beach PCB compared to virgin Aroclor 1254.

TABLE 6-1 AROCLOR 1254 PHYSICOCHEMICAL PARAMETERS

1. Average number of chlorines = 4.96 (a)
2. Average molecular weight = 327 (a)
3. Boiling point 638-663 K (a)
4. Aqueous solubility = 0.06 mg/L (a)
5. Vapor pressure = 1.1 x 10^{-4} mm Hg (a)
6. Antoine coefficients (b)

   $\log (VP) = A - \frac{B}{T}$

   A = 8.8
   B = 3,700

7. Henry's law constant = 8.69 x 10^{-4} $\frac{atm\text{-}m^3}{mol}$ (a)
8. K_{ow} = 1.26 x 10^6 to 6.31 x 10^6 (a)
9. K_{oc} = 4.25 x 10^4 (c)
10. Air diffusivity = 3.99 x 10^{-2} cm^2/sec (d)
11. Appearance = light yellow viscous liquid (e)
12. Density = 1.50 g/m^3 (e)
13. CAS # 110-976-91
14. Viscosity = 1400-2500 (100 F) (b)
15. Dielectric constant = 5.0 (b)

(a) Mackay et al. 1983.
(b) NAS 1979.
(c) Kenanga and Goring 1980.
(d) Calculated with 1-Cl biphenyl as reference.
(e) Callahan et al. 1979.

TABLE 6-2 PROPERTIES OF SOME BIODEGRADATION PRODUCTS OF PCBs

Chemical	CAS Reg. No.	Water Solubility at 25 C	$\log K_{ow}$	Soil Biodegradation Life After Acclimation
o-chlorobenzoic acid	118-91-2	2,100 mg/L	1.98	>64 days
m-chlorobenzoic acid	535-80-8	400 mg/L	2.68	32 days
p-chlorobenzoic acid	623-03-0	77 mg/L	2.65	64 days
2,4-dichlorobenzoic acid	50-84-0	insoluble		
2,5-dichlorobenzoic acid	615-93-0			> 25 days
3,4-dichlorobenzoic acid		insoluble		

Sources: Hawley (1981).
Verschueren (1983).
Windholz et al. (1983).

TABLE 6-3 ORAL TOXICITIES OF POTENTIAL PCB METABOLITES

Chemical	Species	LD50 (mg/kg)
octachlorobiphenyldiol	rat	360
octachlorobiphenyldiol	rabbit	200
o-chlorobenzoic acid	rat	6,460
2,3,6-trichlorobenzoic acid	rat	650
2,3,6-trichlorobenzoic acid	mouse	615
2,3,6-trichlorobenzoic acid	rabbit	812

Note: The oral LD50 of Aroclor 1254 to rats is 1,295 mg/kg.

Source: National Institute of Occupational Safety and Health (1979).

TABLE 6-4 TOXICITY OF POTENTIAL PCB METABOLITES TO MICE GIVEN SUBCUTANEOUS INJECTIONS

Chemical	LD50 (mg/kg)
2,3-dichlorobenzoic acid	900
2,4-dichlorobenzoic acid	1,200
2,5-dichlorobenzoic acid	1,200
2,6-dichlorobenzoic acid	1,500
3,4-dichlorobenzoic acid	400
3,5-dichlorobenzoic acid	250
2,3,4-trichlorobenzoic acid	300
2,3,5-trichlorobenzoic acid	300
2,3,6-trichlorobenzoic acid	1,500
2,4,5-trichlorobenzoic acid	300
2,4,6-trichlorobenzoic acid	1,200
3,4,5-trichlorobenzoic acid	250

Note: The LD50 to mice through intraperitoneal injections of Aroclor 1254 is 2,840 mg/kg.

Source: National Institute of Occupational Safety and Health (1979).

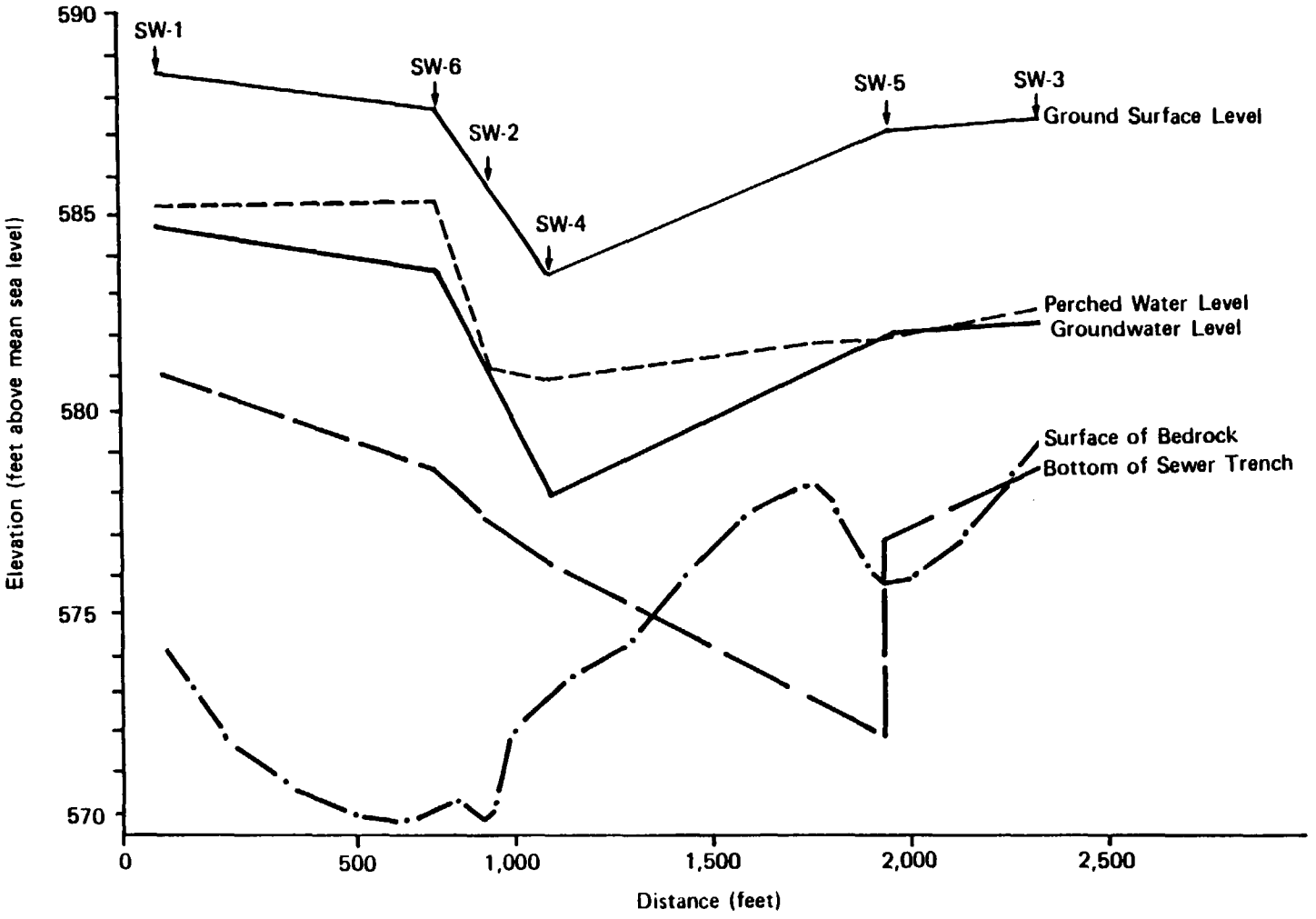


Figure 6-1. Topographic profile along the sewer trench from sewer trench wells 1 through 6.

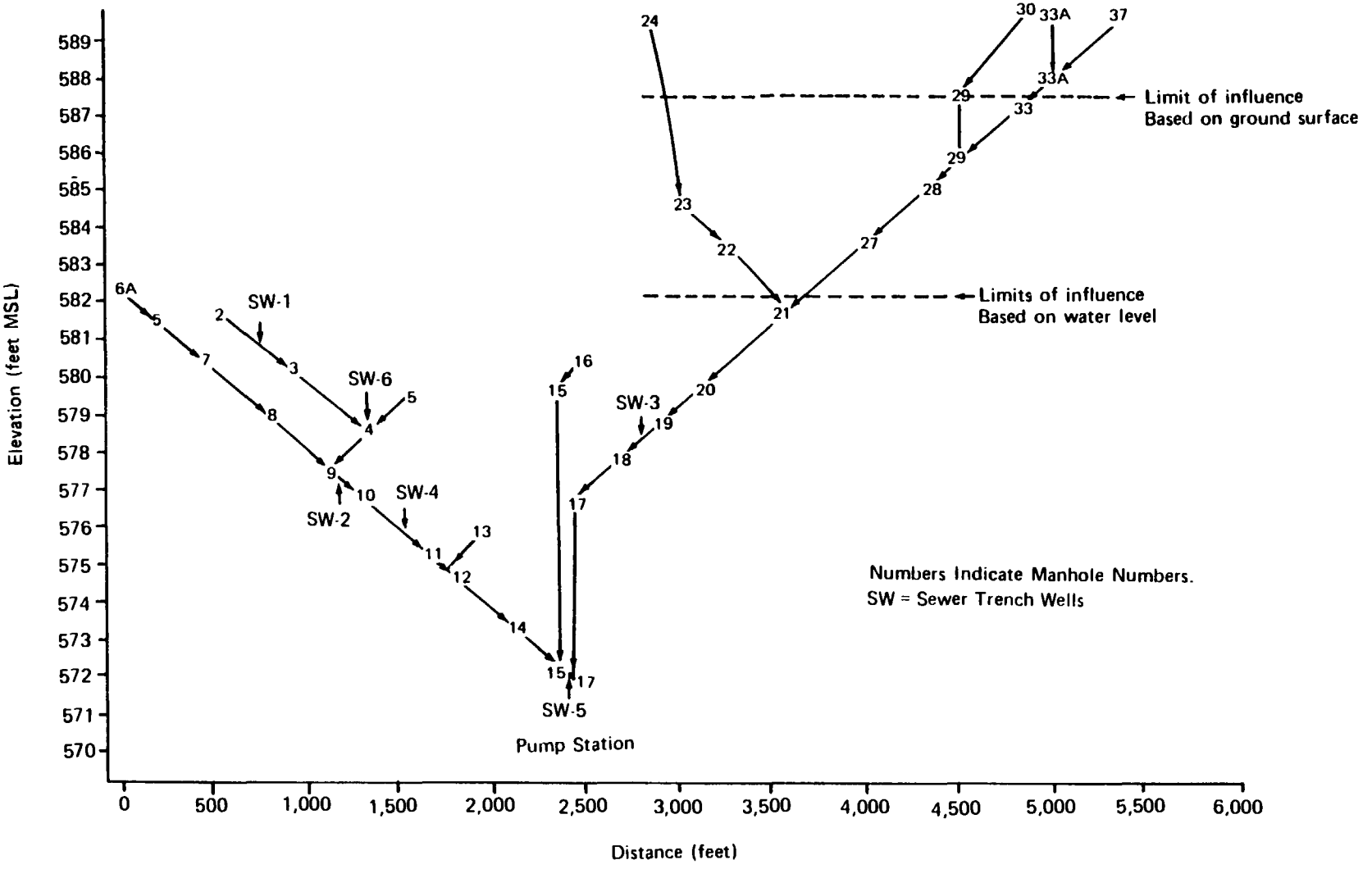


Figure 6-2. Schematic illustrating relative elevations and linear locations of the sewer trench bottoms and manholes.

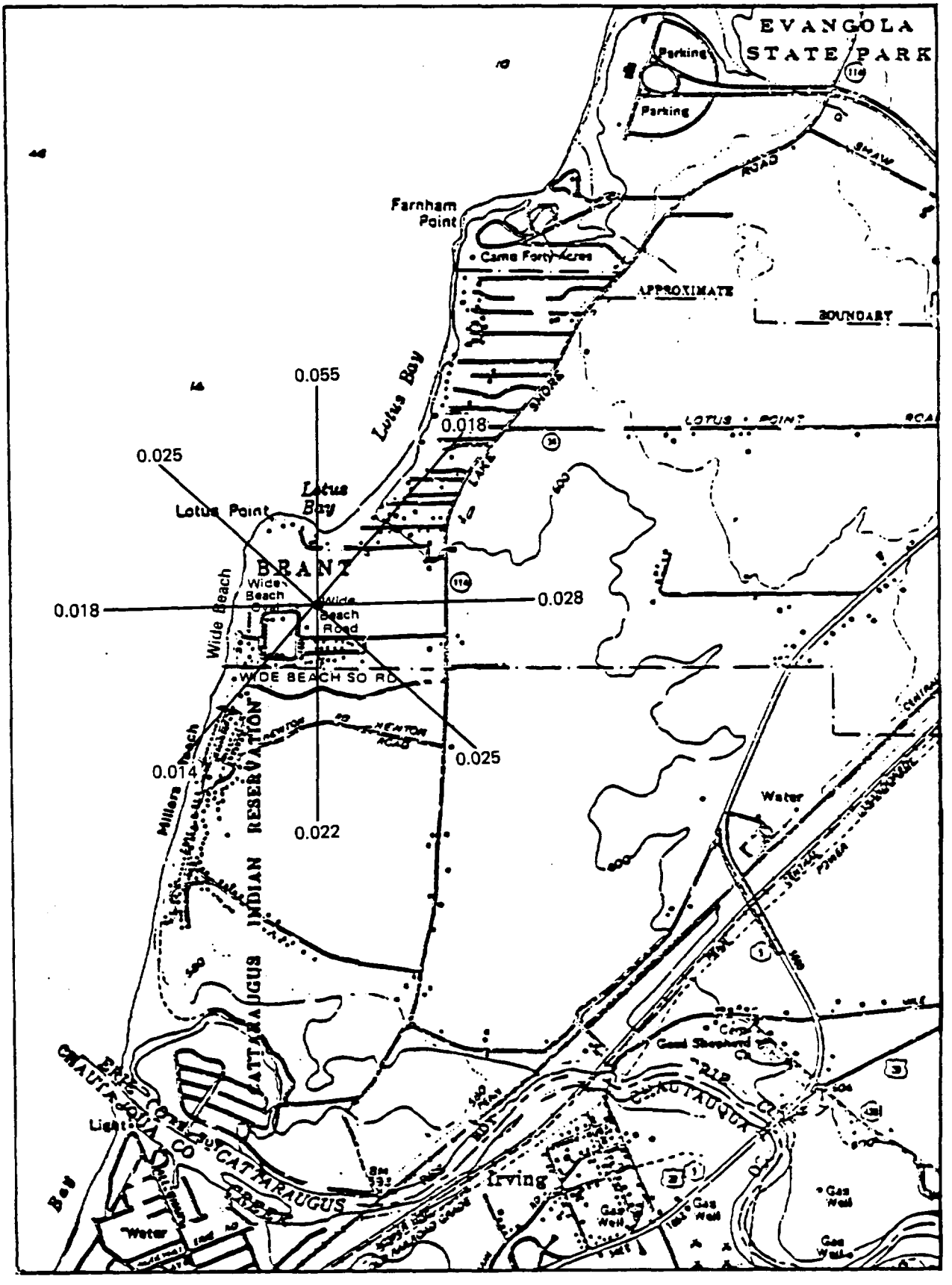


Figure 6-3. Offsite airborne transport of Aroclor 1254 (modeled concentrations in mg/m^3).

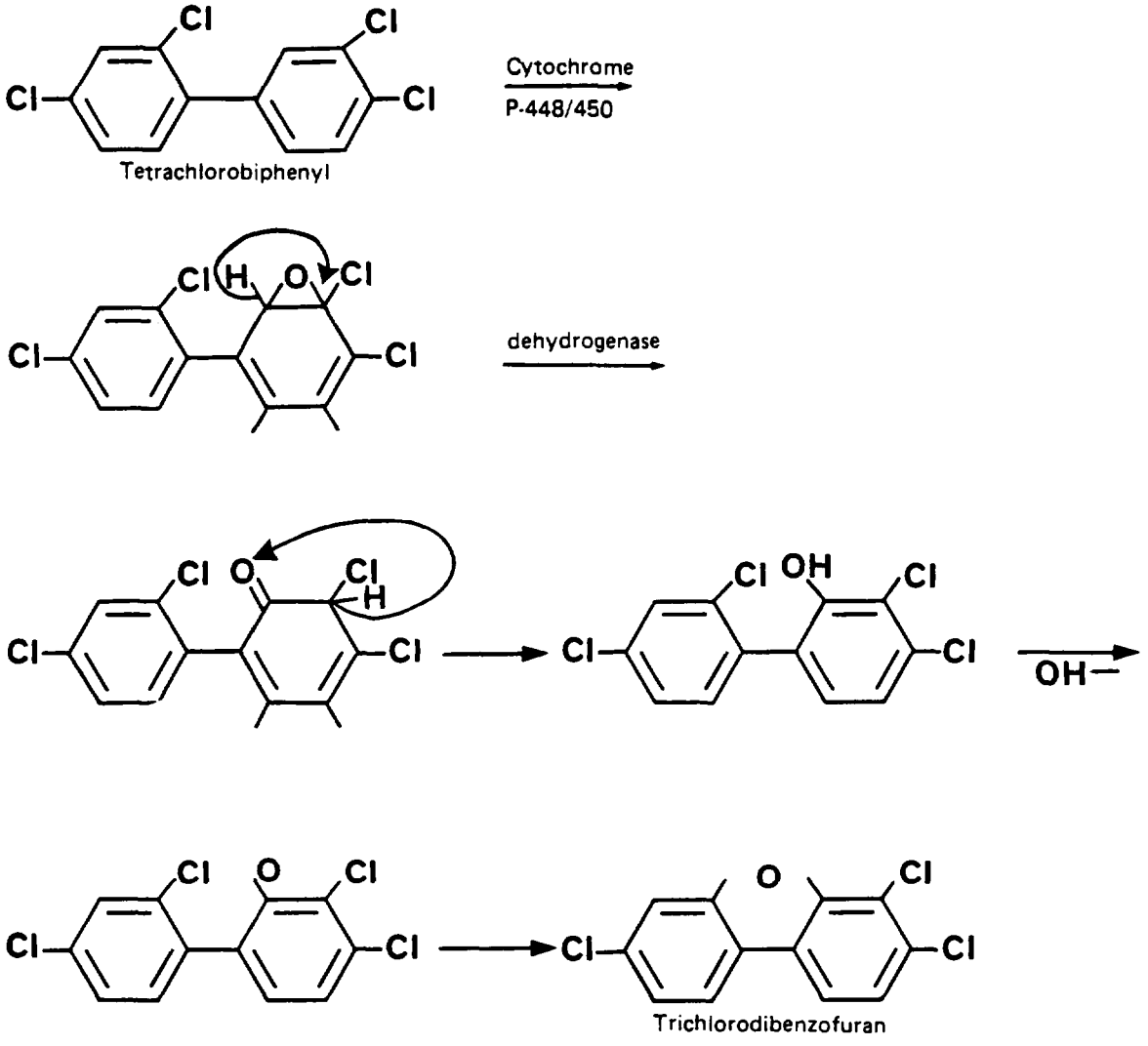


Figure 6-4. Proposed mechanism for biological formation of a polychlorinated dibenzofuran from a PCB.

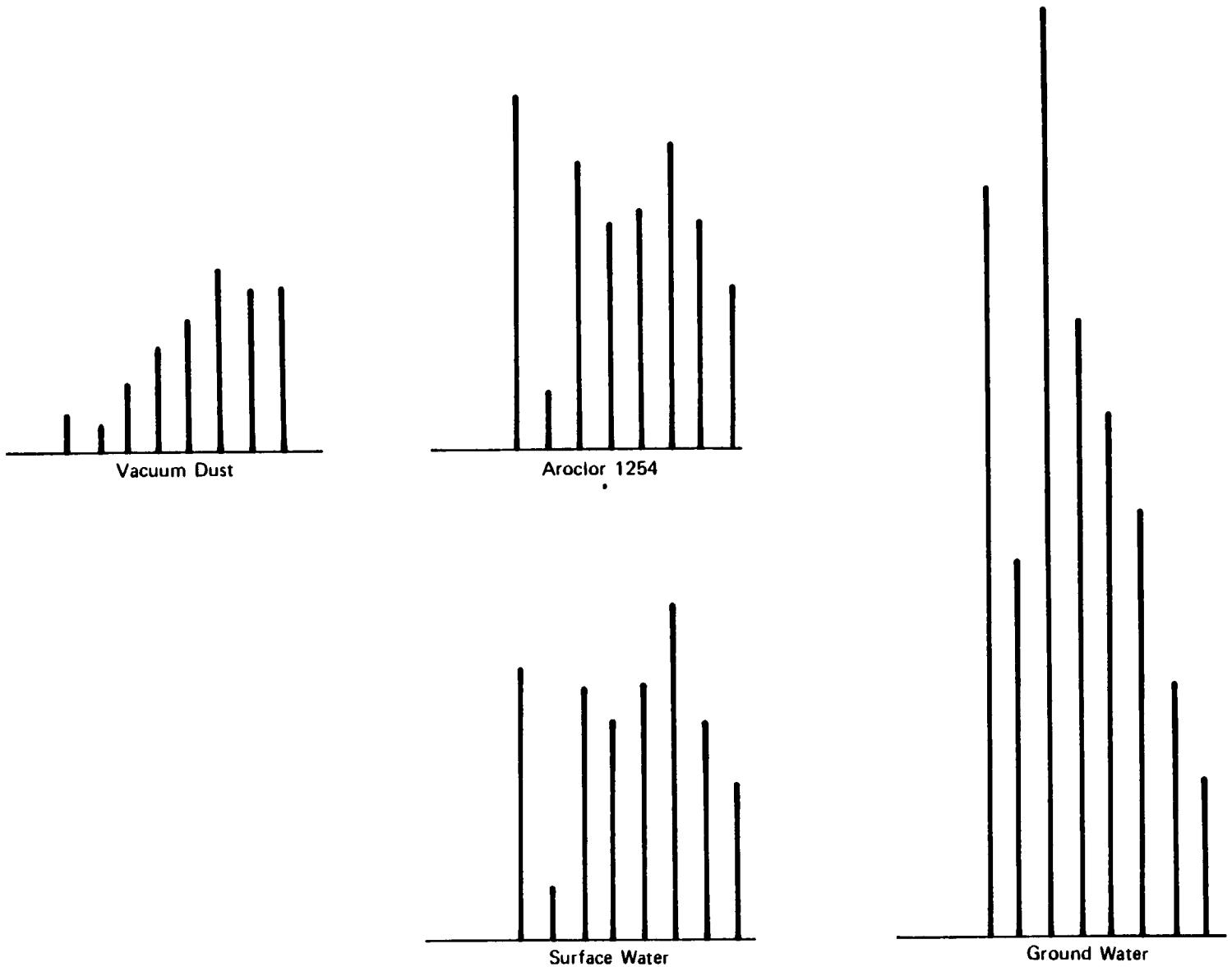


Figure 6-5. PCB profiles for OV-1 chromatograms.

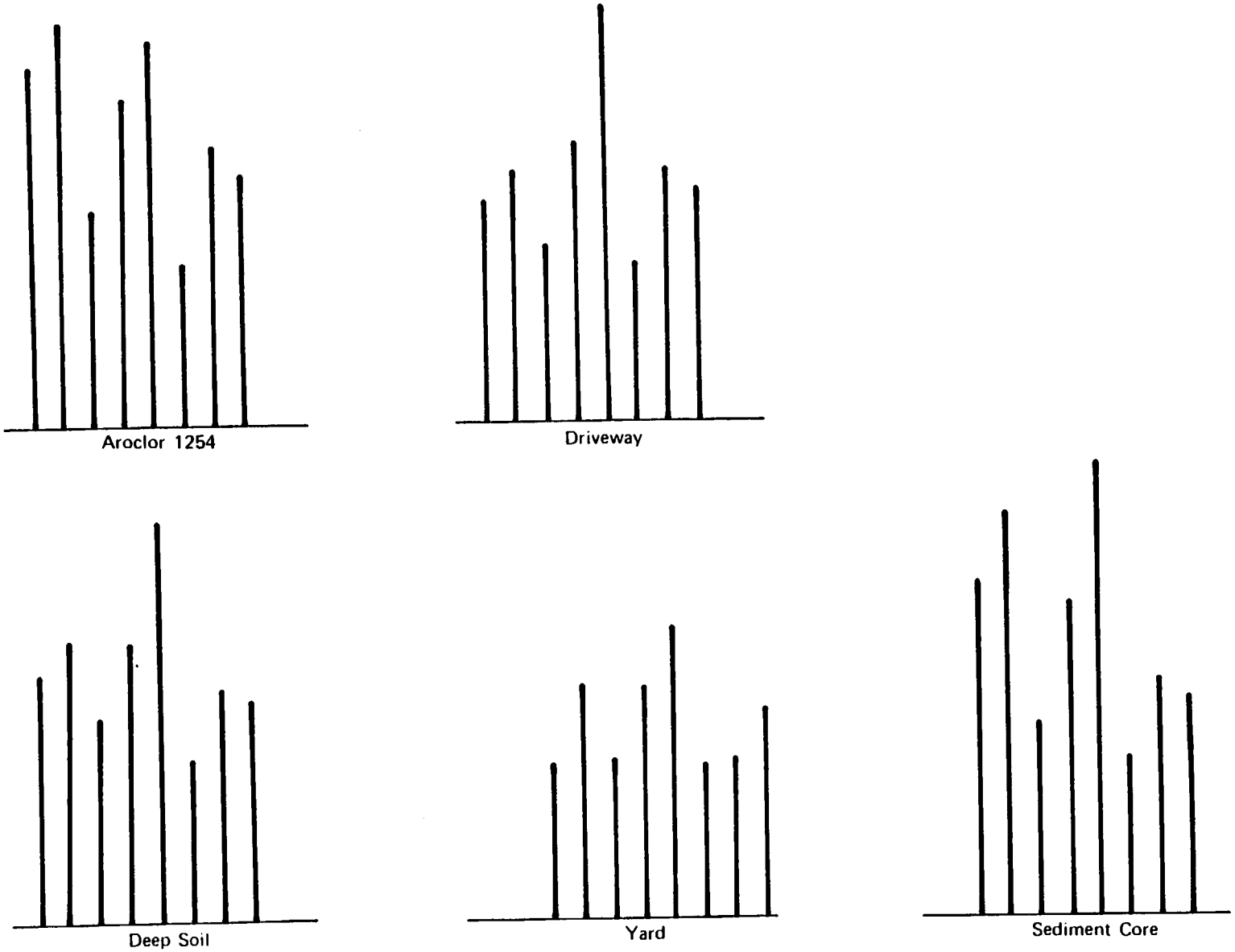


Figure 6-6. PCB profiles for SP-2250 chromatograms.

7. HEALTH RISK ASSESSMENT

7.1 HUMAN EXPOSURE ROUTES

7.1.1 Ingestion

There are essentially two potential routes for ingestion of soilborne PCBs: through contaminated foodstuffs and through direct consumption of soil. Plant tissues are known to accumulate PCBs (Buckley 1982); however, there is little evidence for bioconcentration or biomagnification. The association between PCBs and plant tissues is primarily a surface phenomenon. Fries and Marrow (1981) concluded that plants grown in PCB-contaminated soil were not contaminated by root uptake and translocation, although foliar contamination via vapor sorption occurs. Streck and co-workers (1980) investigated PCB effects on various types of common crops. Using their data, bioconcentration factors may be calculated as follows:

Crop	K (Plant/Soil)
Beet	0.050
Fescue	0.036
Soybean	5.4×10^{-3}
Sorghum	4.6×10^{-3}
Corn	3.8×10^{-3}

Note that in all cases the equilibrium lies to the soil rather than the plant. The importance of this route may be assessed by the following analysis:

> The maximum concentration of PCBs in a Wide Beach yard is 494 mg/kg. Assuming this level in garden soil, the PCB concentration in a typical root crop can be predicted to be
>
> $$[PCB]_{Beet} = K\,[PCB]_{soil}$$
> $$= 0.05 \times 494$$
> $$= 25 \text{ mg/kg}$$

Although no standards exist for root crops, this value exceeds any FDA tolerances for PCBs in food (Hoeting 1983). Since the magnitude of the importance of home-grown root crops to the diet of Wide Beach residents may not be assessed accurately at this time, this analysis should be construed more as an advisory against root crop ingestion rather than a contribution to the overall assessment.

Direct ingestion of soil by children either habitually (pica) or casually may be a significant route of exposure. Mahaffey (1977) estimated that 6-50 percent of young children showed evidence of the pica syndrome with an average ingestion of 0.5 g of soil per day. In the exposure assessment for TCDD conducted at the Centers for Disease Control (CDC), Times Beach, Missouri (Kimbrough et al. 1984), soil ingestion patterns were estimated by age:

Age Group	Soil Ingested (g/day)
0-9 months	0
9-18 months	1
1.5-3.5 years	10
3.5-5 years	1
5 years	0.1

These values are sufficiently generic to apply to the Wide Beach assessment.

Absorption in the gastrointestinal tract is important pharmacokinetically (Section 7.2.1). Albro and Fishbein (1972) studied intestinal absorption of PCBs in rats and concluded that at least 90 percent was absorbed. This high value probably reflects the high lipophilicity of PCBs and will be used in exposure assessment.

PCB exposure by the oral route is then calculated by:

$$\text{PCB Dose} = \text{PCBs in Soil} \times \text{Daily Soil Ingestion} \times \text{Absorption}$$

$$= \text{PCBs in Soils} \times \sum_{i=0}^{5} \text{Ingestion Rates} \times 0.90$$

It is assumed in this analysis that pica is not a problem at >5 years.

7.1.2 Inhalation

Humans may inhale PCBs either directly from the vapor phase or sorbed onto particles. The problem of inhalation is compounded by the occurrence of a substantial background of atmospheric PCBs. Buckley (1983) reviewed the atmospheric background and concluded that for non-urban areas the concentration range was from 0.002 to 1.6 ug/m^3 with a majority in the vapor phase; for urban areas the range was from 0.5 to 36 ug/m^3 with significant amounts in the particulate phase (Section 7.1.4).

The pulmonary system is highly efficient with respect to PCB absorption (EPA 1980; NIOSH 1977). Since the respiratory epithelium behaves like a lipoid-pore type membrane, the uptake of hydrophobic compounds is related to their octanol-water partition coefficients (Lubawy 1982). Partition coefficients for Aroclor 1254 range between 1.3×10^6 and 6.3×10^6 (Mackay et al. 1983) which accounts for the rapid and efficient absorption. Based on data measured by Benthe and colleagues (1972) for exposure of Wistar rats to atmospheric PCBs, calculations reveal an air-liver partition coefficient of 3.0×10^{-2} during exposure. Following exposure, the liver concentration increased until a partition coefficient of 0.15 was reached. This facile transport supports environmental and occupational studies of pulmonary absorption. Based on the experimental database and vapor-particulate equilibrium, it will be assumed that particulate inhalation will control pulmonary exposure and that all PCBs inhaled which are bound to particles deposited in the respiratory system will be absorbed.

For respiration of atmospheric PCBs, the rates derived by International Commission on Radiological Protection (ICRP) (1975) will be used:

Man (>10 years) 2.3×10^4 L/day
Woman (>10 years) 2.1×10^4 L/day
Child (1-10 years) 1.5×10^4 L/day
Infant (<1 year) 0.4×10^4 L/day

These translate into lifetime respired volumes of 5.46×10^5 m^3 for a man and 5.03×10^5 m^3 for a woman.

Based on the ambient air concentration (Section 6.2) of 0.22 ug/m^3 and a simple mass balance approach, the average adult man at Wide Beach will be exposed to 120 mg and the average woman to 110 mg over a 70-year lifetime.

7.1.3 Dermal

Dermal exposure to PCBs may also be a significant route (EPA 1980; NIOSH 1977). Although skin absorption is well documented (NIOSH 1977), its magnitude has not been quantified due to the interference of simultaneous inhalation. For purposes of risk assessment, it will be assumed that absorption is quantitiative. Since the majority of PCBs bind to the soil, their bioavailability is probably decreased. Based on the literature (Poiger and Schlatter 1980), it may be estimated that 1-10 percent of 2,3,7,8-Tetrachlorodiobenzodioxin (TCDD) which is present in soil is transferred through the skin. Since the octanol-water partition coefficient of TCDD (log Kow = 6.15) (EPA 1984) is similar to that of Aroclor 1254 (log Kow = 6.1 to 6.8) (Mackay et al. 1983), as a first approximation, it may be assumed that a similar amount of Aroclor 1254 is absorbed. Almost all individuals contact some soil; however, there is evidence that the magnitude of this is age-dependent. The following soil deposition rates will be used based on the CDC's TCDD assessment (Kimbrough et al. 1984):

Age Group	Daily Deposition of Soil on Skin (g)
<9 months	0
9-18 months	1
1.5 - 3.5 years	10
3.5 - 15 years	1
>15 years	0.1

The PCB dermally absorbed dose will be calculated as:

$$PCB_{dose} = PCB_{soil} \times \text{deposition} \times \% \text{ absorbed}$$

7.1.4 Background Concentrations and Alternate Sources of Exposure

PCBs are generally not found in soils. NAS (1979) reports an estimated average metropolitan soil concentration of 0.002 mg/kg. Other sources of exposure of Wide Beach residents to PCBs could be through ingestion of food, especially fish, and exposure to background atmospheric levels.

Lake Erie has the largest sedimentary burden (182 x 10^3 kg) of total PCBs of all the great lakes (Eisenreich and Johnson 1983). Concentrations in the sediments range from 4 to 800 ng/g with a median of 95 ng/g. Concentrations in the water column range from 2 to 10 ng/L. Thus, there is a large reservoir of PCBs for potential bio-uptake and accumulation. Despite this potential, Lake Erie mean contaminant ranges for PCBs in fish remain low. Swain (1983) reports lake-wide averages of 0.5-1.5 mg/kg for coho salmon and 0.03-0.1 mg/kg for yellow perch. The actual concentrations in the fish will depend on numerous factors--lipid content, feeding habits, species, etc. Swain (1983) reported the following PCB concentrations in various fish from Lake Erie:

Shad	0.69 - 1.72 mg/kg
Perch	0.35 - 1.34 mg/kg
Catfish	3.4 - 3.85 mg/kg
Drum	0.26 - 0.36 mg/kg

It should be noted that the catfish concentrations are in excess of the current FDA tolerence of 2 mg/kg. Concentrations of PCBs in game fish are somewhat lower. Chinook salmon averaged 0.25 mg/kg and rainbow trout averaged 0.70 mg/kg. EPA (1980) assessed the impact of sport fish consumption in the PCB body burden. They found that for fish with residues ranging from 0.35 to 5.38 mg/kg, human plasma levels ranged up to 0.366 parts per million (ppm). Thus, it may be concluded that consumption of locally caught fish could contribute significantly to the local PCB body burden at Wide Beach.

The atmosphere is an additional potential source of PCB exposure. In the Lake Erie area, the median atmospheric PCB concentration is 2.0 ng/m^3 (Eisenreich and Johnson 1983). Kimbrough (1980) reports an average PCB concentration in suburban air of 0.1 ug/m^3. The concentrations noted are higher than the marine/rural background of 0.05 ng/m^3 (NAS 1979). Thus exposure from the atmosphere could also add to the body burden.

7.1.5 PCB Body Burdens

PCBs are found in all human tissue compartments, however, there is a tendency to partition into lipid rich materials. The extent of this partitioning is controlled both by the chlorine content and molecular topology of the PCBs and the tissue lipid content. Matthews (1983) has determined distribution ratios for various PCB congeners:

Compartment	1-Cl-biphenyl	6-Cl-biphenyl
Blood	1	1
Gut Lumen	1	1
Muscle	1	4
Liver	3	2
Skin	10	30
Adipose	30	400

PCBs are environmentally ubiquitous and thus their presence may be anticipated in most human populations. NAS (1979) has estimated that the average body burden is 0.35 mg/kg for the whole body. The majority of measurements have been made on adipose, blood, and breast milk samples.

7.1.5.1 PCB Burden in Adipose Tissue

Country	Mean PCB Concentration (mg/kg)	
Denmark	5.0	(NAS 1979)
Japan	4.7	(NAS 1979)
West Germany	7.9	(NAS 1979)
Austria	4.6	(NAS 1979)
U.K.	1.3	(NAS 1979)
Norway	0.9	(NAS 1979)
Canada	1.2	(NAS 1979)
East Germany	6.4	(NAS 1979)
Israel	3.6	(NAS 1979)
New Zealand	0.9	(NAS 1979)
USA	1.2	(NAS 1979)
USA capacitor workers	42	(Wolff et al. 1982)

7.1.5.2 PCB Burden in Blood

Location	No. of People	Mean PCB Concentrations (ug/L)	Source
Triana, Alabama	458	17.2	Kreiss et al. 1981
Bloomington, Indiana	110	18.8	Kreiss et al. 1981
Billings, Montana	17	7.5	Kreiss et al. 1981
Michigan	370	8.0	Kreiss et al. 1981
Michigan[a]		77	Kreiss et al. 1981
Capacitor Workers	290	88	Wolff et al. 1982
Japan, Mothers		2.8	Verscheuren 1983
Japan, Children		3.8	Verscheuren 1983
Iowa	803	5(ug/kg)[b]	Humphrey 1983

(a) Consume ≥1 fish per week from Lake Michigan.
(b) Median.

7.1.5.3 PCB in Breast Milk

Location	Population Size	Basis	Concentration (mg/kg)	Source
Michigan	1,057	fat	1.5(a)	Wickiszer et al. 1981
Michigan(1976)	95	fat	0.82(b)	Humphrey 1983
Michigan(1980-81)	120	fat	0.96(a)	Humphrey 1983
Michigan	42	fat	0.77(a)	Jacobson et al. 1983
Wide Beach	1	fat	1.08	Erie County letter of 10 March 1982

(a) Mean value.
(b) Median value.

7.1.5.4 Discussion

The average great lakes region PCB exposure is given as (Humphrey 1983):

Medium	Medium Concentration		Exposure
Ambient Air	1.9 ug/m^3		7.8 ug/yr
Drinking water	4 ug/L		2.9 ug/yr
Great Lakes fish	0.4-5.4 mg/kg		46.5 ug/yr
		Total	57.2 ug/yr

For dermal absorption at Wide Beach under an average/realistic scenario (Section 7.1.3), exposure is 3.1 mg/yr or roughly 50 times the background total exposure. This may be translated into a body burden:

$$\frac{3.1 \text{ mg}}{\text{yr}} \times 70 \text{ yr} \times \frac{1}{\frac{70 \text{ kg} \times 30 \text{ kg adipose}}{100 \text{ kg body weight}}}$$

= 10.3 mg/kg for adipose tissue or

or 3.1 mg/kg for whole body which is about 9 times the U.S. average.

For the inhalation exposure estimates developed in 7.1.2, the average man would accumulate

$$120 \text{ mg} \times \frac{1}{\frac{70 \text{ kg} \times 10 \text{ kg adipose}}{100 \text{ kg body weight}}}$$

= 5.7 mg/kg for adipose tissue

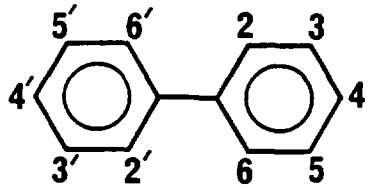
or 1.7 mg/kg for whole body.

7.2 HAZARD ASSESSMENT

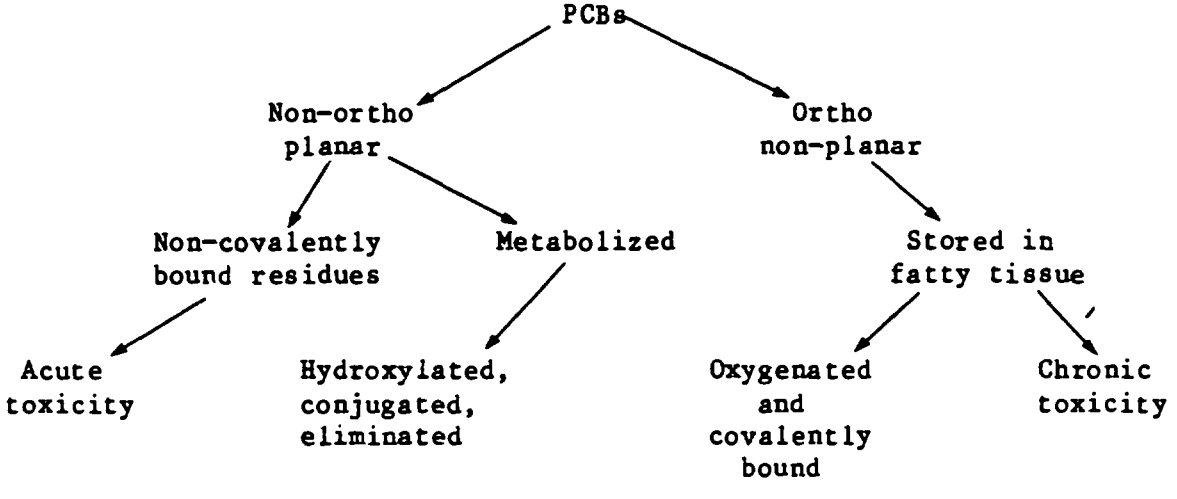
The purpose of this section is to assess the degree of toxicological hazard posed by human exposure to PCBs. This problem is controversial; thus it is necessary to conduct an in-depth review of the problem prior to rendering a conclusion. The toxicology of PCBs will be reviewed with respect to toxicodynamics, acute toxicity, and chronic toxicity including carcinogenicity. The review will conclude with a determination of the most significant health effects and a quantitative dose-response characterization.

7.2.1 Toxicodynamics

PCBs are lipophilic compounds. The lipophilicity of the various congeners increases with increasing chlorine content (NAS 1979). The uptake and metabolism of PCBs is also a function of their chlorine content. The biphenyl molecule has 10 sites where chlorine substitution can occur:



The existence of two adjacent carbon atoms without chlorine substitution in one or both of the rings has been shown to facilitate metabolism since it increases the formation of arene oxide intermediates. All PCBs with five or fewer chlorines will have at least one set of adjacent unsubstituted carbons and will be more readily metabolized by mammals than PCBs with a higher degree of chlorination. Another element of chemical structure which is relevant to toxicodynamics is molecular topology. Substitution of chlorines in the 2, 6, 2′, or 6′ positions (ortho substitution) will result in the overall molecule adopting a non-planar configuration. McKinney (1981) has proposed the following scheme for biological effects of the two types (planar versus nonplanar) of PCBs:



7.2.1.1 Absorption

Single oral doses of 5, 50, and 100 mg/kg body weight of PCBs having chlorine contents ranging from one to six chlorine atoms per molecule were fed to male CD strain rats. Gastrointestinal absorption of all PCBs at all dosages was 92-98.9 percent. The degree of absorption was independent of PCB congener content (Albro and Fishbein 1972).

Adult Rhesus monkeys were given a single oral dose of 1.5 or 3.0 g/kg body weight Aroclor 1248. Absorption from the gastrointestinal tract was shown to be >90 percent of the dose (Allen 1975).

Skin absorption is another significant route of exposure. In dermal application studies in animals, both systemic and local effects have been observed indicating significant translocation (EPA 1980).

7.2.1.2 Distribution

Upon entering the blood, PCBs are distributed to the liver, muscles, kidneys, lungs, and adrenals. Within 24 hours, most of the absorbed dose has been redistributed to the adipose tissues and the skin, which act as major long-term storage reservoirs (NRC 1980; EPA 1980). The maximum amounts accumulated in body tissues and the half-life of PCBs increase with degree of chlorination (Berlin et al. 1975; Lutz et al. 1977; EPA 1980).

Ninety-six 4-week-old male Sprague-Dawley rats (Table 7-1) weighing approximately 100 g were fed diets containing 100 ppm Aroclor 1248, Aroclor 1254 or Aroclor 1262 for 52 weeks (Allen et al. 1976). The rats receiving Aroclor 1248 had the lowest concentration of PCB isomers in their tissues. Higher levels were present in fatty tissues (Aroclors 1254 and 1262) indicating that higher chlorine isomers may be less readily metabolized and excreted (Allen et al. 1976).

Sprague-Dawley male rats (250-300 g) received a single intravenous dose of 0.6 mg/kg of 4-chlorobiphenyl (1-CB); 4,4′dichlorobiphenyl (2-CB); 2,2′,4,5,5′-pentachlorobiphenyl (5-CB), or 2,2′,4,4′,5,5′-hexachlorobiphenyl (6-CB). The following patterns of PCB storage in adipose tissue were observed (Lutz et al. 1977):

PCB	Maximum Percent of the Dose	Time of Maximum Storage	Amount at 7 Days (% of Total Dose)
1-CB	11.63 ± 5.64	1 hour	0.23 ± 0.055
2-CB	52.75 ± 14.99	2 hours	1.837 ± 0.213
5-CB	23.54 ± 3.0	24 hours	13.04 ± 2.1
6-CB	85.18 ± 21.6	42 days	56.08 ± 15.72

7.2.1.3 Excretion

The major routes of excretion of absorbed PCBs are bile (transferred to the feces) and urine. Urinary excretion exhibits an inverse relationship to the degree of chlorination (Lutz et al. 1977).

PCB	Percent of Total Dose (0.6 mg/kg) Excreted in the Urine
1-CB	59.8
2-CB	33.9
5-CB	7.6
6-CB	0.7

Over 60 percent of the urinary excretion of PCBs occurred within the first 24 hours (Lutz et al. 1977; EPA 1980).

7.2.1.4 Metabolism

PCBs are metabolized by (and are inducers of) the hepatic microsomal monoxygenase system. Cytochrome P-450 is the terminal oxidase of this system and is responsible for the oxidation of xenobiotics. Cytochrome P-450 and P-448 action on PCBs results in the formation of arene oxide intermediates (Ueng and Alvares 1981). Further metabolism of the epoxide intermediates results in the formation of several hydroxylated metabolites as follows:

1. Rearrangement of direct oxidation to monochlorobiphenyls (Sundstrom et al. 1976)

2. Hydration of the intermediate to form dihydrodiols which through the action of a dehydrogenase results in diol formulation

3. S-glutathione transferase action or direct glutathione addition on the oxide to produce mercaptic acids which are excreted in the bile

Arene oxide metabolites of PCBs also may bond covalently with the nucleophilic sites on DNA and RNA molecules. The formation of such electrophile-DNA products has been shown to be a prerequisite step in oncogenesis (Ueng and Alvares 1981).

7.2.2 Acute Effects

PCBs are not generally considered to be acutely toxic under environmental conditions. Toxic effects observed from exposure to high levels of Aroclor 1242 included gastrointestinal and neurological dysfunction (EPA 1980). Acute LC50 values for Aroclor 1254 in test animals are shown in Table 7-2.

7.2.3 Chronic Systemic Toxicity

7.2.3.1 Liver

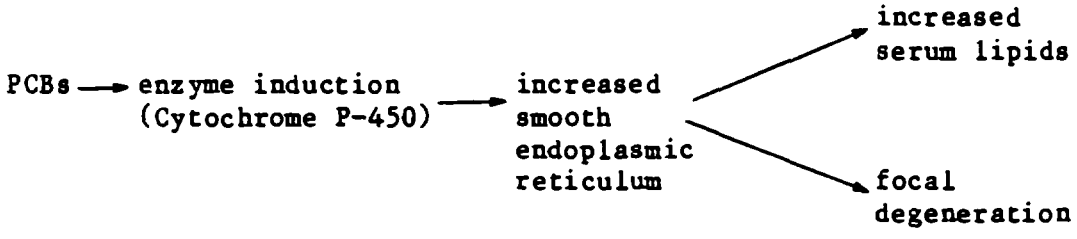
Ninety-six male, 4-week-old Sprague-Dawley rats weighing 100 g were fed diets containing 100 ppm Aroclor 1248, Aroclor 1254, or Aroclor 1262 for 52 weeks. Controls received the same diet without PCBs (Allen et al. 1976). Animals were sacrificed at 13, 26, 39, and 52 weeks. Distinct

differences in levels of serum lipids were observed between treated groups and controls. Total serum lipids of the treated rats were 120 percent that of the controls in the 13th week and 160 percent by the 39th week. By 52 weeks serum lipids for animals given Aroclors 1248 and 1262 stabilized at 140 percent of the controls, whereas levels for Aroclor 1254 were approximately 280 percent of the controls. Triglyceride levels in the serum of rats receiving Aroclor 1254 reached a concentration in excess of 500 percent that of controls. Upon sacrifice, livers of the treated animals were one and one-half times as heavy as the control groups and had widely dispersed areas of focal degeneration and necrosis (Allen et al. 1976).

Similar effects have been observed in humans exposed to PCBs. Serum triglyceride levels higher than 300 mg/100 ml were observed in 60 out of 396 victims of "Yusho" disease due to an accidental PCB poisoning incident occurring in Japan in 1968 from the consumption of rice oil contaminated with Kanechlor 400, a Japanese commercial PCB mixture. Other Yusho victims had serum triglyceride levels of 136 mg/100 ml (up to four times the normal values). Increased smooth endoplasmic reticulum (SER) was reported in one patient (Wassermann et al. 1979, in NAS 1979). It was estimated that Yusho victims ingested 0.07 mg/kg/day Kanechlor 400 for at least 50 days (NAS 1977).

Adult monkeys (Macaca mulatta) fed diets containing 100 and 300 ppm Aroclor 1248 for 2-3 months (total intake of 0.8-1.0 and 3.6-5.4 g, respectively) showed hepatic hypertrophy with a two-fold increase in liver size. Increase and clumping of the SER, enlarged hepatocytes, and increased activity of microsomal mixed function oxidases were observed (Allen 1975).

Degenerative changes observed in the liver appear to result from induction of the hepatic microsomal enzyme system by PCBs.



Increased hepatic microsomal activities result in increased proliferation of the SER and hyperplasia. Following the period of hyperactivity, the liver cells undergo SER deterioration, a decrease in microsomal enzyme activity, rarification (ballooning) of the cytoplasm, and an increase in cytoplasmic lipid droplets. Rupture of the plasma membranes results (Allen et al. 1976).

7.2.3.2 Central Nervous System

Yusho patients reported numbness or pain in the extremities and experienced a decrease in the conduction velocity in peripheral sensory nerves (NAS 1979). Loss of appetite, nausea, headache, vomiting, weakness, and excessive fatigue also were reported.

Locomotor hyperactivity was observed in infant Rhesus monkeys born to mothers fed 2.5 ppm Aroclor 1248 in their diet from 16 to 21 months including three months of nursing. Controls were selected on the basis of comparable birth dates. At eight months of age, PCB levels in body intake of the mothers at completion of nursing ranged from 284 to 303 mg Aroclor 1248. In sessions evaluating locomotor activity using a crossed photobeam cage, PCB-exposed monkeys showed activity levels that began at control levels and then rose to three times those of the controls during the 12-month tests (Bowman et al. 1981).

Allen et al. (1979) reported that infants born to Rhesus females treated with 2.5 and 5.0 ppm Aroclor 1248 in their diet showed hyperactivity and did not learn reversal tasks as readily as controls (see Reproductive Effects).

7.2.3.3 Skin

The most common symptoms observed in Yusho disease victims were acneiform eruptions of the skin, hyperpigmentation of skin, nails, and gingiva, and hypersecretion of the Meibomian glands of the eyes. Babies born to Yusho patients developed chloracne and a persistent dark discoloration of the skin and mucous membranes (Wassermann et al. 1979, in NAS 1979).

A number of studies with Rhesus monkeys (Allen 1975; Allen et al. 1979, 1980) have reported facial acne and edema, swelling of the eyelids, loss of facial hair and eyelashes, and hyperpigmentation in infants of animals exposed to 2.5 and 6.0 ppm Aroclor 1248 for 18 months and in adult monkeys receiving 100 and 300 ppm Aroclor 1248 in their diets for 2-3 months.

There have been 12 epidemiologic studies of dermatologic effects of PCBs (Gaffey 1983). Those studies in which humans were exposed by direct contact concluded that PCBs were chloracingenic. In addition to chloracne, other dermatologic symptoms such as hyperpigmentation, burning sensations, and rashes were observed. The findings of dermatitis were not correlated with blood PCB levels and were highly idiosyncratic.

7.2.4 Carcinogenicity

The area of carcinogenic effects is considered to be the most controversial component of the PCB problem (Miller 1983). It is compounded by the fact that many PCB mixtures are contaminated by polychlorodibenzofurans (PCDFs) which are thought to be extremely toxic compared to PCBs (Masuda 1983).

Groups of male and female F344 rats were fed low-fat diets containing 0, 25, 50, or 100 ppm Aroclor 1254 for two years (Morgan et al. 1981). For males, 92 percent of the control group, 83 percent of the group exposed to the low dose, 58 percent of the medium dose group, and 46 percent of the high dose group survived until termination of the study. In the females, 67, 79, 83, and 71 percent of the control, low, medium, and high exposure groups survived, respectively. The incidence of stomach adenocarcinomas and intestinal metaplasia observed (Morgan et al. 1981) are presented in Table 7-3.

Multiple lesions were found only in rats from the treated groups. There were no significant differences in tumor incidence between males and females. None of the stomach lesions detected in the controls were adenocarcinomas. Stomach adenocarcinomas are rare in F344 rats (<0.05 percent in historical controls) (Morgan et al. 1981).

Four groups of 50 BALB/CJ inbred male mice 5-6 weeks old were fed 0 or 300 ppm Aroclor 1254 in their diet for either 6 or 11 months. The mean dietary dose of Aroclor 1254 was 49.8 mg/kg/day. The following incidence of hepatoma was observed (Kimbrough and Linder 1974).

Dietary Level Aroclor 1254 (ppm)	Duration (months)	Number of Survivors/ Number Exposed	Hepatoma Incidence
0	11	34/50	0
0	11	24/50	0
300	11	22/50	10
300	6 months with 5 months recovery	24/50	1

None of the controls developed hepatomas, 1 of the 24 surviving mice fed Aroclor 1254 for 6 months, and 10 of the 22 surviving mice fed the compound for 11 months developed hepatomas. In addition, most of the livers of the 24 mice exposed for 6 months with a 5-month recovery period had enlarged cells with atypical hyperchromatic nuclei. The mouse strain used in this study rarely develops hepatomas spontaneously (historical incidences of 0.3 and 0.6 percent reported) (Kimbrough and Linder 1974).

In another study 400 weanling Sherman strain COBS female rats 21-26 days old (weighing 48-97 g) were exposed to 0 and 100 ppm Aroclor 1260 for 21 months. The rats were sacrificed when 23 months old and the incidence of hepatocellular carcinomas was observed (Kimbrough et al. 1975):

Type of Lesion	Incidence	
	Controls	Exposed
Liver--hepatocellular		
Carcinoma	1/173	26/184
Neoplastic nodules	0/173	144/184

Of the 184 treated animals examined, 170 showed neoplastic lesions with 26 of the lesions clearly carcinomas (Kimbrough et al. 1975).

The NCI Bioassay for Aroclor 1254 was completed in 1978 (Fung 1982). It concluded that Aroclor 1254 was not carcinogenic with respect to hepatocellular carcinoma in either male or female F344 rats. It was also noted, however, that there was a high incidence of hepatocellular proliferative lesions and gastrointestinal tract carcinomas which may have been associated with administration of the chemical.

Studies have also addressed the question of whether or not PCBs act as tumor promoters (Sleight 1983). There was evidence that PCBs did exhibit a promoting effect when administered in conjunction with a carcinogenic nitrosamine or azobenzene. There is no evidence of carcinogenicity from epidemiologic studies (Gaffey 1983). A summary of animal carcinogenesis tests is presented in Table 7-4.

7.2.5 Mutagenicity

Negative results have been obtained both in studies using animals and studies using human lymphochromosomal cells examining the mutagenic properties of Aroclors 1242, 1254, 1232, 1268, and 2,5,2'5'-tetrachlorobiphenyl (NIOSH 1977; NAS 1979, 1980; EPA 1980).

In tests using the Schmidt's micronucleus method with ddY strain mice, Kaneclor 500 alone at a dose of 100 mg/kg body weight and in combination with 25 mg/kg body weight dimenthylnitrosamine (DMN) gave negative results (Watanabe et al. 1982).

Although in earlier tests using a single isomer, 4-chlorobiphenyl was found to be mutagenic in Salmonella typhimurium (Wyndham et al. 1976), repetition of the experiments with different cultures of the tester strain have not detected any mutagenic activity (EPA 1980).

Several animal tests have reported positive mutagenicity for Aroclor 1254. These include sperm morphology changes in insects, DNA damage in rats, and DNA synthesis dysfunction in rats (RTECS 1984).

7.2.6 Developmental Toxicity

Watanabe and Sugahara (1981) have reported on the teratologic effect of Kanechlor-500. Female ddY strain mice 7-8 weeks old and 26-29 g body weight were mated, then injected in the back with 0.05 ml of (Kanechlor 500) PCB solution in 95 percent ethanol at concentrations of 0 and 1.0-5.0 mg/day for 10 days from Day 6 of gestation. Mice were sacrificed on Day 18 of gestation and the uterus was examined for resorption sites, dead fetuses, and abnormal physical features.

Total Dosage of PCB (mg)	Incidence of Fetal Cleft Palate Affected/Exposed (percent affected)	Resorbed and Dead Fetus Affected/Exposed (percent affected)
50	13/225 (5.8)	24/249 (9.6)
40	12/307 (3.9)	34/341 (10.0)
30	9/253 (3.6)	27/280 (9.6)
20	4/418 (1.0)	28/446 (6.3)
10	1/514 (0.2)	37/551 (6.7)
0	0/631	35/668 (5.3)
No treatment	1/1,134	63/1,197 (5.3)

The authors indicated that the critical level of Kanechlor-500 required to produce fetal cleft palate appeared to be under 10 mg/mouse total dose (Watanabe and Sugahara 1981).

A number of other studies performed on Aroclors 1242, 1254, and 1260 have shown no other evidence of teratogenicity of PCBs (NAS 1977; NRC 1980).

7.2.7 Reproductive Effects

A number of studies have reported reproductive effects in mammals from PCB ingestion. Allen et al. (1979) fed adult female Rhesus monkeys (5.6 kg weight) a diet containing 0, 2.5, and 5.0 ppm Aroclor 1248 for 18 months. After four months (total intake of 60-120 mg PCBs) the menstrual cycles in the treated females were decidedly altered (5-7 days longer than in control group). Flattening and prolongation of the serum progesterone peak was observed. Females were bred after seven months (total intake of from 105 to 210 mg PCBs) to control males. The following results were observed:

	PCB Exposure	
	2.5 ppm	5.0 ppm
Total number females impregnated	8/8	6/8
Absorptions/resorptions	3/8	4/8
Stillbirths	0/8	1/8
Normal births	5/8	1/8

All infants born to the experimental animals were small (1-2 standard deviations from normal) with detectable levels of PCBs in their skin (1.0-4.8 ug/g tissue). Analysis of the tissues of the stillborn infant monkeys showed 25 ug PCB/g in the adrenals and 64 ug PCB/g tissue in the pancreas. Infants were nursed and within 2 months showed signs of PCBs intoxication (swelling of the eyelids, loss of eyelashes, increased skin pigmentation). Levels of PCBs in the mother's milk ranged from 0.154 to 0.397 ppm. At 4 months of age the surviving infants were weaned and their learning and behavioral development were evaluated. Infants from treated mothers were hyperactive and did not learn reversal tasks as readily as control infants. These abnormalities persisted in the animals for over 2 years (Allen et al. 1979).

Four male Rhesus monkeys were fed a diet containing 5.0 ppm Aroclor 1248 for 18 months (total consumption 530-692 mg PCB). During the first 12 months, sperm counts and breeding performance in the treated males were similar to that of controls. Between the 12th and 18th months one male developed clinical signs of PCB intoxication, suffered a marked decrease in sperm counts, and failed to impregnate females. A testicular biopsy indicated hypocellularity of the seminiferous tubules and absence of spermatozoa. A complete recovery of spermatogenesis was noted 1 year after animals were removed from the PCB diet (Allen et al. 1979).

Studies have also indicated that residual effects of low-level ingestion of PCBs may persist for over 1 year after discontinuation of exposure (Allen et al. 1979). Sixteen adult female Rhesus monkeys of approximately 5.6 kg weight consumed a diet of 2.5 or 5.0 ppm Aroclor 1248 for 18 months. Eight controls were fed a diet with no PCBs added. Total intakes for the 2.5 and 5.0 ppm PCB groups were an average of 270±25

and 498±50 mg, respectively. The PCB diets were discontinued for 1 year prior to breeding at which time menstrual cycles had already returned to normal. The following results were observed:

Previous Treatment PCB in diet (ppm)	Total Intake of PCB (mg)	Number Conceived	Live Births	Birth Weight (g)
Controls	--	8/8	8/8	516±65
2.5	243-309	8/8	7/8	480±83
5.0	460-614	7/7	4/7	440±55

One of the females in the 2.5 ppm and three of the females in the 5.0 ppm group suffered abortions and stillbirths. Stillborn infants had PCB tissue levels of 2.0-2.5 ug/g tissue. During 4 months of nursing, infants from exposed mothers developed hyperpigmentation. Analysis of the milk indicated PCB levels averaging 0.050 ug/g whole milk. Skin biopsies at birth and three months of age indicated increases in the levels of PCBs in the infants' tissues from nondetectable to an average of 3.31 ug/g tissue. Two infants from each exposure group died after weaning at four months of age and having manifested symptoms of anorexia, swollen eyelids, loss of eyelashes, acne, alopecia (loss of hair), and scaly skin (Allen et al. 1980).

Babies born to Yusho victims, individuals ingesting less than 720 ml of Kanechlor 400 in contaminated rice oil (EPA 1980), were "small for date" when born and suffered from retarded growth, abnormal tooth development, and hyperpigmentation (Urabe et al. 1979).

Some organisms appear to be extremely sensitive to reproductive effects of PCBs. This is especially true of the mink (Mustela vison) and, to a lesser extent, the ferret (Mustela putorious fuso). Recent studies (Ringer 1981) showed effects to mink reproduction on administration of 2 mg/kg Aroclor 1254. Meat containing PCBs (i.e., partially metabolized PCBs) was more toxic by an order of magnitude. The effects were embryotoxic with spermatogenesis, oogenesis, and implantation unaffected.

7.2.8 Summary and Conclusions

Although there are no unequivocal, definitive studies, the preponderance of evidence indicates that Aroclor 1254 is suspected to be carcinogenic in animals. This evidence includes:

- Structural similarity to known promoters (e.g., 2,3,7,8-TCDD)
- Genotoxicity as indicated by DNA damage
- Precancerous or proliferative lesions and benign tumors

- Positive tumor responses in several studies although not dose or target organ related

- Positive study of Morgan et al. (1981)

Based on these conclusions, EPA suggested values for cancer unit risk will be used in the risk assessment process. For inhalation this value is 1.2×10^{-3} for a 70-year exposure to 1 ug/m^3 (EPA 1984). For ingestion the potency factor of 4.3396 $(mg/kg/day)^{-1}$ will be used (EPA 1980). According to the weight of evidence approach adopted by EPA (49 Fed. Reg. 46300), Aroclor would be classified as a possible human carcinogen (Group C).

7.3 RISK ASSESSMENT

The purpose of this section is to quantify to the extent possible the adverse health effects associated with contamination of the Wide Beach site. This quantification will form the baseline condition for the feasibility study in addition to defining present conditions. The risk assessment was conducted by constructing scenarios for dermal, inhalation, and ingestion of PCBs. The exposure concentrations were then multiplied by the appropriate carcinogenic risk factor (Section 7.2.8) to yield a generalized lifetime risk. The risks resulting from the different exposure routes are then added to determine the overall risk. Both worst-case and average/realistic scenarios were constructed based on exposures. The average/realistic scenario is based on average concentrations and realistic assumptions. The worst-case scenario is based on maximum concentrations and conservative assumptions. The worst-case may be viewed as the upper bound on the risk, zero as the lower, and the average/realistic scenario as a measure of central tendency.

7.3.1 Exposure to Indoor Dust/Soil

WORST-CASE SCENARIO FOR AMBIENT DUST INHALATION (BY MASS BALANCE)

1. Maximum PCB concentration = 770 mg/kg (From vacuum cleaner dust measurements)

2. Maximum dust concentration indoors = maximum outdoors = 0.453 mg/m^3

3. All particles respirable

4. 70-year exposure

$$\text{Maximum PCB} = \frac{0.453 \text{ mg}}{\text{m}^3} \times \frac{770 \text{ mg}}{10^6 \text{ mg}}$$

$= 3.5 \times 10^{-4}$ mg/m^3
$= 0.35$ ug/m^3

Based on EPA (1984) inhalation unit risk, exposure to 1 ug/m^3 atmospheric PCB results in 1.2 x 10^{-3} cancers. Elevated cancer risk for exposure to 0.294 ug/m^3 is 4.2 x 10^{-4}.

AVERAGE/REALISTIC CASE FOR AMBIENT DUST INHALATION

1. Average PCB concentration = 38.9 mg/kg
2. Average dust concentration = 0.116 mg/m^3
3. 75 percent of particles are respirable
4. 70-year exposure

$$\text{Exposure} = \frac{0.116 \text{ mg}}{m^3} \times \frac{38.9 \text{ mg}}{10^6 \text{mg}} \times 0.75 \times 1000$$

$$= 3.4 \times 10^{-3} \text{ ug/mg}^3$$

$$\text{Risk} = 4.1 \times 10^{-6}$$

WORST-CASE SCENARIO FOR VACUUM DUST DERMAL ABSORPTION OF PCB

This analysis is based on calculation of risk from soil ingestion for different age groups and summing them for a total lifetime risk. In the analysis, the typical male body weight for the various age groups was obtained (ICRP 1975) and the fraction of time spent in the age group was calculated. Daily soil deposition rates (Section 7.1.3) were multiplied by the PCB concentrations in the dust and the absorption factor to yield the absorbed dose. When divided by the body weight, this then yields the PCB dose in mg/kg/day. The dose multiplied by the potency factor yields the risk per group which then yields the time weighted risk for the age group when multiplied by the fraction of time spent in the age group.

1. Highest dust PCB concentration = 770 mg/kg

2. 50 percent absorption from soil through skin

Age Group	Deposition of Soil on Skin (g/day)	Absorbed PCB Dose (mg/day)	Male Body Weight (kg)
<9 months	0	0	3.5
9-18 months	1	0.385	10
1.5-3.5 years	10	3.85	15
3.5-15 years	1	0.385	30
>15 years	0.1	0.038	70

Age Group	Fraction of Life at Age	Dose (gm/kg/day)	Risk Per Group	Time Weighted Risk
<9 months	--	0	0	--
9-18 months	0.0107	3.8×10^{-2}	1.6×10^{-1}	-1.8×10^{-3}
1.5-3.5 years	0.0286	2.5×10^{-1}	1.1	3.2×10^{-2}
3.5-15 years	0.1643	1.3×10^{-2}	5.5×10^{-1}	9.0×10^{-2}
>15 years	0.7857	5.5×10^{-3}	2.4×10^{-3}	1.9×10^{-3}
			Total Lifetime Risk	4.5×10^{-2}

Based on EPA (1980) potency factor of 4.3396 $(mg/kg/day)^{-1}$

AVERAGE/REALISTIC CASE FOR INDOOR DERMAL ABSORPTION

1. Average soil PCB concentration 38.9 mg/kg (Section 4)

2. 10 percent dermal absorption

   Risk = 4.4×10^{-4}

7.3.2 Exposure to Outdoor Dust/Soil

Exposure estimate for inhaled soilbound PCBs under worst-case assumptions:

1. PCB concentration = 5,300 mg/kg (maximum PCB soil concentration)

2. Ambient air particulate concentration = 0.453 mg/m^3

3. All particles are respirable (all particles are <16 um)

4. 70-year lifetime exposure.

$$\text{Maximum PCB Exposure} = \frac{5{,}300 \text{ mg}}{10^6 \text{ mg}} \times \frac{0.453 \text{ mg}}{m^3}$$

$$= 2.4 \text{ ug PCB}/m^3 \text{ air}$$

Risk = 2.9×10^{-3}

MOST REALISTIC CASE OF OUTDOOR PARTICULATE INHALATION

1. Average PCB concentration in yards and driveways = 46 mg/kg

2. Average ambient air particulate concentration = 0.116 mg/m^3

3. 27 percent of particulates are respirable (<16 um)

4. 70-year lifetime exposure

$$\text{Average PCB Exposure} = \frac{46 \text{ mg}}{10^6 \text{ mg}} \times \frac{0.116 \text{ mg}}{\text{m}^3} \quad 1.27$$

$$= 1.4 \times 10^{-4} \text{ ug PCB/m}^3 \text{ air}$$

$$\text{Risk} = 1.7 \times 10^{-7}$$

INGESTION OF OUTDOOR SOIL UNDER WORST-CASE ASSUMPTIONS

This analysis is based on calculation of risk from soil ingestion for different age groups and summing them for a total lifetime risk. In the analysis, the mean male body weight for the age groups was obtained (ICRP 1975) as was the fraction of a lifetime spent in the age group. The absorbed dose was then calculated by multiplying the amount of soil ingested by the PCB soil concentration and the absorption factor. When divided by the body weight, this then yields the dose in mg/kg/day. The dose multiplied by the potency factor yields the risk per group which yields the time weighted risk for the age group when multiplied by the fraction of time spent in the age group.

1. PCB soil concentration = 5300 mg/kg

2. Absorption is 90 percent

3. Pica ingestion patterns as described in Section 7.1.1

4. 70-year lifespan

Age Group	Male Body Weight (kg)	Fraction of Lifestage	Ingestion of Soil (g/day)	Absorbed Dose of PCB (mg/day)	Dose (mg/kg/day)
< 9 months	3.5	0.0107	0	0	0
9-18 months	10	0.0107	1	4.8	0.5
1.5-3.5 years	15	0.0286	10	48	3.2
3.5-5 years	18	0.0214	1	4.8	0.3
5-6 years	19	0.0143	0.1	0.5	0.02
>6 years	70	0.9140	0	0	0

Age Group	Risk per Group	Time Weighted Risk
<9 months	0	0
9-18 months	2.2	2.4×10^{-2}
1.5-3.5 years	13.9	4.0×10^{-1}
3.5-5 years	1.3	2.8×10^{-2}
5-6 years	0.1	1.4×10^{-3}
>6 years	0	0
Total Lifetime Risk		4.5×10^{-1}

Based on EPA (1980) potency factor 4.3396 $(\text{mg/kg/day})^{-1}$

INGESTION OF OUTDOOR SOIL UNDER AVERAGE/REALISTIC ASSUMPTIONS

1. PCB soil concentration = 46 mg/kg

2. Absorption is 90 percent

3. Pica ingestion patterns as described in Section 7.1.1

4. 70-year lifespan

Age Group	Male Body Weight (kg)	Fraction of Life at Age	Ingestion of Soil (g/day)	Absorbed dose of PCB (mg/day)
<9 months	3.5	0.0107	0	0
9-18 months	10	0.0107	1	0.04
1.5-3.5 years	15	0.0286	10	0.41
3.5-5 years	18	0.0214	1	0.04
5-6 years	19	0.0143	0.1	0
>6 years	70	0.9149	0	0

Age Group	Dose (mg/kg/day)	Risk per Group	Time Weighted Risk
<9 months	0	0	0
9-18 months	4×10^{-3}	1.7×10^{-2}	1.8×10^{-4}
1.5-3.5 years	2.7×10^{-2}	1.2×10^{-1}	3.4×10^{-3}
3.5-5 years	2×10^{-3}	8.7×10^{-3}	1.9×10^{-4}
5-6 years	0	0	0
>6 years	0	0	0
		Total Lifetime Risk	3.8×10^{-3}

WORST-CASE SCENARIO FOR OUTDOOR SOIL DERMAL ABSORPTION OF PCB

1. Highest soil concentration 5,300 mg/kg

2. 50 percent absorption from soil through skin

3. Methodology the same as for vacuum dust

   Risk = 3.0×10^{-1}

AVERAGE/REALISTIC CASE FOR OUTDOOR SOIL PCB ABSORPTION

1. Average soil concentration 46 mg/kg

2. 10 percent absorption from soil through skin

   Risk = 5.2×10^{-4}

7.3.3 Risk Associated with Drinking Water Exposure

7.3.3.1 Trace Metals

Conclusions presented in the RAMP indicated that a rigorous investigation of ground-water quality should be conducted, especially with regard to trace metals. The results of this investigation were presented in Section 4.1. EA has developed a series of decision criteria for levels of trace metals in drinking water supplies (Table 7-5). These criteria are based on the health-related acceptable daily intake concept in addition to consideration of existing regulatory limits. In no case are EA's criteria higher than the relevant New York State drinking water standards. If the measured levels in the environment exceed the applicable decision criteria, the potential exists for health concern.

With a few exceptions, the ground-water concentrations at Wide Beach were below the decision criteria. The Major house (73 Oval) had a cadmium concentration (35 ug/L) 3.5 times higher than the criterion in one sampling. This home also had elevated levels of other metals, although the decision criteria were not exceeded. This is probably a function of the water system plumbing rather than the aquifer.

Nickel was found at levels exceeding the decision criteria in almost all cases. The source of this is probably natural. The Lake Erie Basin had the highest nickel concentration (56 ug/L) in the United States of those surveyed by NAS (1975).

Nickel has been shown to cause adverse health effects, including mutagenicity (Newman and Summitt 1982), reproductive effects (Shroeder and Mitchner 1971), and carcinogenicity (NAS 1975). Based on the data of Schroeder and Mitchner (1971), EPA (1980) calculated an Acceptable Daily Intake (ADI) of 4.43×10^{-4} mg/kg. For a 70-kg individual who consumes 2 L of water per day, this translates to a decision criterion of 0.016 mg/L. The Canadian regulatory agencies have used the same data to calculate a level of 0.20 mg/L (after treatment) using a different set of assumptions. In the interests of consistency, the assumptions currently used in the United States (EPA 1980; NAS 1977) should be applied resulting in a decision criterion of 0.016 mg/L.

7.3.3.2 PCBs

The appearance of PCBs in drinking water supplies since 1982 at Wide Beach is rather sporadic (Table 4-10). Of a total of 244 samples, PCBs were detected in only 34, or 14 percent. In only three cases did the concentration exceed the New York State Department of Health advisory level of 1 ppb. These wells showed no detectable PCBs at later sampling. These results are consistent with previous analyses conducted by ECDEP and FIT, which also indicated sporadic trace level occurrence of PCBs in drinking water at the site. It is concluded that, taken by itself, there is no significant threat from PCBs in drinking water at Wide Beach at the present time.

7.3.4 Risk Associated With Airborne Exposure

The elevated cancer risks associated with exposure to airborne PCBs may be calculated using modeled concentrations (Section 6.2), inhalation exposure concepts (Section 7.1.2), and unit cancer risks (Section 7.2.4). This model is thought to give a more reasonable picture than the mass balance approach in Sections 7.3.1 and 7.3.2 since dust is unlikely to be suspended constantly. For the worst-case onsite scenario, the elevated cancer risk would be 3×10^{-4} [C] and 5×10^{-6} [C] for the average scenario. For PCB transported offsite to Lotus Point, the risk would be 2×10^{-6} [C] for the worst-case and 2×10^{-6} [C] for the average scenario.

The most realistic scenario may be constructed using particle size information (Table 4-25). Using a conservative assumption that particles with diameter less than 16 um are respirable, the exposure and risk will be diminished by the fraction of respirable particles. The average fraction is 27 percent; thus the average onsite scenario risk would be reduced to 1×10^{-6} [C] and the average offsite risk reduced to 5×10^{-7} [C].

It should be kept in mind that these risks are only relevant to the site in its current state. Construction activities during remediation could potentially result in significantly elevated levels of risk. This will be discussed in greater detail during the feasibility study.

7.3.5 Assumptions Employed in the Risk Assessment

1. Maximum PCB concentrations are those measured onsite.

2. Average PCB concentrations are arithmetic mean.

3. Indoor dust levels equal outdoor dust levels (Kimbrough et al. (1984).

4. PCB degradation rates are longer then human lifetimes (Section 6.3).

5. If the particle size distribution is unknown, 75 percent are assumed to be respirable (Schaum 1984). Soil particle sizes were measured over a limited range for cost-effectiveness. For those measured, it is assumed that particles with aerodynamic diameters $\leq$16 um are retained in the lung or bronchii.

6. A linear dose-response relationship with no threshold exists for PCB-tumor activity.

7. Deposition of soil on skin is distributed as in Kimbrough et al. (1984).

8. Dermal absorption for PCBs is taken to be similar to TCDD based on the literature (Poiger and Schlatter 1980) and structure-activity relationships.

9. Soil ingestion patterns are given by Kimbrough et al. (1984).

7.3.6 Conclusions Concerning Human Health Effects

1. Significant routes of human exposure to PCBs at Wide Beach include ingestion of contaminated vegetables, ingestion of soil (Pica), inhalation of contaminated dust, and dermal ingestion.

2. The preponderance of evidence in the scientific literature indicates that Aroclor 1254 is carcinogenic in laboratory animals. The strength of evidence indicates that it should be classified as a possible human carcinogen.

3. Risk assessment indicates that there is an elevated cancer risk for Wide Beach residents as compared to the general rural population. For outdoor exposure through dermal absorption, soil ingestion, and particulate inhalation, the elevated lifetime risks are on the order of 10^{-3}.

4. As defined by CERCLA, there is a danger to human health at Wide Beach under current conditions. The potential effects are related to chronic rather than acute exposure.

7.4 ENVIRONMENTAL EFFECTS ASSESSMENT

7.4.1 Plants

The database regarding the effects of PCBs on aquatic plants is relatively small. Inhibition of plant growth due to PCBs has been documented mainly for algae (Strek 1980). EPA (1980) reports toxic effects to unicellular plants at concentrations of Aroclor 1254 as low as 0.1 ug/L. Verschueren (1983) cites Cooley and Keltner as having demonstrated a 13.3 percent decrease in population size for the alga, Tetrahymera pyriformis, in a 96-hour static bioassay with 10 ug/L Aroclor 1254.

Numerous effects have been noted on terrestrial macrophytes grown in soil containing PCBs. Strek (1980) reported reductions in plant height, fresh weight, and cumulative water use for the soybean (Glycine max) and beet (Beta vulgaris) at 1,000 mg/kg Aroclor 1254. Respiratory effects were noted at lower doses. Strek also reported depression of height and foliage fresh weight of pigweed (Amaranthus retroflexus) at 100 mg/kg. Atrazine susceptable biotypes were considerably more sensitive. Strek notes that effects on plants are probably due to interference with photosynthesis and respiration. Weber and Mrozek (1979) reported similar results with soybean and fescue.

In addition to toxic effects on plants themselves, there is additionally the problem of plant contamination and subsequent transfer to higher trophic levels. PCBs in soils have been demonstrated to contaminate plant roots (Moza et. al. 1979; Strek 1980). Absorption seems to be related to the water and oil content of the plant's root and subsequently its ability to accumulate lipophilic xenobiotics (Iwata et. al. 1974; Pahren et. al. 1979). Contamination of the foliage and stems is attributed primarily to adsorption to the leaves and stems from the air, and subsequent movement through the epidermal layers (Buckley 1982).

7.4.2 Aquatic Life

EPA (1980) recommends a criterion of 0.014 ug/L as a 24-hour average for protection of aquatic life. During a storm event, the concentrations of Aroclor 1254 released into the wetlands south of the Wide Beach Oval could be sufficiently high as to pose a threat to aquatic life.

7.4.3 Birds

Most of the studies concerning effects of PCBs on birds have used domesticated fowl. Calbrese and Sorenson (1977) reported that 20 mg/kg PCB in feed reduced hatchability and caused teratogenic effects in White Leghorn hens. Decreased eggshell production and shell thickness were noted at 100 mg/kg of Aroclor 1254. Other studies have shown reproductive impairment in chickens for various PCBs at levels from 5 to 20 mg/kg (Briggs and Harris 1973; Lillie et. al. 1974). Hatchability, embryo viability, and egg production were also found to be adversely affected in pheasants. Reproduction in ring doves (Streptopelia risoria) was reduced by a diet containing 10 mg/kg Aroclor 1254 (Peakall and Peakall 1973). Other reproductive studies in wild birds are summarized by Wasserman (1979). In addition to reproductive effects, several of these authors noted liver damage and immunosuppression in avian species.

Domesticated fowl are particularly susceptible to chick edema, an extracellular accumulation of body fluids, occurring prior to death (McConnell 1980). This condition has been noted in both laboratory feeding studies and in an epidemiological study which traced chick death to PCBs from leaking transformer fluid.

Reproductive effects are not the only effects reported for birds. PCB poisoning was strongly implicated in the death of ring-billed gulls (Larus delawaersis) in southern Ontario (Sileo et. al. 1977). Acute toxic effects have been demonstrated in ring-necked pheasants (Phasianus colchirs) (Dahlgren et. al. 1972), Japanese quail (Coturnix coturnix) (Call et. al. 1973), and various small bird species (Stickel 1975). PCBs have also been associated with abnormal behavior in laboratory studies with European robins (Erithacus rubecula) (Ulfstrand et. al. 1971), redstarts (Phoenicurus phoenicurus) (Karlsson et. al. 1974), ring-necked pheasants (Dahlgoer and Linder 1971), and bobwhite quail (Colinus virginianus) (Hudson et. al. 1984).

There are inadequate data to derive a dose-response relationship for PCB avian toxicity. Reproductive and developmental effects appear to be most important. In a recent report by Heinz et. al. (1984), carcass residues

from 23 to 218 mg/kg PCBs on a wet-weight basis were measured in four species of birds collected along a PCB contaminated area on the Sheboygan River, Wisconsin. The detected levels are associated with reproductive impairment in laboratory studies. Food items in the stomach of collected birds contained from 12 to 58 mg/kg PCBs, indicating a heavy contamination of food sources. In light of the high degree of soil contamination and the evidence of bioconcentration in small mammals at Wide Beach, the potential for adverse effects on birds exists through the ingestion of contaminated food stuff.

7.4.4 Mammals

More studies have been conducted on mammalia than any other class; however, many of these (e.g., with primates) are not relevant to Wide Beach ecology. Adverse effects to mammals have been summarized by Wasserman et al. (1979), EPA (1980), NIOSH (1979), and most recently Sleight (1983). The most deleterious effects of PCBs on mammals appear to be cancer, reproductive toxicity, and hepatotoxicity. The question of cancer has been addressed in Section 7.2.4.

Liver pathology occurring in mammals includes fatty metamorphosis, occurrence of intracellular hyaline bodies, histologic changes, enzyme induction, and hepatic porphyria. The NCI cancer bioassay (Fung 1982) produced dose-response data for nodular hyperplasia in rats (Figure 7-1). These data indicate that, even at low doses, there exists a potential for liver toxicity in rodents exposed to Aroclor 1254.

Reproductive effects have been observed in mice, rats, rabbits, Rhesus monkeys, ferrets, mink, seals, and humans. Mink are generally accepted to be the species most sensitive to reproductive failure. Dietary dosages as low as 0.64 mg/kg fed to female mink (Mustela vison) for 160 days resulted in nearly complete reproductive failure through reabsorption of embryos, stillbirths, or early kit mortality (Platonow and Karstad 1973; Aulerich and Ringer 1977; Jensen et. al. 1977). Ringer (1983) reports that oral doses of Aroclor 1254 as low as 2 mg/kg adversely affected reproduction. Partially metabolized PCBs were even more toxic. When PCB contaminated carp were fed to mink for a total of 56 mg PCB over 250 days, there was total reproductive failure compared to 3.8 live kits per female for a control. Aulerich and Ringer (1977) presented evidence that the reproductive effect of PCBs may be directly proportional to total intake, rather than to a chronic exposure to some threshold concentration. Furthermore, in a study examining PCB residues in a wild population of mink in western Maryland, levels were found similar to those causing impaired reproduction in laboratory experiments (O'Shea et. al. 1981). The authors concluded that, since residues associated with reproductive failure can be detected in tissues of individual mink from localities not known to be subject to point sources of PCB pollution, mink in areas of known heavy PCB contamination are likely experiencing serious reproductive difficulties.

An analysis of liver tissue taken from small mammals collected at identified areas of PCB contamination at the Wide Beach study site and similar noncontaminated habitats offsite is summarized in Table 4-36. A description of the habitats at each of the stations can be found in Section 3.5.

PCB levels from mammals taken in contaminated areas, normalized for the percent lipid in each of the composited samples, are elevated over the control samples collected at Evangola State Park. The contaminant level from the back yard station is substantially higher than the other stations and corresponds with the distribution of the contaminated oil. Although specific ecological pathways cannot be delineated from the limited data set, it is evident that a source of contamination exists for carnivores and scavengers feeding in the vicinity of the contaminated stations.

7.4.5 Conclusions Concerning Environmental Effects

- Phytotoxicity has been described in the literature to occur at PCB soil concentrations as low as 100 mg/kg. Additionally, PCBs may be taken up by plants. Concentrations greater than 100 mg/kg were found in soils at the site.

- EPA's ambient water quality criterion for PCBs is 0.014 ug/L. Concentrations greater than this are released to Wide Beach wetlands during storms.

- Avian toxicity has been demonstrated at feed PCB levels as low as 5 mg/kg. Mammalian toxicity has been demonstrated at feed PCB levels as low as 0.64 mg/kg. Soil PCB concentrations at Wide Beach potentially could produce feed levels at this magnitude.

- It is concluded that soil-bound PCB at Wide Beach poses a danger to the environment in the context of CERCLA.

TABLE 7-1 TISSUE LEVELS (ug/g) OF POLYCHLORINATED BIPHENYLS IN RATS FED 100 mg/kg OF AROCLOR 1254

	Time (weeks)				
Tissue	13	26	39	52	65[a]
Fat	982±212	1,170±76	981±120	1,080±440	1,130±590(a)
Liver	30±6	25±17	86±67	31±18	35±9
Kidney	40±31	66±43	75±76	186±160	16±5
Brain	6±0.8	3±2	8±3	60±8	10±2

(a) Rats were off PCB diet from 52nd to the 65th week.
Source: Allen et al. 1978.

TABLE 7-2 ACUTE MAMMALIAN LD50 VALUES FOR AROCLOR 1254

Organism	Route	LD50 (g/kg)
Rat, adult, Sherman	Oral	4-10
Rat, weanling, Sherman	Oral	1.295
Rat, female, Sherman	Intravenous	0.358
Rat, 30-day old, Wistar	Oral	1.3
Rat, 60-day old, Wistar	Oral	1.4
Rat, 120-day old, Wistar	Oral	2.0
Rat, 120-day old female, Wistar	Oral	2.5

Source: EPA (1980).

TABLE 7-3 INCIDENCE OF STOMACH ADENOCARCINOMAS AND INTESTINAL METAPLASIA OBSERVED BY MORGAN ET AL. 1981

Concentration of Aroclor 1254 (ppm)	Number of Rats with Stomach Lesions (affected/exposed)	Number of Rats with Intestinal Metaplasia (affected/ exposed)	Number of Rats with Stomach Adenocarcinomas (affected/ exposed)
0	3/47 (6.4%)	3/45	0/47
25	5/48 (10.4%)	4/48	1/48
50	8/48 (16.7%)	5/48	3/48
100	17/48 (35.4%)	15/48	2/48(a)

(a) Regions of severe dysplasia identified in two additional foci of intestinal metaplasia but sections available did not allow for confirmation of adenocarcinoma.

TABLE 7-4 SUMMARY OF CANCER BIOASSAYS (RTECS 1984)

Species	Route	Lowest Toxic Dose	Duration	Effects	Quality
Rat	Oral	4 g/kg	2 years	Liver tumor Gastrointestinal tract tumor	Equivocal
Mouse	Oral	17 g/kg	48 weeks	Liver tumor	Not available
Mouse	Skin	4 mg/kg		Skin tumor	Equivocal
Mouse	IP	500 mg/kg		Reproductive tumor Pulmonary tumor	Equivocal
Rat	Oral			Gastrointestinal tumor	Equivocal

TABLE 7-5 DECISION CRITERIA FOR TRACE METALS

	ug/l
Antimony	50
Arsenic	50
Beryllium	350
Cadmium	10
Chromium	50
Copper	500
Lead	50
Mercury	2
Nickel	16
Selenium	10
Silver	50
Thallium	12
Zinc	5,000

Source: Chrostowski (1985).

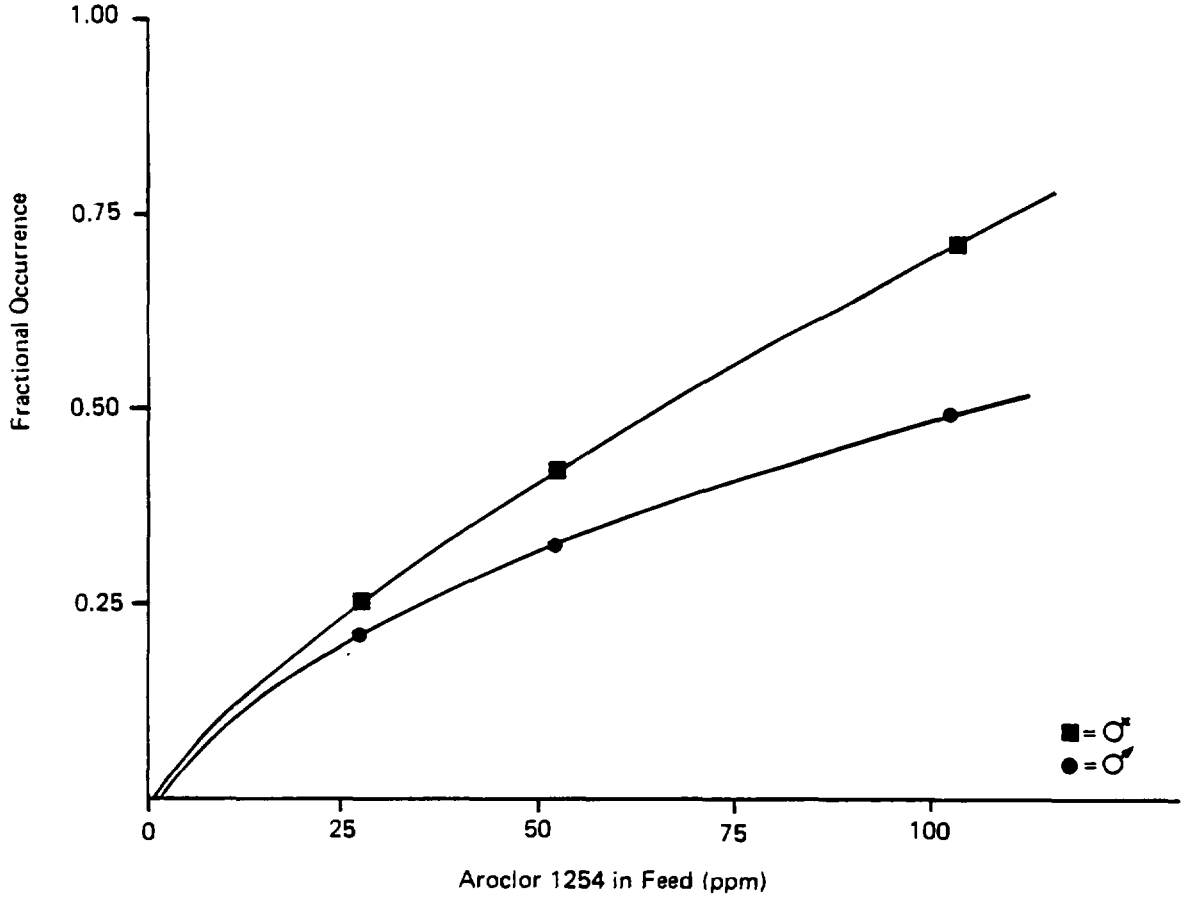


Figure 7-1. Dose-response curves for occurrence of nodular hyperplasia in livers of F-344 rats. (Derived from data presented in Fung and Kirchner 1982)

8. SUMMARY AND RECOMMENDATIONS

8.1 RANGE AND EXTENT OF CONTAMINATION

Polychlorinated biphenyl (PCB), specifically Aroclor 1254, is the primary contaminant at the site. In general, some degree of contamination exists over the entire site. Ground water, surface water, soil, indoor dust, air, and biota all exhibited detectable levels of Aroclor 1254.

In ground water, observation wells associated with sewer trenches were the ones most contaminated. Aroclor 1254 was found in all six sewer trench wells at a mean concentration of 3.0 ug/L, in one of eight monitoring wells at a concentration of 0.2 ug/L, and sporadically in drinking water samples at a mean concentration of 0.44 mg/L when detected.

High levels of PCB contamination (>50 mg/kg) were found in the soil in proximity to the oiled roadways. Aroclor 1254 was detected in 116 of 123 front yard samples at concentrations ranging up to 600 mg/kg with a mean value of 22 mg/kg. All 84 roadway samples had detectable PCBs ranging up to 226 mg/kg. The highest level of PCBs at the site was 5,300 mg/kg found in surficial soil at catch basin C. The contamination was primarily surficial. In a series of surficial borings (0-6 in.) and deep borings (up to 11 ft), the average surficial concentration was 61.3 mg/kg compared to 0.056 mg/kg for deep samples.

Phthalate esters (12 incidences) and 1,2,4-trichlorobenzene (7 incidences) were also found in the soil at the site.

Surface water running off from the site contained PCBs in both sorbed and free phases.

PCBs were detected in all 50 vacuum cleaner dust samples with a mean concentration of 38 mg/kg.

8.2 INITIAL REMEDIAL MEASURES

The risk estimates developed in Section 7 in conjunction with supporting data in Section 4 warrant initial or interim remedial measures. The primary routes of concern are direct contact with and ingestion of PCB-contaminated soils, especially among children, and inhalation of contaminated dust particles. Roads and drainage ditches as well as driveways and front yards of all residential lots constitute direct-contact exposure media. Inside the homes, vacuum cleaner dust was found to be contaminated with Aroclor 1254 at concentrations ranging from 0.25 to 770 mg/kg. Three samples ranged between 150 and 770 mg/kg, 21 percent ranged between 20 and 43 mg/kg, and 72 percent were <20 mg/kg.

Temporary measures can be taken to reduce exposure that will be compatible with the eventual final remedial action (e.g., excavation, construction, etc.), assuming that action will not commence until at least mid-1986. The following course of action is recommended:

1. Notify Wide Beach residents of the soil and vacuum cleaner sampling results, discuss risk estimates, and issue appropriate advisories on minimizing contact with soil and ingestion of homegrown root crops.

2. Issue recommended procedures for an immediate thorough cleaning of all living and storage areas, as well as the passenger space of all vehicles. All vacuum cleaner bags should be removed and discarded, drapes and upholstery shampooed, and carpets cleaned with a commercial steam/hot water cleaning solution. Professional home cleaning (by a contractor) would be advisable after source control is achieved.

3. Develop an educational program designed to prevent unnecessary exposure to soils through direct contact (e.g., walking barefoot during summer, gardening, digging, etc.), and secondary contact from pets and clothing. Residents should be advised to take extra measures to prevent the tracking of soils into living areas and to minimize the exposure of children to contaminated areas.

8.3 LONG-TERM REMEDIAL MEASURES

The available data on the following areas are adequate enough to define the extent of contamination and evaluate migration pathways:

- roadways and ditches
- front yards and driveways
- surficial areas proximate to roads and ditches
- sewer trench systems
- storm drain and outfall system
- interior space of houses
- existing onsite potable water supply

These areas have been designated for the Feasibility Study because of observed or potential PCB contamination at levels $\geq$50 mg/kg (ppm) in soils and $\geq$1 ug/L (ppb) in ground water, associated exposure pathways identified in Sections 6 and 7, and risk estimates developed in Section 7. The surficial soils throughout the site, in addition to the specific areas listed, should be evaluated during the Feasibility Study to determine precisely which areas will require remediation to reduce risks to human health, welfare, and the environment.

The following areas are insufficiently defined regarding the extent of PCB contamination:

- ground water, surficial soils, and pond sediment north of the site
- back yards
- septic tanks

It is anticipated that definition of these areas may change the scale but not the recommended alternatives for the Feasibility Study and/or remedial design.

8.4 RECOMMENDATIONS FOR FURTHER INVESTIGATION

8.4.1 Offsite Transport Study

As part of the remedial investigation, the potential for surface-water and ground-water transport offsite to the north has been identified. However, sufficient information has not been developed to fully assess these possibilities. The objective of this additional remedial investigation task will be to identify and quantify any offsite transport occurring to the north of the Oval. Topographic and ground-water contour data indicate transport in this direction is possible, however further investigation is required to more fully evaluate potential pathways.

To address this, the following additional remedial investigation activities are recommended:

1. Extend the survey to include an area approximately 500 ft north along the Lake Erie shoreline and 600 ft east from the lake. This will help define the direction and discharge rate of surface-water runoff from the northern portion of the site.

2. Place three additional observation wells between the Oval and the pond north of the site.

3. Obtain a full round of water-level elevations including all wells and water surfaces and the pond north of the site. This will enable determination of the potential for offsite ground-water discharge to the north to be addressed.

4. Obtain, for PCB analysis, 15 surficial samples from three transects across the newly surveyed area, and two sediment and one water sample from the small pond in this area, to determine the presence of PCB contamination.

8.4.2 Back Yard Sampling

The available data do not suggest major problems with PCB contamination of back yards. However, owing to the sporadic occurrence of hot spots and the potential for PCB redistribution via surface water and atmospheric transport, back yards should be sampled to determine which areas may require remediation. Representative sampling of surficial soils in the back yard areas and analysis for PCBs is recommended.

8.4.3 Septic Tank Sampling

Septic tanks reportedly have been closed at Wide Beach since residents were required to connect to the sanitary sewer system installed in 1980. The materials remaining in these tanks and overflow systems may pose a

threat to the aquifer if sufficient quantities of PCBs are left in-place idefinitely. Septic tanks would have received PCB-contaminated soils washed from clothing and floors in the homes and some garages. Representative subsampling of the septic tanks (up to 20 tanks) is recommended. Tank sediment would be analyzed for PCBs.

It may also be advisable to sample dilute sewage at the lift station onsite to estimate the relative significance of PCB loadings, if measurable, being washed through the new sanitary sewer system under current conditions. Two 24-hour composite samples are recommended, with analysis for total PCBs.

These additional studies should be conducted expeditiously and concurrent with the Feasibility Study. They will provide a more complete database to address contaminant migration offsite in order to develop comprehensive remedial alternatives and realistic cost estimates.

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