

ABANDONED LANDFILL STUDY
IN THE
CITY OF SEATTLE

SEATTLE-KING COUNTY DEPARTMENT OF PUBLIC HEALTH

JULY 30, 1984

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CHAPTER I
INTRODUCTION

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INTRODUCTION

The Seattle Abandoned Landfill Survey was conducted in June and July of 1984 by the Health Department's Environmental Health Division at the request of the Mayor's Office. The twelve sites were selected during a May 16, 1984 meeting between the Seattle-King County Department of Public Health, the Seattle Solid Waste Division, and the Seattle Law Department. The primary objective of the survey was to determine if any public health problems existed at the predetermined sites.

The Parks Department developed the geographical and historical data on park sites, and the Health Department researched the remaining sites. This information was used by the field staff for guidance in determining where the sampling efforts should be focused.

Due to the limited time and resources available for the study, the staff decided to conduct a primary survey utilizing general sampling parameters. In the event the primary survey revealed any environmental health problems, then funds would be requested for more detailed followup work. The parameters chosen as criteria for the primary survey were:

1. Gas - Methane and non-specific organics/inorganics exclusive of methane;
2. Water - Conductivity, dissolved oxygen, pH, turbidity and temperatures.



CHAPTER II
HISTORICAL REVIEW OF ABANDONED SITES

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CHAPTER II
HISTORICAL REVIEW OF ABANDONED SITES

OVERVIEW

For the purposes of making preliminary assessments of public health hazards, twelve abandoned disposal sites in Seattle were prioritized for in-depth studies. An effort was undertaken to gather as much historical information as possible about each site. Specifically data gathering focused on past and present uses of the site; any engineering information on the site, including topography and soil studies; information pertaining to waste disposal practices at the site; and any information on known or suspected problems. This effort relied on available secondary data sources. Official records were few. Anecdotal recollections, historical documents and maps, newspaper clippings, environmental impact statements and specialized studies or citizen's advisory committee reports formed the bulk of the written record. Specific geographical boundaries on some of the sites were impossible to ascertain from the records available. This study identifies the sites by the geographical location commonly accepted.

The historical study of abandoned landfills presents a picture of "probably anything" located "most anyplace."

In 1931, C.L. Murray, then Superintendent of the Garbage Division of the Health and Sanitation Department, defined garbage in Seattle as:

"Everything that is wasted from the home, the business house, manufacturing plant, or in fact any building within the limits of the

city. We collect this material without any separation - ashes, cans, kitchen waste, lawn clippings, tree trimmings, everything...."

The material went to sanitary fills located at convenient spots about the city on low lands such as tide lands or deep ravines. Many property owners permitted the City to dump on their land in order to bring the property level with the street grade, making it more desirable for building sites. According to one document at least 150 acres of land were so reclaimed in Seattle.

By the late 1920s people began to rebel against garbage dumps in residential areas. As late as 1927 there were reported to be sixteen garbage fills scattered throughout the City. Some of the known historical sites are shown in Table "I". By 1931 there were six. While the specific location of the disposal sites changed in the ensuing years, six sites could still be identified in the 1950's and 1960's. These final sites were closed in the late 1960's and all refuse handled through the transfer stations located on abandoned sites and disposed of at sites located at Midway, Cedar Hills, and the Kent Highlands.

Probably the major concern left from the legacy of solid waste practices are the large number of abandoned sites of unknown location and the practice of mixing commercial/industrial/residential wastes. In 1955 Seattle was noted to produce about 1,000 tons/day of garbage and trade waste. "Standard practice" today, whether it be in the way a sanitary landfill is operated or in the requirement to keep careful records and separate out certain types of solid waste, was not standard practice even thirty years ago.

Some of the abandoned sites probably received more of the commercial/industrial waste than others. (Anything located in the southend of Seattle is more suspect than other sites.) Also, in 1954 Phillip Royal, Principal Engineer of the Department of Engineering at that time, reported that:

"The City employs three open fire dumps. One is located on the University of Washington campus, one at Interbay and one at South Park. The City itself makes no collection of material consigned to these dumps, but as many as 2,000 cars and trucks a day deliver refuse to these sites to be burned. This refuse consists of large timbers, waste lumber, shrubbery, building refuse of all sorts, leaves, paper, boxes, barrels, scrap metal, logs and stumps, bed springs, tanks, large cans and some garbage. Waste oil, tires and industrial waste such as sawdust are not accepted. Materials received by the dumps are burned in the open air and flames, smoke, ash and odors are scattered by winds over a considerable section of the surrounding neighborhood, resulting in many justifiable complaints from nearby homes. The problem of the fire dumps is acute, the solution a difficult one to find. Much of the material delivered to the dumps is peculiar to this vicinity and cannot be burned in any type of incinerator in general use today. Much of it is metal; a great deal is salvageable.

"These dumps, through use and custom, have become a necessary sanitary facility, albeit obnoxious to the immediate neighborhood. If these facilities were not available, large quantities of debris would be

scattered illegally on vacant lots and public streets, thereby creating a worse nuisance."

As noted by the Citizen's Committee on Solid Waste in 1971, Chaired by Robert Sylvester, Seattle had exercised no defined control or jurisdiction over non-residential solid waste collection and disposal even though it was directly related to the health and welfare of citizens. According to a 1980 Battelle report on the "Identification of Hazardous Waste Disposal Sites and Management Practices in Region 10" it was not unusual for industries to use regional landfills for waste disposal. Municipal landfills receiving large amounts of hazardous wastes are of high priority concern primarily because the specifics about them are unknown today. Fortunately most municipal landfills received small amounts of industrial waste. Battelle notes that these are low priority concerns "...because of the buffering effect due to the large amounts of sanitary waste present."

INTERBAY

INTERBAY

Interbay Dump, officially known as Sanitary Fill No. 2 was established in April, 1911, under City Ordinance 15095. The Interbay disposal site was essentially north of Pier 91 Naval Station between Magnolia Bluff and Queen Anne Hill. Fifteenth Avenue West bordered the east; West Wheeler on the south; West Dravus and Barrett Streets on the north; and railroad tracks on the west. It consisted of about 55 acres and received waste primarily from the city west of Aurora Avenue and north of Denny Way.

1. PAST AND PRESENT USES

This was a low-lying former tidal area filled and made available for recreational purposes. It was turned over to the Park Department when the fill was completed and in 1963, 29 acres were leased and used as a small nine-hole golf course and driving range under private operation of Sterling Theaters, Inc. It is also the site for the Interbay Athletic Field.

In 1961, a major portion of the area was made available for overflow parking from the Century 21 World's Fair, although little was used.

Facilities exist for soccer, handball and softball. The garbage fill was still "unsettled" in 1971 when additional development was considered, so the major "development" was a "P-Patch" site.

Historically, a "shanty town" was found on site between the fire and garbage dumps adjacent to the railroad tracks. A major sociological study of the settlement was conducted in 1937. It was the scene of "intense economic

activity" in which quantities of salvage were reclaimed and sold. It was an economic community of self-supporting resident squatters which began in 1929.

2. SITE/ENGINEERING INFORMATION

Soil and foundation studies done by the Seattle Engineering Department at the Interbay Park site in 1977 reported that:

"...compact drift of unknown depth but at least 1,000 feet deep lies beneath the site, hence bedrock is at great depth. Long ago, an arm of Smith Cove extended beneath the park site (as evidence by sea shells in the samples) leaving soft bay deposits. On top of this intertidal soil are stream and pond sediments including peat from the stream that flowed from Salmon Bay to the south. Also, the area adjacent to 15th Avenue West probably is mantled with colluvium or slide debris from the east judging by the layers of soft, gray silt and loose sand.

"On top of all these natural soils are hydraulic fills and a sanitary landfill, the latter being up to 40 feet deep consisting of garbage and debris interbedded with the silty sand used for cover."

There is some evidence of high groundwater levels (within 7-10 feet of ground surface) in a few soil logs.

The uneven rate of settlement has limited development at the site.

3. WASTE DISPOSAL PRACTICES

This particular site was one of the longest fill projects in the City. It started about 1911 and continued to be filled off and on as late as 1968.

The original site was a garbage disposal at the north end of Interbay. Residents of the community celebrated its closure in 1926. In the 1930's he "sanitary fill" was in operation again. Garbage was dumped at the southend and northend received combustible wastes and was the "fire dump." The southend received the contents of garbage cans collected from homes and business establishments in the City. No fire was kept at the southend, but sand and earth were spread and watered down over the garbage routinely. Industrial areas ran to the north and south from Elliott Bay to Salmon Bay and their waste was deposited here.

In 1946 there was a major operation and plans were made to bring the fill level with 15th Avenue West. This operation ceased in March 1962, but as a result of the closure of the Ravenna disposal site the Interbay site was reopened on December 1, 1964, to permit rubbish disposal by passenger cars and pickup trucks. This continued until 1968.

Eyewitness accounts note that all sorts of material were dumped there, but no extensive drilling has been done to determine exactly what is there. It was also used by the military for waste disposal. In essence any putrescible or non-putrescible waste is there.

4. SUSPECTED PROBLEMS

Despite the age of the garbage at this site, methane generation is vigorous and will continue for years. It has been recommended that special precautions must be taken to reduce noxious and offensive gases from escaping if construction or other ground breaking activities take place.

There have been additional precautions against gas buildups at the site to prevent explosive hazards. Additional information shows that a fire occurred at the dump as a result of a gas explosion on property of Standard Oil Company in the mid-1960's. An eyewitness at the site suggests there could be soil contamination from the same company as a result of oil spills.

The cracked condition of 17th Avenue West at West Barrett Street is evidence of the tendency of the area to settle. Any buildings on the site would need to be designed for pile support.

The potential for high groundwater and consequent leachate formation are also concerns at this site.

GENESEE (RAINIER VALLEY)

GENESEE LANDFILL

Also known as the Rainier Valley Dump, this includes the old South Alaska Street site and the old Wetmore Slough Fill site. It comprises the area extending southward from Lake Washington between 43rd and 45th Avenues South and westward between South Conover Way and South Alaska Street to 38th Avenue South. It included about 26 acres of fill, and from 1942 served the area south of Atlantic Street east of 15th Avenue South and Airport Way to the south city limits. It served a broader area as sites prevalent in the 1940's closed. One source notes the site closed on September 27, 1966, but other sources note operations continued to some degree until 1968.

1. PAST AND PRESENT USES

This area was originally a slough and is now a recreation area, including Genesee Playfield and Park.

2. ENGINEERING INFORMATION

City of Seattle Engineering Department boring logs show garbage fill extending anywhere from 5 feet to 19 feet in depth and soils consisting of silty clay, blue clay, sandy clay, brown dirt and/or brown sand in various locations. Groundwater is found as high as 5.3 feet.

A 1967 report prepared by Jordan/Avent and Associates noted that the general topography of the central recreation area was extremely uneven with large areas of standing water. It is stressed in this report that the topography of the areas has changed considerably since 1910 due to the fill

development. The fill has areas where the ground surface over the past 65 years has been raised approximately 50 feet.

It appears that the general area has been used as a fill site since the 1890 filling of Wetmore Cove, the mouth of the slough that extended from Lake Washington south to the present South Genesee Street, westerly across the present Rainier Playfield, becoming a ravine that is now Columbia Park and School.

3. WASTE DISPOSAL PRACTICES

Discussions with individuals who worked at the site indicate that all sorts of waste and garbage were dumped at the site.

Few regulations existed at the time to regulate the dumping of materials and virtually no records were kept at this particular site. An individual from Solid Waste said that a lot of commercial dumping took place at the site. The unequal distribution of cover material has left some areas of the park with a very thin cap over the fill. Some reports have shown that the quality of rubbish has high gas explosive potential and numerous years will be required before significant decomposition of the rubbish occurs in its existing environment. One test reflects that a gas emission produced a flame about five feet which had to be extinguished by a fire extinguisher.

4. SUSPECTED PROBLEMS

Since the dump site served portions of the southend industrial area, some industrial toxics can be anticipated. The site is listed on the EPA ERRIS

listing.

The problems of settling and instability common to the Montlake fill are apparent here as well. In 1965 the unstable fill hinderd efforts to build four tennis courts: only two were completed. At about that time the fill is noted to have developed seepage problems, polluting Lake Washington.

The site has had seepage problems and has apparently negatively impacted storm drainage on the south of Genesee Street. The contamination of groundwater and surface water from the site must be considered as a potential problem. Also, it can be expected that for the next several decades methane gas generation will be developing within this area and could create a hazardous condition if not properly vented.

MONTLAKE (UNIVERSITY)

MONTLAKE DISPOSAL SITE

Also known as the Ravenna Dump, the Union Bay Dump and the University Dump, this site was operated for forty years from 1926 until about 1966. It was located on the Old Union Bay Swamp south of Northeast 45th Street and east of Montlake Boulevard Northeast. It constituted approximately 200 acres. With the possible exception of the south industrial area, this was Seattle's largest landfill site.

1. PAST AND PRESENT USE

The site was originally a vast cattail marsh created by the drop in Lake Washington with the construction of the Hiram M. Chittenden Locks in Ballard. The site has been closed 18 years ago and no major building has yet occurred on site.

Temporary housing was located on the earliest fill area in 1949, but the main uses since the landfill closure have been for a 16 acre intramural playfield, several parking areas, storage yards, a driving range, tennis courts, canal house and canoe channels. Much of the site is vacant and used for "passive recreation." The area is rich in waterfowl and a favorite spot for birdwatchers.

The driving range was started in 1964 after the Mountlake parking and intramural fields were established. The central canal was also constructed about this time by carving a channel through dirt fill which was placed on top of a continuous timber mat dike. In 1969, the early housing on the triangle areas was removed. In addition, uneven ground settlement and high

water table forced the removal of Graves Field to higher ground near Five Corners. A Fire Arts facility was constructed on pilings in 1970.

Since then paths have been graveled, roads repaired and parking lots regraded. Ponds which have appeared on the site as settlement occurred have not been filled.

In 1980 an impact statement was developed for a research and teaching arboretum with buildings, greenhouses and planting areas on a portion of the landfill. This project was moved to a site further east, off landfill soils and no other major building has been attempted.

2. SITE/ENGINEERING INFORMATION

Cross sections of the Montlake site show fill up to 40 feet in depth underlaid by a peat layer about 20-40 feet in depth. Soft to medium clay and silt up to 100 feet in depth are found below the peat with compact clay, sand and gravel below the soft clay.

In 1975, soil samples taken at the site noted that, except for a few narrow strips, the site is generally underlain by soils with poor permeability. As a result: drainage of surface water is accentuated; methane gas produced is inhibited from uniform venting at the surface, causing surface cracking where gas escapes; and a bog-like environment is created.

Probably because the site was operated in conjunction with the University of Washington, several test holes have been dug and water samples have been

taken through the years. For example, test holes dug in July, 1968 revealed the dirt cover was from 8 inches to 24 inches on the east side of center road and 6 inches to 24 inches on the west side. Contract specifications on closing the site had stipuated a minimum of 24 inches of earth cover. In addition 6 inches sandy loam topsoil were to cover the entire site. The flow of the central canal was to be augmented in the summer to improve water quality.

The 1980 impact statement stated that nearly all of the refuse within the site is saturated as a result of high water table. Over a large percentage of the area the water table lies two feet or less below the surface.

Superficial water samples taken in 1980 from ten locations showed slightly high specific conductance, high color, normal to moderately high total suspended solids, high alkalinity, and very high total coliform and chemical oxygen demand. Analysis by plasma spectrograph showed some high heavy metal concentrations.

Groundwater analysis showed particularly high concentrations of heavy metals, total suspended solids, chemical oxygen demand, color, and total coliform. However, there is currently no indication of a chemical mixing between the water in the landfill and the water at the surface of the site or in Lake Washington. So far the dikes around the perimeter of the Montlake fill appear to be an effectual barrier and filter to the passage of the highly polluted groundwater in the landfill.

Five subsurface and three surface gas samples taken at the site in 1980 were analyzed by gas chromatograph for six hydrocarbon compounds, including methane. It was noted that methane production was substantially less than similar samples taken in 1975 after a wet weather period. The maximum methane concentration in September 1980 was 17.3% or 175,000 ppm. It was suggested that since the 1980 sampling was after a dry period of the year, the gas generation may occur on a seasonal basis as a function of water percolation into the fill.

3. WASTE DISPOSAL PRACTICES

The Montlake fill was used both as a fire dump and as a general landfill operation during its existence. Both putrescibles and non-putrescibles up to 40 feet in depth can be found there. It has been characterized as similar to the Midway dump with respect to neighborhood concerns and complaints. It received anywhere from 40 percent to 66 percent of Seattle's refuse.

The site served the general geographical area east of Aurora Avenue north of Galer Street, from Washington Park and East Mercer Street to the lake.

Rubbish filling began at "Five Corners," the northeastern corner of the marsh, in 1926 and moved intermittently south and east following the solid ground. By 1949 an open burning dump was in operation on the western edge of the marsh. Internal canals were dredged for drainage. Sanitary landfill methods began in 1956 and timber mat diking was successfully applied to the problem of plot displacement. Tilling spread rapidly into the marsh and reached its greatest extent in 1964. A new canal was placed along the

western dike to accommodate runoff from the urban area to the north. Landfill operations ceased in 1966 but a series of surface cover filling grading and seeding operations continued until 1971.

In 1959 basically two separate disposal operations existed at the site. The "garbage" was handled by a contractor who collected and disposed of refuse from individual homes. This amounted to about 110 truckloads of garbage hauled to the site each day (five-day week) in enclosed 20 cubic yard compactor trucks. The City also operated a "public refuse" dump for individuals and industries who hauled their own waste. As noted, the latter operation was discontinued in 1964.

Fly ash from the University of Washington Physical Plant was disposed of at this site, and was used as final filling in reclaimed areas.

The volume of material delivered to the Union Bay Disposal site was increased considerably with the closing in 1962 of the Interbay disposal site south of Salmon Bay. Likewise, when in 1961 construction on the Seattle freeway began, the State Highway Department designated Union Bay as the site for the wasting of demolition debris.

Efforts were made to leave "peat holes," 100 feet across, on the easterly edge of the fill in 1963 when the site was used for freeway demolition material. The peat from the swamp was considered a valuable resource for soil humus and stabilizer throughout the University Campus and over the reclaimed lands.

A brick gas burner was installed near the southwest parking entrance to allow methane burn-off during putrefication of organic material. This was removed about 1963.

Settlement stations were installed in several areas and elevation readings taken through the early 1960's. Water sampling was conducted in Union Bay and in the adjacent lake by Robert W. Seabloom, Sanitary Engineer. This was considered necessary for guidance and protection of the University. Readings of water quality were taken at catch basins and/or seepage basin inlets.

4. SUSPECTED PROBLEMS

Historic problems with this area included providing drainage, peat movement, uneven settlement, and methane production. These remain concerns today.

From 1958 the filling operation was guided by a specific plan incorporated in the University of Washington General Development Plan. The plan for development of the Union Bay area indicated reclaimed land would be used largely for automobile parking, athletic fields and recreation. No major buildings were to be constructed for 20 to 50 years "...due to the depth of the peat and overlying fills and the anticipated continuation of settlement and shifting as well as the natural generation of large volumes of flammable gas in the decomposition process." The 1980 environmental impact statement notes that "...the activity of the site's landform is continuing, with subsidence occurring at the rate of almost one foot per year in some

locations...It is estimated that a major portion in the central part of the site will be inundated by water within 50 years."

The water samples show the potential the landfill site has for environmental pollution. The types of contamination possible vary from known heavy metals to unknown pollutants. The site is also one of the EPA's ERRIS sites. The University of Washington disposed of their wastes at this site, and while this refuse was largely paper, some chemicals were dumped. For a period the University of Washington Physical plant is known to have dumped waste transformer oil on site. Since the site was open to the public and industries until November 30, 1964, almost any material could have been dumped here.

HALLER LAKE (NORTH AURORA)



NORTH AURORA DISPOSAL SITE
(Haller Lake/North 125th Street Fill)

This is approximately a ten acre site bounded on the north by North 125th; on the west by Stone Avenue; on the east by Ashworth; and on the south by portions of the Westwood Village addition. Records indicate it was operated by the City of Seattle from May 1954 until probably about 1957.

1. PAST AND PRESENT USE

The City of Seattle purchased this site in 1954 specifically for use as a burning dump. It had previously been operated as a dump site by King County and was bounded on the east by private homes, and on the north, west and south sides by a combination industrial commercial area. As was true with much of the land in that area, the site had originally been part of a King County gravel pit.

After closure the disposal site was covered with soil, smoothed, and used unofficially as the neighborhood baseball field. Otherwise it stood idle. While the site was originally planned to be a park, the main portion of the completed fill was sold in about 1965/66 . The 76-site Halcyon Mobile Home Park (12215 Ashworth North) was built there. On the five acres north of the landfill site and at about a 20 foot elevation drop is the Bell-a-Bee Mobile Home Park, which was developed about 1956. The Seattle Engineering Maintenance Division shops are located just north of 125th at the site of a former lumber yard. This is also apparently part of the original fill area. Private homes bound the eastern and southern edges of the site, with

commercial business and a driving range on the west side.

2. ENGINEERING INFORMATION

Engineering records show an 18 inch sanitary and a 36 inch storm sewer sewer constructed on the landfill site in September 1957. These tie into separated sewer lines on Stone Avenue North. There have been no apparent problems with these lines.

The landfill is the same approximate elevation as the Ashworth home sites and those on the Westwood Village addition on the south. It is, however, several feet higher in elevation than the northern and western boundaries.

Six inch vent pipes are installed throughout the Halycon park. There are known gas (methane) problems at this site.

3. WASTE DISPOSAL PRACTICES

Both putrescible and non-putrescible wastes were dumped at this site. Daily fires are remembered by long-term residents. It appears the garbage was primarily residential. Neighbors recall seeing garbage and refuse of residential origin in the site, but no commercial/industrial waste. However, this site is found in the most recent ERRIS listing of EPA Region 10 which indicates someone at sometime recalls something suspicious being dumped there.

4. SUSPECTED PROBLEMS

Health Department records show that in March 1970 the ground between two

trailers at the Halycon Mobile Home Park (spaces 11 and 47) was sinking. Settling problems are also common around the Park's laundry area. The problem with settling appears to be the major site problem. However, drainage problems were noted along the roadway in 1967 and 1968. Residents of the area still complain about "strange" drainage and surface problems, particularly along the Stone Avenue boundary at some period.

Sewer lines have broken at the Bella-a-Bee park north of the "official" site and may indicate settling problems there as well. This would be possible if the County had used that portion of the old gravel pit as a disposal site years before, concentrating on the upper portion. This is likely based on personal accounts of the area, although no records could be found to document the assumption.

It is also interesting that this site is listed on the ERRIS listing of EPA.

WEST SEATTLE

WEST SEATTLE - HARBOR AVENUE

Also known as the West Hanford Street fill this site was authorized under City Ordinance No. 67982. It enabled the filling of the Seattle tidelands. The original fill area extended near City View Street, north West Hanford but the more recent boundaries were Harbor Avenue Southwest on the west; Railroad tracks on the east; West Hanford Street on the south and Southwest Florida Street and a timber trestle on the north. The site was over 20 acres in size and operated from about 1939 until 1966.

1. PAST AND PRESENT USE

Since the dump was originally a tidal flat area, there was no major commercial use until the fill was completed. It became a major reclamation effort typical of that found throughout Seattle. Early maps show the high tide line extending over Harbor Avenue Southwest. It also was a unique challenge with respect to land ownership. Historian Myra L. Phelps has chronicled some of the significant challenges as follows:

"When it became apparent that the South Park Disposal site was not going to be adequate for the needs of the West Seattle area, an ordinance was introduced in the City council at the suggestion of the Engineering Department to condemn the tide flat area between Harbor Avenue Southwest and 26th Avenue from Southwst Hanford Street to Southwest Florida Street. Most of this property was owned by the Nettleton Lumber Co. and by Walter Syckoff. These owners, upon being appraised of the pending condemnation, contacted the Engineering Department in an effort to save their property.

On being assured that the City wished only to obtain the legal right to develop a sanitary fill in the area, they accepted the proposal and the necessary leases were executed, giving the City the right to fill certain specified areas for a period of 30 years, while locations within the property necessary for the owners' creosoting and lumber operations were established. To complete the boundaries of the new sanitary fill, the City purchased several tracts along Harbor Avenue Southwest, condemned the remaining few parcels, and added these new acquisitions of land to the small tracts which it already owned in the area. After filling had proceeded for a considerable number of years, the Port of Seattle purchased the leasehold property from the owner, with the City retaining the right to fill. In 1965, the City sold to the Port the property that it had acquired in fee for the disposal site, still retaining the right to fill until the operation was completed. Later the City released the unfilled area abutting 27th Avenue Southwest to the Port, and this property has since been filled with dredged material from the Bay and the Duwamish Waterway. Still later the Lockheed Ship Building Corporation purchased the Nettleton Lumber Company site and expanded its ship building business.

This sanitary fill provided advantages: The owners of the property had their holdings increased in value at no cost to themselves, the City had an invaluable garbage disposal site at little cost, and it was able to sell its share of the fill site at a profit."

In essence the landfill operation converted tideflats to a significant portion of the Seattle Port Commission's Industrial and Harbor Development District. The Seattle Fire Department also found the site useful for their oil fire control school. In March 1965 the City Engineer gave permission to the Seattle Fire Department to use a portion of the disposal site adjacent to Harbor Avenue Southwest and Southwest Lander for this purpose. They used about 500 square feet of the fill for about three months. Today the Purdy Co., a major disposal site and recycler of industrial metals, occupies the northern portion of the West Seattle fill site at Southwest Florida.

2. SITE/ENGINEERING INFORMATION

Longfellow Creek ran through the landfill area and in 1962 it was noted as an impediment to the ultimate use of the land planned by the City of Seattle. Adjacent to this creek a dike was constructed in about 1959 and the fill area at that time extended between the dike and Harbor Avenue, west to Florida Street.

In 1966 Sea-Land was noted to be dredging and filling the area to the east of the dike and Longfellow Creek may have been in a culvert at this time.

The dike constructed in the late 1950's apparently was an improvement over boom sticks commonly used in the 1940's. Boom sticks were placed at the easterly edge of the fill area and enabled the operation to retain a larger amount of floating debris.

A January 10, 1944 letter to the City Engineer notes that "...directly

inside the gate on West Hanford Street there exists a pipe through which water from an inlet in the pavement discharges, a sump was provided to accommodate these drainage waters."

In August 1965 a sketch shows the location of a 84 inch concrete culvert which goes through the landfill area. It was west of 28th Avenue Southwest and 765 feet east of Harbor Avenue Southwest. The purpose of this culvert is unclear although it may have some relationship to an attempt to rechannel Longfellow Creek, a dredging operation or drainage discharges.

3. WASTE DISPOSAL PRACTICES

Early maps of this area dated December, 1943 show the early fill area starting slightly north of City View Street, extending from Harbor Avenue east almost toward 28th Avenue Southwest and north to West Hanford Street. Much of this fill was on land owned by King County and Bethlehem Steel Company. The later fill extended north from this area as described by a 1965 garbage utility report:

"The West Seattle disposal site is a tidal flat lying between Harbor Avenue Southwest and 26th Avenue Southwest, and between Southwest Hanford and Southwest Florida Streets. A part of the site is owned by the City, but most of it is leased. It has been used primarily for disposal of garbage collected by the City contract garbage collectors. However, on December 1, 1964, following closure of the Ravenna rubbish disposal site, this operation was changed to allow rubbish disposal by trucks over 8,000 pounds gross vehicle weight."

Correspondence dating to 1943 makes it clear that hog fuel and sawdust were used as covering at that time. Presumably the practice changed with request of the City Engineer to use earth of suitable quality after that time. Generally they did not operate this as a fire dump. Correspondence dated to 1942 notes that the City at that time was divided into six refuse disposal areas. One area was the entire area west of the West Waterway. Material from this district was deposited at the West Seattle Dump. Industries including lumber yards, ship building, creosoting and several mills were among those in that area since the early 1920's. Thus industrial waste is no doubt part of this disposal site. This is also suggested by the presence of this site on the ERRIS list of EPA.

Personal recollections of the site provide information about a fertilizer plant at the corner of Harbor Avenue and Spokane around 1950 which disposed of waste at West Seattle. Likewise steel mill waste clinkers were dumped on site.

4. SUSPECTED PROBLEMS

Historically the West Seattle site had problems with fires. In May 1965 several small fires were burning. At 2:30 a.m. on July 10, 1965 a fire started in a garbage load on a truck and spread to box loads of paper. About 1967 when the dump was closed there was an underground fire which caused the ground to cave in.

Another historic problem was that associated with the frequent breakage of boom sticks and the subsequent tidal movement carrying the garbage out and

depositing it on the mud flats.

The major current concern reflects the high water which underlies and/or permeates the fill. Since specific knowledge of the waste disposed there is lacking, only assumptions can be made. It can be assumed that industrial waste is buried at the site. It can also be assumed groundwater contamination of the areas has and/or is occurring. The significance of this is not known, but the possibility that the site contributes to the total toxic load of the Duwamish Waterway should be investigated further.

SOUTH PARK



SOUTH PARK

This approximately 96 acre site is bounded on the east by West Marginal Way and 5th Avenue South; on the north by Kenyon Street; on the west by 2nd Avenue South and Occidental Avenue; and on the south by Sullivan Street. It began operation sometime after 1945 and closed in 1966.

1. PAST AND PRESENT USE

The site was used in the early 1950's by area saw mills as a disposal point for waste sawdust. Personal anecdotes provide information about hay being hauled to the site from West Seattle. Records dating to 1955 describe the area as a burning dump used by the City of Seattle as one of their key disposal sites.

It was and is located on submarginal property at the edge of an industrial area. In 1955, the property was partly owned by the city and partly held by the County for taxes and partly owned by private parties who had given the City oral permission to fill. The original access road to the dump (West Marginal Way) was lost when it was taken by the State for use as a limited access to the First Avenue South Bridge. This caused the landfill operations to be moved to the south and east on the property portion held by King County.

In 1966 the site was converted to a solid waste transfer station. The operations building as well as the existing transfer station are located on the old burn dump. A city plan to build a methane-generating plant at the site was aborted a few years ago. The County land south of the transfer

station is for sale but vacant. The surrounding area is still industrial/-commercial land.

2. SITE/ENGINEERING INFORMATION

A 1983 report developed by Shannon and Wilson for the Solid Waste Utility details field explorations and engineering studies for a potential operations building at the South Transfer Station. In that report the site is described as a relatively flat and covered with grass. Field observations reveal that at the Occidental Avenue side the landfill site is at least ten feet higher than the adjacent land.

In February 1983 three soil borings were completed. The findings reported by Shannon and Wilson noted that, "...The subsurface soils at the site generally consisted of fill over very loose to medium dense, black, silty sand with scattered organics and an oily sheen and odor, over medium dense, black, clean to silty sand. The fill which was a loose, silty, gravelly sand with humerous brick and glass fragments and scattered organics was about ten feet in thickness. The underlying oil-coated sand extended to a depth below the existing ground surface from 20-22 feet. The black sand is a natural alluvial deposit. It should be noted that all the sand below the fill is similar, except the upper ten feet had an oily sheen and odor. Groundwater levels at the time of drilling and two weeks after varied from 10 to 13 feet below the existing ground surface."

The engineering report recommended that the fill be excavated and replaced with suitable imported compacted sand or gravel, before any

buildings were to be constructed on the fill.

A stream is known to have run through the property for years.

3. WASTE DISPOSAL PRACTICES

This site was primarily used for non-putrescible wastes and sawdust in the early years of operation. It was operated as a fire dump (ie. combustible refuse was burned) until December 1961. There is unburned fill on the site, particularly in the south portion of the fill area (County owned portion). Clinkers and ashes were commonly used for fill. A 1965 Garbage Utility Report describes the operation as follows:

"...(It) is used solely for disposal of rubbish by vehicles under 8,000 gross vehicle weight. The site is on land partly city-owned and partly under lease from King County. The rubbish brought to this site is pushed into place, compacted with a bulldozer, and watered for fire protection. No intermediate earth cover is used, but the final lift of rubbish is covered with earth."

Anything and everything was likely dumped here. Since it was adjacent to industrial areas and since several industries in the area are known to have dumped in the landfills geographically close to them, it can be assumed some industrial wastes are buried in this disposal site. This is also suggested by the EPA ERRIS listing which identifies this site. Likewise the soil tests done by Shannon and Wilson indicate odors, an oily sheen and organics which would likely be associated with commercial rather than residential waste. In addition, the personal recollections of commercial haulers are that "lots of

toxics" went to South Park.

4. SUSPECTED PROBLEMS

While South Park was a fire dump it has historically had additional problems with unplanned fires, as noted in one anecdote of the disposal of a grocer's wooden matches which started a fire. Sawdust fires and hay fires are also remembered from the early 1950's.

The stream which flowed through the property and a swampy area adjacent to the Duwamish is reported to have been quite foul. Mosquito control in the area was difficult. It is suggested that this creek may have been seeping into a ditch adjacent to the site and was consequently piped to the back side of a neighboring wrecking yard.

Operators digging in the southern portion of the fill checking for underground fires are reported to have developed severe headaches.

The water table is fairly high at ten feet, the level at which organics, oily shee and odor are documented in soil logs. This suggests groundwater contamination is probable in the area.

Also due to the location of the fill and its early history of use as a non-putrescible waste site its potential as a significant industrial waste site should not be ignored.

GREEN LAKE

GREEN LAKE LANDFILL SITE

Several areas around all sides of Green Lake were used for refuse fills. This occurred for a number of years from the early 1900's until approximately 1933. As many as 100 acres of park along the shoreline may have been added by this process.

1. PAST AND PRESENT USES

The lake areas have historically and currently been a recreational area. Part of the area reclaimed from swamp and cattails became the Woodland Park Playfield. In the 1930's there was a great pride in the fact that the "new" Green Lake field house stood on land reclaimed by a garbage fill. The site of the aqua theater is also fill area.

2. SITE/ENGINEERING DATA

Prior to 1911, drainage from the lake was via the natural drainage channel along what is now Ravenna Boulevard, thence down the ravine of Ravenna Park and into Lake Washington at Union Bay. Water levels varied at approximately 162 feet above mean low water. With the completion of the North Trunk Sewer in the fall of 1911, new outlets were provided to Green Lake and the water level was lower approximately 7 feet to a new level of 155 feet above mean low water.

Following the lake lowering in 1911, work commenced on a diking and filling project. A dike was constructed in the lake, paralleling the shoreline, extending from the southend of the lake along the eastern

shoreline and northerly to the west beach, a distance of around two miles. 260,000 cubic yards of earth fill was used to form the dike by dumping fill material off a rail trestle constructed in the lake for this purpose. Fill material dumped along the lakeshore without the outward dike would have pushed large quantities of the semi-buoyant bottom muck further out into the lake. The area behind the dike was partially filled by hydraulic dredging of muck from the lake bottom. This dredged material was very light and fluffy when dry and did not provide a stable fill material. About 900,000 cubic yards of material was dredged over a three-year period. Supplementary fill became necessary because of excessive settlement of the dredged material (this is especially true near the east beach). For several years, refuse (garbage) was dumped along the shoreline for fill material. Additional fill material was provided by continued clearing and leveling of the lower Woodland Park area, from contractors engaged in nearby street construction and from the Aurora Avenue construction. By 1933, following filling of a small pocket of stagnant water at the present site of the Aqua Theater and the Pitch and Putt golf course, filling was virtually completed.

3. WASTE DISPOSAL PRACTICES

While very little information could be found about this site, it appears the bulk of the refuse disposed here was wood and coal ashes, since paper wood and metal were still relatively scarce as waste products.

In 1900 the shoreline was as far south as 54th and there were several off shore islands. The area was filled to its present shoreline by 1930 with dredging and from the Aurora "cut" through the park. As indicated by the

curve in East Green Lake Drive, the lake shore had been relocated by a sanitary fill after the lake was lowered in 1911.

4. SUSPECTED PROBLEMS

No specific problems were found historically other than ground settling around the Field House/Evans Pool. Buildings were built on pilings. Due to the apparent large proportion of rubbish vs. garbage fill in this landfill area, it is doubtful that any other serious problems should be anticipated at this site.

JUDKINS PARK

JUDKINS STREET DISPOSAL SITE

Available reports show that the landfill started in this around around 1910 and continued until the early 1950's. In 1942 "refuse area No. 3" was comprised of the area south of Denny Way east of 4th Avenue and south of Galer Street and Washington Park and East Mercer Street to Atlantic Street, and a small area between Airport Way and 15th Avenue South to Hindu Street. Material from this area was deposited at the 22nd Avenue South dump at 22nd Avenue South and Norman Street. In 1945 the "Judkins Street Dump" was noted to be at 25th Avenue South and Charles Street, so the site apparently consisted of several acres which may not be generally identified as a disposal site.

1. PAST AND PRESENT USES

Historically this was an area of deep ravines. It is now primarily the site of Judkins Park and Playfield, including parking lots, play and picnic areas, sand lots, game courts, and a baseball field.

2. SITE/ENGINEERING DATA

According to the Sherwood files, considerable regrading has taken place in this area since the turn of the century. The 1910 topographic survey of Seattle shows a steep-sided ravine or stream erosion cutting through this site in a north-south direction. The contours indicate depths of 30 to 50 feet with ravine bottoms generally meandering back and forth across the site. Fills are present throughout most of the site, particularly within the 150 foot contour. These fills are believed to have been dumped without

systematic compaction or control.

In 1974 subsurface conditions were investigated by the Seattle Engineering Department's Materials Laboratory . They note:

"...we encountered 4 to 53 feet of loose, miscellaneous rubbish and soil fill, overlying very compact glacial derived sediments consisting primarily of glacial till. The ravine also contains some loose to firm weathered soils and/or stream erosional deposits which because of their composition and appearance, are difficult to distinguish from the overlying fills. However, these erosional soils are believed to be relatively shallow in depth....

"Two significant variations were noted in the composition of the fill materials. The first concerns the relative quantity of garbage or organic matter. In the north portion of the site, generally encompassing the existing playground, we encountered considerably more partly decomposed garbage, whereas, the fills to the south contain predominantly inert materials. Discussions with the City's Solid Waste Utility section indicate garbage filling in the area was terminated prior to 1957. Subsequent fills were apparently restricted to non-organic materials.

"The second difference noted was in the quantity of soil mixed with rubbish fills. The fills to the south appear to contain significantly more soil.

"Ground water was encountered near the contact with the underlying native soils. From the profiles it is apparent that groundwater is collecting

in the old erosional channel and flowing to the south under the fill."

3. WASTE DISPOSAL PRACTICES

Both putrescible and non-putrescible waste was deposited here. The ravines were filled with miscellaneous rubbish consisting primarily of cinders, ash, charcoal, wood, paper, metal, glass and decomposed garbage or organic matter. Scattered quantities of rubber, brick, concrete, pottery, cloth, and sawdust were also identified.

As noted, the northern portion contained more garbage and historically appears to have been filled first. The southern portion contains more rubbish. It seems likely that primarily residential rather than industrial refuse filled the area.

4. SUSPECTED PROBLEMS

One study done in 1976 by the Engineering Materials Testing Lab suggested that a possible problem with methane would occur if proper ventilation did not occur beneath slab buildings planned for the area.

The other major concern with the site has related to settlement, noted in a 1974 study:

"Settlement of the existing playfield and the more recent fills to the south are expected to continue in the future. However, subsurface exploration indicates these settlements within the playground area are due primarily to continued decomposition of organic matter. The more recent fills to the south, however, contain predominantly inert materials

and settlement is thus due principally to consolidation of the fill under its own weight. In the areas to the south settlements are expected to occur much more rapidly."

WASHINGTON PARK (ARBORETUM)

WASHINGTON PARK LANDFILL SITE

There was very little information available on this site. However, it appears that the filling occurred in several areas, with the first major fill starting in a ravine just north of Madison Street in 1909. Records list this site in 1911 as East Ward Street and 29th Avenue North - Washington Park. In 1920 the site is noted as north of East Madison, in the vicinity of 30th Avenue North - park property. Another nearby site is noted as 26th Avenue North and East Miller Street - park property. Filling was done with garbage in 1929 and became the "largest garbage fill" in the City until 1935 when plans for the Arboretum were completed.

1. PAST AND PRESENT USES

This area was logged by the Puget Mill Company in the late 1800's. In 1900 they gave the City 62 acres of ravine for Washington Park in exchange for water main work in an adjacent subdivision. The new park land was a rough ravine sloping abruptly to a stream running from about 33rd into Union Bay. The original 62 acres extended from Union Bay south to Prospect Street. The City immediately purchased the ravine between there and Madison Street. By 1909 a huge fill had been placed across the ravine and an "athletic field" (baseball) was established on the sanitary fill. A shelter house was placed on the athletic field in 1930. A trestle bridge across the creek was replaced with a fill about 1915. The site now is the Arboretum and is primarily park area.

2. SITE/ENGINEERING DATA

Historical records indicate that the sanitary fill was first placed in the deep ravine north from Madison Street. It then continued in the marsh area near Union Bay. When dredging operations began for the new ship canal more fill was placed in the marsh.

Soil logs in the area show groundwater levels from four to seven feet below the ground surfaces. Fill extends at least 10 - 15 feet.

3. WASTE DISPOSAL PRACTICES

There is no record of the material disposed of at this site over the years. However, the Health Department protested the closing of the largest garbage fill in the City due to the increased cost of hauling to a more distant site. Thus it can be assumed the refuse was putrescible and non-putrescible, but probably primarily residential. In 1929 it is noted that additional filling was done with garbage in the atheletic field area. In fact, several areas were probably filled for land reclamation.

Soil samples show wood, ash, cinders, gravel, charcoal, grass, and trace organics. According to an Engineering News Record report (8-13-1939), "...concentrated food waste from hotels and restaurants...is not taken to the fill; such waste, held to be City property, is collected separately for hog feeding and yields the City a revenue." Thus the putrescible portion of the refuse may not be as great as the non-putrescible as suggested by the soil log.

4. SUSPECTED PROBLEMS

The only major problem is that there is a lack of specific site data. Since this was the largest fill at that time anything could have been placed there and records are too vague to pinpoint disposal sites. Water tables are high and depending on the materials dumped, groundwater could conceivably be contaminated. However, location and age of the site make the problem of either groundwater contamination or methane generation remote.

RAINIER

RAINIER LANDFILL

The landfill was a part of about nine acres "on the east side of Rainier Avenue from Conover to Crawford Streets" obtained by the City in 1910 for development of "Columbia Playfield." The portion of the site identified as landfill is adjacent to Genesee Park between South Oregon Street and South Alaska Street. Garbage and rubbish filling probably occurred in 1913 and possibly about 1916.

1. PAST AND PRESENT USES

This was apparently vacant property that was specifically developed for playfield purposes. Originally the area may have been transversed by a country road which ran alongside an electric railway extending from Pioneer Square down "Rainier Valley" to Rainier Beach.

A ballfield and tennis courts were provided in 1910; a small "comfort station" in 1913; and a gym and related facilities were constructed in 1928; the field house was finished in 1949. Since then street paving, light and upgrading of facilities have occurred.

The site was originally known as Columbia Playfield, but this name was changed to Rainier playfield in 1928.

2. SITE/ENGINEERING DATA

Historical records note that this is a fairly flat area. However, at the time of the 1910 acquisition and playfield development at this site an open ditch remained as a remnant of the stream flowing into Wetmore Slough. This

was a nuisance and prevented full use of the field. It was put into a sewer and covered with a garbage fill.

In 1916, street improvements in the area caused the playfield to be surrounded with fills, making it a poorly drained basin.

3. WASTE DISPOSAL PRACTICES

As noted, the garbage fill was a land reclamation effort apparently limited in scope. No records exist of what actually was dumped at this site, but it was likely residential garbage, although road construction debris was placed adjacent to the site also.

4. SUSPECTED PROBLEMS

Because of the age of the fill, nothing suggests that there is anything hazardous at this site.

SICKS STADIUM

SICKS STADIUM SITE

This 12.73 acre parcel of land identified as a landfill site was the area of the old Sick's stadium, bounded on the north by Bayview Street, the east by Martin Luther King Way (previously Empire Way); the west by Rainier Avenue; and McClellan Street on the south. Unknown are the dates of operation.

1. PAST AND PRESENT USE

In 1913 Dugdale Park is recorded at the corner of Rainier Avenue South and South McClellan Street, as home for the Seattle Northwest League Baseball Team (Manager, Dan E. Dugdale). On July 4, 1932 the grandstands of the Park were destroyed by fire. The site remained vacant Rainier Valley pasture until 1937 when Emil Sick, founder of the Rainier Brewery, built a new stadium at the site. Sick's Stadium was bought by the City of Seattle in 1967 but with the development of the Kingdome, it became a "white elephant" and was demolished in the late 1970's to make way for the CX Corporation's Kodak Processing Plant/Rainier Electronics Park which currently occupies the site.

It is impossible from the records to determine precisely when the area was used as a landfill. There are no official health or engineering records identifying it as a site. There were documented sites north and west of Sick's Stadium in the early 1900's. It may have been so used prior to development of Dugdale Park or during the period when the land was apparently vacant between 1932 and 1937. It may also have been a "neighborhood dump"

rather than a major disposal site.

The area directly surrounding the stadium site is a collection of small businesses and light industry. Several residential areas are within easy access to the site.

2. SITE/ENGINEERING INFORMATION

Several environmental impact statements and recent engineering reports are available for this site which provides comprehensive site information.

The site is depressed about full ten feet below the level of the adjacent streets. It was apparently at one time a bog which collected run-off from surrounding areas. It is thus not a free draining area and one report conjectured that it may have been filled to get above the water table.

Soil problems were known to exist on the site and there had been some settlement beneath the footings of the Sick's grandstand.

The site was the subject of a soils investigation performed by Shannon and Wilson, Inc. in 1968 with regard to remodeling the stadium. Additional existing soils information is available from eight borings which were drilled by the Seattle Engineering Department around the perimeter of the site. Several borings on Alpec property to the north of the site were drilled by Dames and Moore, Inc. in conjunction with expansion of that facility.

These explorations encountered recent sediments 20-25 feet in depth consisting of aluminum and soft to medium soft deposits of silty clay to clayey silt with organics. The deposits are overlain by recent medium density

sandy silt fill in certain areas for a depth of approximately 15 feet. Current standards for compaction were not originally used after the fill construction. However, over the years natural consolidation of the material has formed a fairly firm crust. As these deposits are usually of low strength and highly compressible, a detailed soils investigation was necessary when CX Corporation built their facility.

That soil study done by Roger Lowe Associates found the existence of thin flat layers which were evidence of the original swamp environment of the site. There are also significant areas of cut and fill at the site. Since the streets are higher it was conjectured that the depressed area was partially excavated which would explain the encountered over-consolidation of underlying soil layers. Subsurface conditions varied significantly from east and west across the site. Rubbish fill was encountered as was organic silt.

During the testing which was done in September 1978 the water table was less than five feet below ground level. It was expected to rise a few feet over the winter months.

3. WASTE DISPOSAL PRACTICES

Since no official records could be found for this site's use as a landfill, it is difficult to say when or what material was dumped on site. Personal recollections of individuals working in the solid waste business over the last several years do not include the Sick's site, although putting dirt fill on the perimeter of the area is recalled. Also a site about six blocks south of Sick's was identified. A large shopping center and

supermarket now sit on that site. Soil studies do show rubbish fill at the Sick's site and it seems likely that primarily non-putrescible materials were dumped there. It is also possible neighboring businesses used that area, probably sometime in the early 1900's or in the mid 1930's, the two time periods when no official activity existed at the site.

4. SUSPECTED PROBLEMS

The major problem at this site seems to be settling. Indeed CX Corporation was planning to survey settlement throughout the construction period and thereafter for a year at monthly intervals.

Drainage is a historic problem, but more significant is the high ground water at the site. If the site had been used for any industrial waste, groundwater contamination would have occurred. It can probably be safely assumed the quantities, even if they existed were small and time has negated any major concern at this site.

SIXTH AVENUE SOUTH

SIXTH SOUTH AND SOUTH OF SPOKANE

This general area is one location of several landfill operations conducted in the tideflat area at the southern end of the City of Seattle during the early 1900's. This site is not mentioned as a major disposal site in documents dating 1955, so presumably the fill at this site was completed by that time. One Municipal News reference notes that the Spokane Street dump closed in October 1931. However, there is anecdotal information that filling continued slightly west of this location at 4th and Spokane through at least the early 1950's.

1. PAST AND PRESENT USE

As noted, this area was part of the Seattle tidelands and was not useful until filled. Marshland with grass six feet tall predominated this area. Early pictures of Seattle show a box factory just north of this site and the disposal site itself is under water with railroad trestles criss-crossing the area.

Today the area is a commercial/light industrial area. The extension of 6th Avenue South, south of Spokane is on old fill as are businesses such as Owl Transfer and Storage Company (3623-6th South) and Ackerly Communications (3601-6th South). In fact, the major industrial section south of Jackson Street and west of Beacon Hill was originally a huge tideflat area filled and converted to industrial usage today.

2. SITE/ENGINEERING INFORMATION

The area is generally level today with buildings and pavement throughout. Conversations with occupants of the buildings indicate that settling is a continuous problem - an issue that will be apparently be vocalized strongly regarding tax increases in the area. The buildings are on pilings.

When the dirt roadway of 6th Avenue was regraded and paved around 1970, several people are reported to have come to collect old bottles that were dug up from the fill area.

Soil explorations done in 1962 by Dames and Moore, prior to construction on 6th Avenue South and South Spokane Street, note that the garbage fill was underlain by soft clay. The soil borings indicated garbage fill extended approximately 11 feet. Below the garbage a layer of soil mixed with garbage and debris was encountered for an additional two feet. At that point a stratum of organic silty clay seven to eight feet in thickness was encountered. This was underlain by loose to moderately compact granular soils consisting of sand and sandy loam. Groundwater was found at about eight feet - ie. in the fill itself.

3. WASTE DISPOSAL PRACTICES

According to the personal recollections of several individuals involved in the solid waste business, the tide flats historically received not only dredging material but also garbage. The 6th and Spokane Street site is one of several areas receiving such fill as part of general land reclamation.

In the early 1900's the base of Beacon Hill and the area across from Rainier Brewery are reported to have been huge fill sites. Basically any area north and south along 6th Avenue and the tide flats received waste at some point.

The lower areas around 6th and Spokane were gradually filled in and the railroad tracks raised from dredgings. The dump in the area received street sweepings and garbage from the Pike Place Market, among other materials. It has been referred to as a night dump.

In correspondence dated 1942 the major filling on 6th Avenue was apparently north of this site. The geographical area it served comprised "the area between Denny Way west of 4th Avenue and Airport Way, 15th Avenue South, Boeing Field, thence to the West Waterway. Material from this district is deposited at the Industrial District dump at 6th Avenue South and Lander Street."

The present area seems to have actually extended from 4th and Spokane since records dated 1920 identify that location. It seems likely that it received waste similar to that which would have been taken to the Lander Street site in later years. Since it served an industrial area, some industrial waste is likely. For example, during the more recent filling of the area in the early 1950's, one of City Light's original buildings was adjacent to the site. This included a pole yard and a storage area for old transformers. Excess transformers and a variety of waste are reported to have been buried in the dirt at the south end of the fill.

4. SUSPECTED PROBLEMS

The major problem with this site is the inability to accurately define its boundaries and dates of operation. It appears to have operated off and on for probably 30 years or more, receiving a variety of miscellaneous putrescibles and non-putrescibles. Thus, it is difficult to assess how much time and dilution will have minimized problems.

There are recent complaints in the area. Buildings continue to settle. Odors have been a problem in buildings at 6th and Spokane. In fact, at the Owl Transfer Company where the building is reported to be 22 years old, one gets "nice whiffs on certain days." Occupants have even spread lime under the building near their front offices to counteract odors. Seattle Disposal Company has received complaints about "gas" from the Ackerly Communications Company within the last year. There are reports within the last few years of contractors trying to level buildings and/or repair ruptured sewer and water lines where the further down one went, "the worse it got."

Another concern for the area relates to the type of material deposited where there is a high water table. Several suspected hazardous waste disposal sites on EPA's ERRIS list are in this general area. Given that one historic disposal site is identified as the industrial area dump, there is a strong suggestion, although no hard evidence, that hazardous materials are on-site. Groundwater contamination is likely.

CHAPTER III
METHODS AND MATERIALS



TABLE I

DOCUMENTED HISTORICAL LANDFILL SITES

1910 ff

Tideflat area south of Jackson Street and west of Beacon Hill
 Vicinity of 6th South and south of Spokane
 West of Sick's Rainier Brewery

1911

East Ward Street and 29th Avenue North - Washington Park
 Gilman Avenue and 16th Avenue West
 27th Avenue South and Massachusetts Street
 26th Avenue Northeast and the railroads - This ran back into Ravenna Park and the University Village area
 35th Avenue Southwest and West Lander Street
 22nd Avenue West and West Garfield Street
 Foot of Wallingford Avenue at Lake Union
 Along Salmon Bay at Ewing Street
 Along north side of Salmon Bay Waterway at about 20th Avenue West

1920

Terry Avenue, south shore of Lake Union - Private property and street
 South end of Wallingford Avenue - City property (since 1911)
 Market Street and 28th Avenue Northwest - Private property and street
 North of East Madison, vicinity of 30th Avenue North - Park property
 26th Avenue North and East Miller Street - Park property
 West Garfield and 22nd Avenue West - Street (since 1911)
 Foot of 26th Avenue Northeast - City property
 Puget Mill property - one-half mile south of Youngstown
 First Avenue South and West Dakota Street - Railroad property
 Oregon Street between 42nd and 44th Avenues South - Street
 Crockett Street between Nob Hill and Third Avenue North

1920 (cont'd)

Block bounded by Dexter Avenue, Valley Street, 8th Avenue and Aloha Street in Block 9, Eden Addition Southeast corner of 4th Avenue South and Spokane Street
 - Park property
 The Columbia City Branch Library grounds
 Green Lake field house and playground area

September 1942

Ravenna Dump - on University of Washington property near Montlake
 Interbay Dump - in vicinity of 17th Avenue West and West Barrett Street
 22nd Avenue South dump - 22nd Avenue South and Norman Street
 Industrial District Dump - 6th Avenue South and Lander South
 Rainier Valley Dump - 43rd Avenue South and Dakota Street
 West Seattle Dump - West Hanford Street and Harbor Avenue Southwest

1945

University Dump - 25th Northeast and East 45th
 Interbay Dump - 16th Avenue West and Ray Street
 Judkins Street Dump - 25th Avenue South and Charles Street
 6th Avenue South Dump - 6th Avenue South and Stevens
 West Seattle Dump - Harbor Avenue Southwest and West Hanford
 Genesee Dump - 44th Avenue South and Genesee

CHAPTER III

METHODS AND MATERIALS

A. Sampling Instrumentation

The field test parameters of this study incorporate measurements of gases to include methane gas and non-specific organic/inorganic trace gases with ionization potentials of less than $\sim 10\text{eV}$, and measurements of water quality to include pH, temperature, dissolved oxygen concentrations, electrolyte conductivity, and turbidity.

Gas measurements were made from 1/2 inch diameter bore holes sunk three feet into the ground at locations throughout the landfill area. Each was capped for a minimum of 20 minutes prior to testing to allow landfill gases to reach a state of equilibrium within the test holes. Methane gas and trace gas levels were monitored using the following instrumentation:

1. Methane Gas - Gas-Pointer Combustible Gas indicator, a product of Bacharach Instrument Company of Pittsburgh, Pennsylvania and Mountain View, California, a division of AMBAC Industries, Inc.

Sample gas is collected from the test hole through a suction tube, processed directly by the meter, and reported as % methane per volume of atmosphere.

2. Trace Gas - Model PI 101 Photoionization Analyzer, a product of HNU Systems, Inc. of Newton, Massachusetts.

Sample gas is collected from the test hole through a suction tube

designed to draw gas at a flow rate of three to 300 to 700 centimeters per minute past a photoionization sensor. The sample is directly processed by the instrument, recording trace organic and inorganic gases with ionization potentials of less than ~ 10 eV as parts per million.

Molecules with higher ionization potentials such as those forming the major components of air, would go undetected. Methane, with an ionization potential of 12.98 eV, would not register as part of the trace gases.

3. Water samples were tested in the field using a Model U-7 Water Quality Checker, a product of Horiba Instruments, Inc. of Irvine, California.

The instrument is field calibrated using a standardized solution prior to testing, at a frequency of one per 1/2 hour of operation. Field water samples are then placed into the unit's water test chamber for direct analysis by the sensor probes and read-out on digital display. The sensor probes are thoroughly rinsed with distilled water before and after each water testing.

B. Abandoned Landfill Sites

On May 16, 1984 a meeting was held between representatives of the Seattle-King County Department of Public Health, the Seattle Engineering Department's Solid Waste Division, and the Seattle Law Department to determine the abandoned landfills to be targeted for this study. A list of twelve sites was organized based on the information available at that time. All sites are presented in Table I and Figure 1.

FIGURE 1
 ABANDONED LANDFILL LOCATIONS

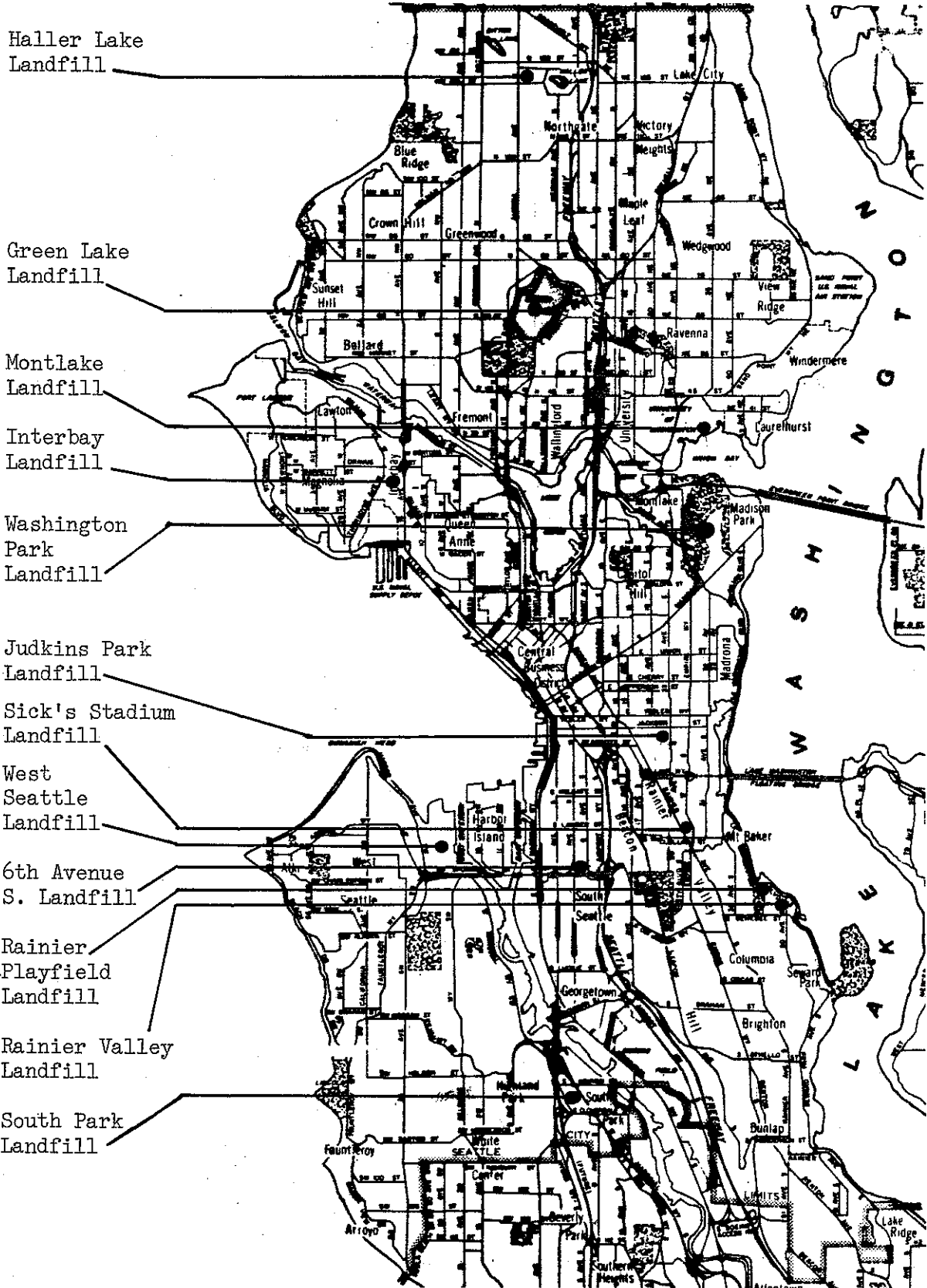


TABLE I

ABANDONED LANDFILL LOCATIONS

- A. Interbay Landfill: 15th Avenue West south of West Dravus Street, north of West Wheeler Street.
 - B. Rainier Valley Landfill: North of South Alaska Street to Lake Washington.
 - C. Montlake Landfill: East of Montlake Boulevard, south of Northeast 45th Street.
 - D. Haller Lake Landfill: East of Stone Avenue North, south of North 125th Street.
 - E. West Seattle Landfill: East of Harbor Avenue Southwest, south of Southwest Florida Street.
 - F. South Park Landfill: East of First Avenue- South, south of Kenyon Street South.
 - G. Green Lake Landfill: North, south, east, west perimeter of Green Lake.
 - H. Judkins Park Landfill: West of 22nd Avenue South, south of South Charles Street.
 - I. Washington Park Landfill: University of Washington Arboretum south of Union Bay.
 - J. Rainier Park Landfill: East of Rainier Avenue South, south of South Oregon Street.
 - K. Sick's Stadium Landfill: East of Rainier Avenue South, south of South Bay Street.
 - L. Sixth Avenue South Landfills: 2900 Block of Sixth Avenue South, Spokane Street and 6th Avenue, Spokane Street and 4th Avenue South.
-

CHAPTER IV
RESULTS AND DISCUSSION



CHAPTER IV

RESULTS AND DISCUSSION

Section 2.

A. Interbay Abandoned Landfill

On June 28, 1984 sixteen bore holes were tested at the Interbay site for methane and non-specific trace gases. These data are presented in Table II.

Of note, nine of the fifteen methane samples collected exhibited concentrations within or above the explosive range for methane gas (4% - 18%). Trace gases (non-specific organic/inorganic gas not including methane) were observed ranging from ambient air levels to a peak level of 79.5 parts per million (ppm).

Due to the steep banks at the north, west, and south perimeters of the site, groundwater seepage was observed ponding at the base of these embankments. Water sample data, appearing in Table III, reflects relatively low dissolved oxygen concentrations and elevated electrical conductivity values suggesting that leachate from the landfill is seeping through the clay sidecaps and draining off site. The odor, color, and algal build-up in the sampling sites provided a visual indicator for the presence of leachate.

An inspection of an existing golf clubhouse at the south end of the landfill revealed severe settling and damage to its concrete foundation indicating the instability of the site property.

FIGURE 2

INTERBAY ABANDONED LANDFILL SAMPLING SITES

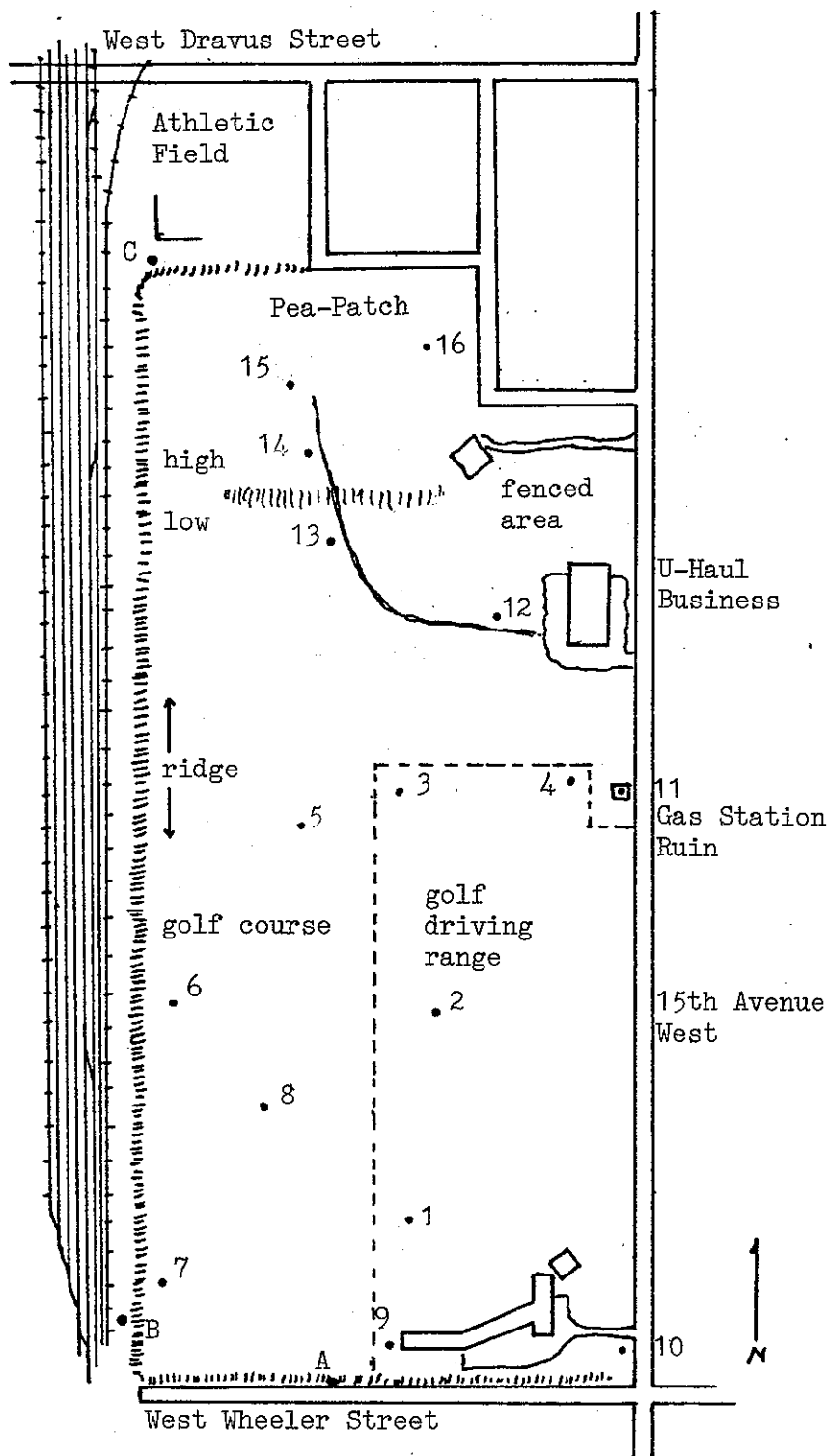


TABLE II
 METHANE AND TRACE GAS CONCENTRATIONS
 INTERBAY ABANDONED LANDFILL

<u>Site</u>	<u>Methane (%)</u>	<u>Trace Gas (ppm)</u> *
1	Trace	0.2
2	5	1.6
3	50	0.3
4	30	0.0
5	5	0.6
6	5	0.5
7	Trace	4.5
8	---	10.2
9	Trace	49.5
10	6	---
11**	Trace	---
12	2	---
13	67	0.0
14	Trace	37.6
15	8	79.5
16	6	3.2

* Reading represents change from ambient air level
 ** Test from gas station storage tank ruin

TABLE III
SURFACE WATER PARAMETERS
INTERBAY ABANDONED LANDFILL

	<u>Site A</u> ⁽¹⁾	<u>Site B</u> ⁽²⁾	<u>Site C</u> ⁽³⁾
pH.....	7.7	7.5	8.2
Temperature..... °C	23.4	19.7	18.4
Dissolved ⁽⁴⁾ Oxygen ppm	(3.3)	(1.9)	(2.5)
Electrolytic..... Conductivity mv/cm	2.8	0.7	2.6
Turbidity..... ppm	2	30	10

-
- (1) Standing water at base of south ridge
 - (2) Standing water at base of southwest ridge
 - (3) Flowing water at base of northwest ridge
 - (4) Dissolved oxygen sensor calibrating 1.8 ppm below actual level

B. Rainier Valley (Genesee) Abandoned Landfill

1. Genesee Park

Genesee Park is a large recreational field extending between 38th Avenue South and 46th Avenue South. Thirteen bore holes were tested on June 19, 1984 for methane and non-specific trace gases at this site. Collected data appear in Table IV.

Of the thirteen methane sampling sites, six were observed within or above the explosive range for methane gas (4% - 18%). Peak levels were obtained at the park's east end with a maximum value of 55% methane gas. Non-specific trace gas levels were observed exhibiting low values with a range of -0.3 ppm to +3.8 ppm relative to the ambient air level.

Surface water data is presented in Table V. The physical parameters of surface water tested on the site compared favorably with the parameters of a lake water sample retrieved from the Stanley Sayers Pit (Table VII) in most respects. However, an oily sheen was observed on pooled water at the east end of the park indicating the negative influence by the landfill on this surface water.

It was apparent that the east end (school property) lacked adequate fill cover as evidenced by patches of discolored soil and refuse scattered over the site. Iron stains from seasonal ground water run-off were observed on the sidewalk bordering the east perimeter on 46th Avenue South.

2. Genesee Playfield

The abandoned landfill at the Genesee Playfield extends between South Genesee Street to Lake Washington. On June 20, 1984, thirteen sites were tested at this site for methane and trace gas concentrations as indicated in Figure 4. Tests results appear in Table VI.

Methane gas concentrations ranged between 0% to 5% with explosive/flammable levels observed at two locations (Figure 4). Trace gas levels were all observed at or below ambient air values. It should be noted that the precipitation falling that day may have adversely affected the non-specific trace gas measuring equipment.

Water sample sites and results appear in Figure 4 and Table VII respectively. Water quality parameters of the pooled surface water sample and the lake water are comparable, indicating the lack of influence on this pooled surface water by the landfill by-products.

FIGURE 3

RAINIER VALLEY ABANDONED LANDFILL SAMPLING SITES
GENESEE PARK

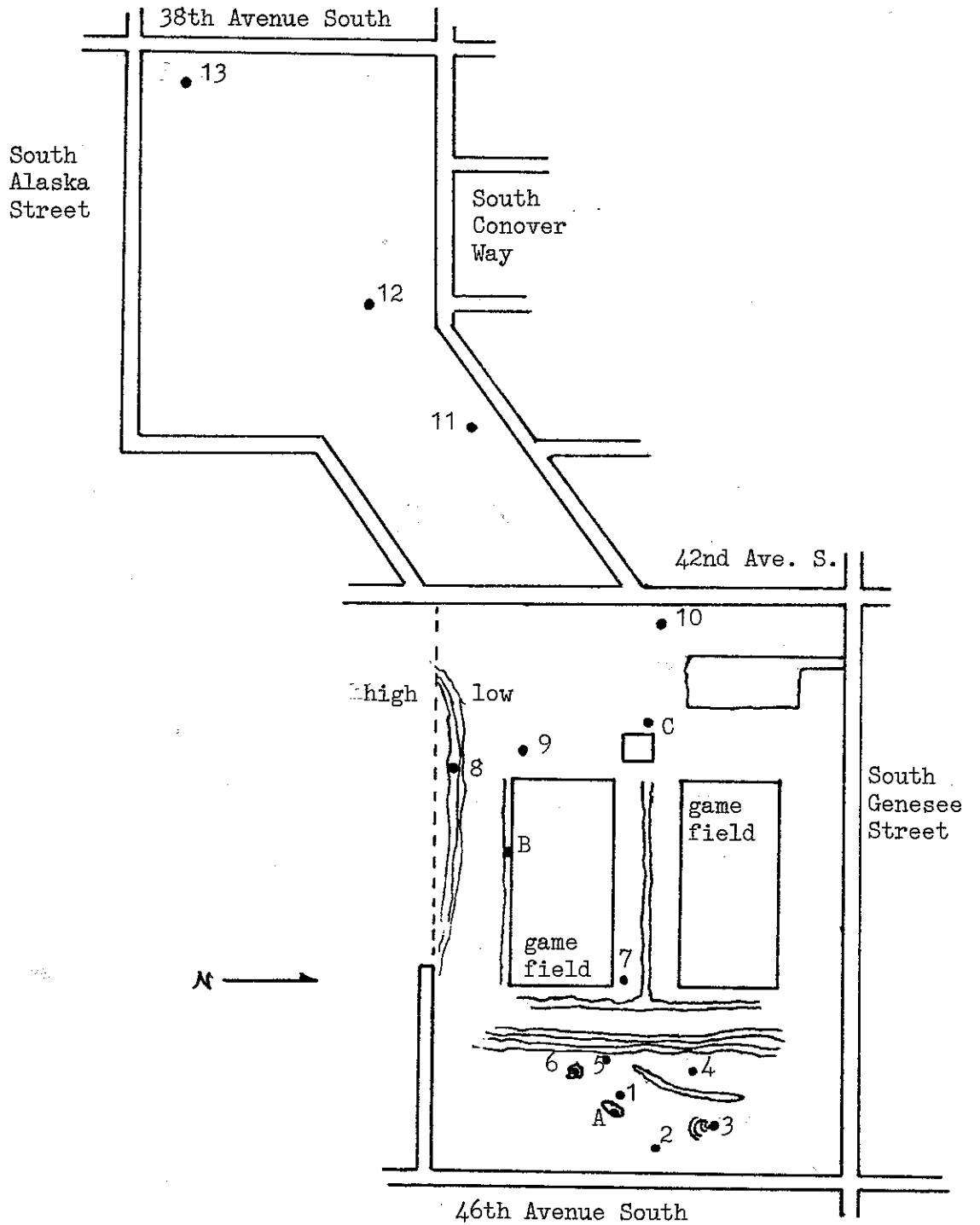


TABLE IV
 METHANE AND TRACE GAS CONCENTRATIONS
 RAINIER VALLEY ABANDONED LANDFILL: GENESEE PARK

<u>Site</u>	<u>Methane (%)</u>	<u>Trace Gas (ppm)*</u>
1	8	Background
2	Trace	-0.3
3	55	1.4
4	0.8	1.0
5	27	3.0
6	16	2.2
7	Trace	Trace
8	11	3.8
9	Trace	0.8
10	Trace	1.2
11	Trace	Trace
12	5	Trace
13	Trace	0.6

*Reading represents change from ambient air level

TABLE V
 SURFACE WATER PARAMETERS
 RAINIER VALLEY ABANDONED LANDFILL: GENESEE PARK

	<u>Site A</u> ⁽¹⁾	<u>Site B</u> ⁽²⁾	<u>Site C</u> ⁽³⁾
pH.....	7.4	5.8	7.0
Temperature..... °C	23.0	26.2	19.9
Dissolved..... Oxygen ppm	17.7	7.4	10.4
Electrolytic..... Conductivity mv/cm	0.5	0.1	0.2
Turbidity..... ppm	152	7	2

-
- (1) Pooled surface water, stagnant
 - (2) Flowing surface water (from spring)
 - (3) Drinking fountain water, Seattle water supply

FIGURE 4

RAINER VALLEY ABANDONED LANDFILL SAMPLING SITES
GENESEE PLAYFIELD

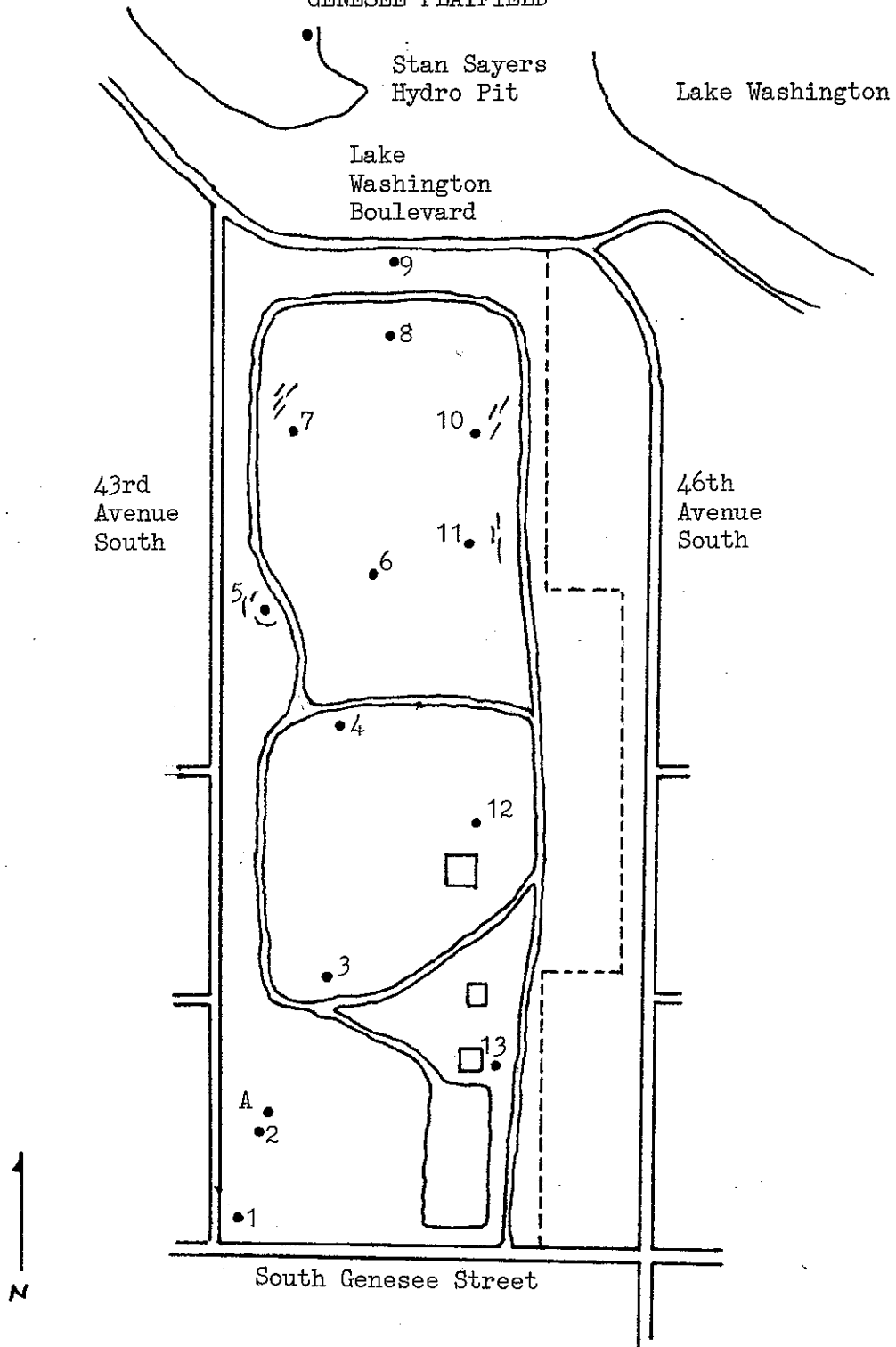


TABLE VI

METHANE AND TRACE GAS CONCENTRATIONS
 RAINIER VALLEY ABANDONED LANDFILL: GENESEE PLAYFIELD

<u>Site</u>	<u>Methane (%)</u>	<u>Trace Gas (ppm)*</u>
1	0	-1.0
2	0.3	0.0
3	1.6	-0.8
4	1.6	-0.8
5	5.0	-0.8
6	Trace	-0.6
7	4.0	-0.6
8	0	-0.8
9	0	0.0
10	0	-0.5
11	0.9	---
12	0	---
13	2.8	---

*Reading represents change from ambient air level

TABLE VII

SURFACE WATER PARAMETERS
 RAINIER VALLEY ABANDONED LANDFILL: GENESEE PLAYFIELD

	<u>Site A</u> *	<u>Site B</u> **
pH.....	8.3	7.5
Temperature..... °C	21.9	20.6
Dissolved..... Oxygen ppm	12.0	8.4
Electrolytic..... Conductivity mV/cm	0.1	0.1
Turbidity..... ppm	6	2

* Surface water on playfield
 ** Lake Washington water sample

C. Montlake Abandoned Landfill

The eighteen test sites and gas level data collected at the Montlake site on June 25, 1984 appear in Figure 5 and Table VIII respectively. Of the eighteen methane test locations, twelve sites contained gas levels within or greater than the explosive/flammable range for methane gas in air (4% - 18%), with a majority of peak readings at the landfill's southend (Figure 5). A level of 8% methane gas was observed in the south methane burner stack while only trace levels were recorded in the north stack.

Non-specific trace gas levels ranged from 0.1 ppm to 219.8 ppm above ambient air readings. The trend for a correspondence between high trace gas levels with areas of low methane concentrations was observed.

Water sample test data and location sites are found in Table IX and Figure 5.

Samples obtained from pooled surface water on the field exhibited a higher electrolyte conductivity than the sample obtained from the lake slough. This may be partially attributed to a dilution factor. Of visual note was the apparent stagnation of the Lake Washington slough water.

FIGURE 5

MONTLAKE ABANDONED LANDFILL SAMPLING SITES

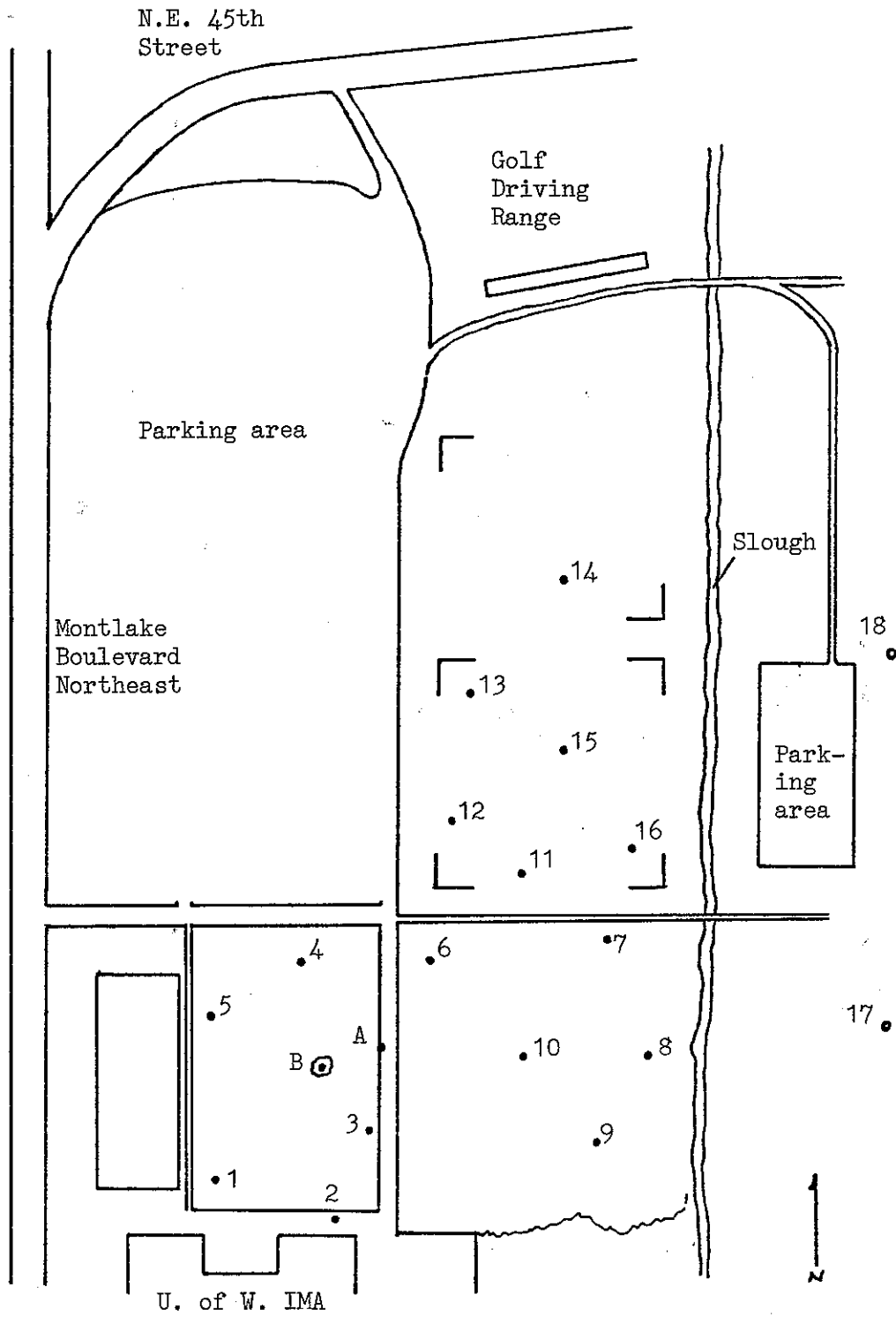


TABLE VIII

METHANE AND TRACE GAS CONCENTRATIONS
MONTLAKE ABANDONED LANDFILL

<u>Site</u>	<u>Methane (%)</u>	<u>Trace Gas (ppm)*</u>
1	40	1.3
2	Trace	0.1
3	28	1.6
4	38	0.8
5	15	1.1
6	11	2.5
7	16	2.9
8	7	21.6
9	9	14.5
10	14	---
11	10	29.4
12	10	23.4
13	Trace	24.4
14	2.4	23.4
15	Trace	4.9
16	Trace	219.8
17**	8	0.7
18**	Trace	---

* Reading represents change from ambient air level

** Sample from methane vent stack

TABLE IX
 SURFACE WATER PARAMETERS
 MONTLAKE ABANDONED LANDFILL

	<u>Site A</u> ⁽¹⁾	<u>Site B</u> ⁽²⁾	<u>Site C</u> ⁽³⁾
pH.....	6.8	6.5	5.8
Temperature..... °C	23.9	28.4	28.1
Dissolved..... Oxygen ppm	(6.1)	(2.9)	(6.5)
Electrolytic..... Conductivity mv/cm	0.4	0.5	0.2
Turbidity..... ppm	6	25	4

-
- (1) Standing water in ditch
 - (2) Standing water on playfield
 - (3) Water from Lake Washington slough
 - (4) Dissolved oxygen sensor calibrating 1.1 ppm below actual value

D. Haller Lake Abandoned Landfill

The Haller Lake abandoned landfill is divided by a ridge into two distinct elevation levels with the southend considerably higher than the northern section. Each of the two levels is now the home of mobile home parks built in the early mid 1960's.

On June 28, 1984 17 bore holes were tested for methane and non-specific trace gases. Site locations and test data are presented in Figure 6 and Table X respectively.

Methane gas levels measured at the north were all observed below the explosive concentration range (4% - 18%) for methane. However, three of the ten south section test sites were observed with methane gas within or above the explosive/flammable range. These sites were located sporadically throughout the south area.

Non-specific trace gas levels were measured ranging between 0.2 ppm to 33.4 ppm in the north section, and 0.4 ppm to 81.4 ppm above ambient air levels in the south area. Highest trace gas readings corresponded to areas of lowest methane gas concentrations.

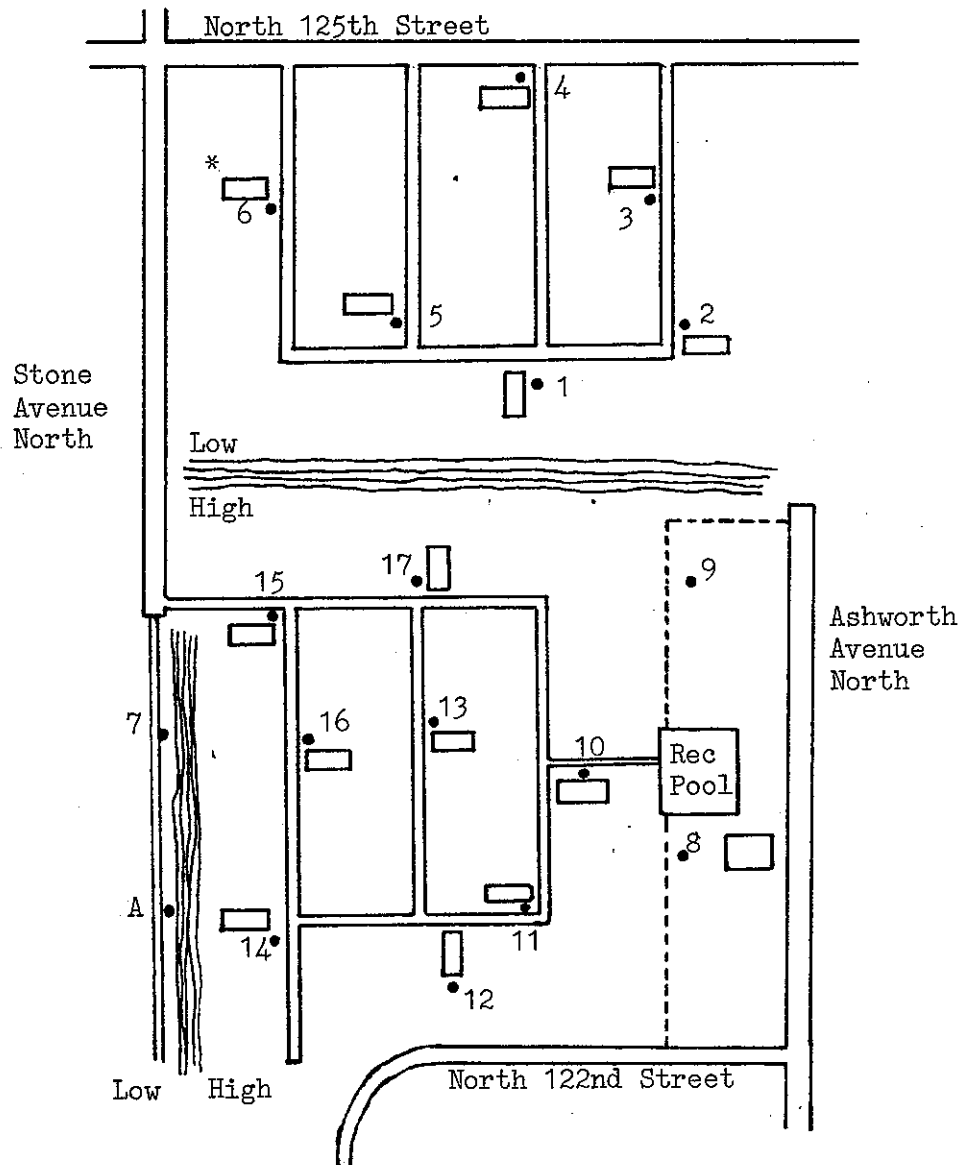
One surface water sample was retrieved from the base ditch of the landfill's west ridge and appeared stagnant and turbid. Its relatively low electrolyte conductivity level of .2 mv/cm suggests minimal landfill leaching occurring.

It was noted that many of the residents have had to repeatedly jack up

their dwelling due to the unstable earth settling. Streets throughout both trailer parks have settled considerably causing disruption to surface drainage.

FIGURE 6

HALLER LAKE ABANDONED LANDFILL SAMPLING SITES



* Sampling site mobile home positions

TABLE X

METHANE AND TRACE GAS CONCENTRATIONS
HALLER LAKE ABANDONED LANDFILL

<u>North Site</u>		
<u>Site</u>	<u>Methane (%)</u>	<u>Trace Gas (ppm)*</u>
1	Trace	0.2
2	Trace	0.2
3	3.6	2.8
4	3.6	2.4
5	0.8	33.4
6	0	4.0
7	Trace	4.4
<u>South Site</u>		
<u>Site</u>	<u>Methane (%)</u>	<u>Trace Gas (ppm)*</u>
8	0	69.4
9	0	2.0
10	23	2.0
11	7	3.0
12	0	3.0
13	0	2.8
14	3.6	0.4
15	Trace	3.2
16	10	3.8
17	Trace	4.4

* Readings represent change from ambient level

TABLE XI
 SURFACE WATER PARAMETERS
 HALLER LAKE ABANDONED LANDFILL

	<u>Site A</u> ⁽¹⁾
pH.....	5.3
Temperature..... °C	20.0
Dissolved ⁽²⁾ Oxygen ppm	(1.9)
Electrolytic..... Conductivity mv/cm	0.2
Turbidity..... ppm	29

-
- (1) Standing water in west bank ditch
 - (2) Dissolved oxygen sensor calibrating 1.3 ppm
below actual level

E. West Seattle Abandoned Landfill

The West Seattle abandoned landfill, a former tidal area of Elliot Bay, is bordered by Southwest Hanover Street and Southwest Florida Street to the south and north, and Harbor Avenue Southwest and the railroad tracks to the west and east. This area has been extensively capped with a hard limestone slag obtained as a by-product of steel manufacturing by the current property owner, the Bethlehem Steel Corporation. This property is presently used for metal and gravel storage at the southerly end, and as a metal salvage site to the north.

On July 2, 1984 eight bore holes were penetrated (into the limestone slag cover) for testing of methane and non-specific organic/inorganic trace gas concentrations. Because of the inaccessibility created by the metal salvage operation at the northend, all landfill site bore holes were situated within the southern section with the exclusion of one northeast perimeter testing hole. Data and corresponding site locations appear in Table XII and Figure 7 respectively.

Four of the seven test holes tested for methane gas exhibited levels within or above the 4% to 18% explosive range for methane gas. Peak concentrations were observed at the southend of the landfill at 27% and 60% methane gas.

Non-specific trace gas levels ranged between the air ambient level to 21.6 ppm above this ambient level. Peak trace gas readings corresponded to peak methane gas locations.

A water sample was obtained from a tidal pool located at the northeast corner of the landfill. The pool had approximate dimensions of 120 feet in length, 35 feet in width and 20 feet in depth. The pool had an inlet and outlet pipe. Water was noted draining profusely from the side walls at low tide. Barnacles were evident on the pool's pipes and rocks. The pool appeared oily and polluted.

The water sample test parameters are presented in Table XIII. The high electrolyte conductivity value can be attributed to the salt in the water which could effectively mask any other ion contaminants.

FIGURE 7

WEST SEATTLE ABANDONED LANDFILL SAMPLING SITES

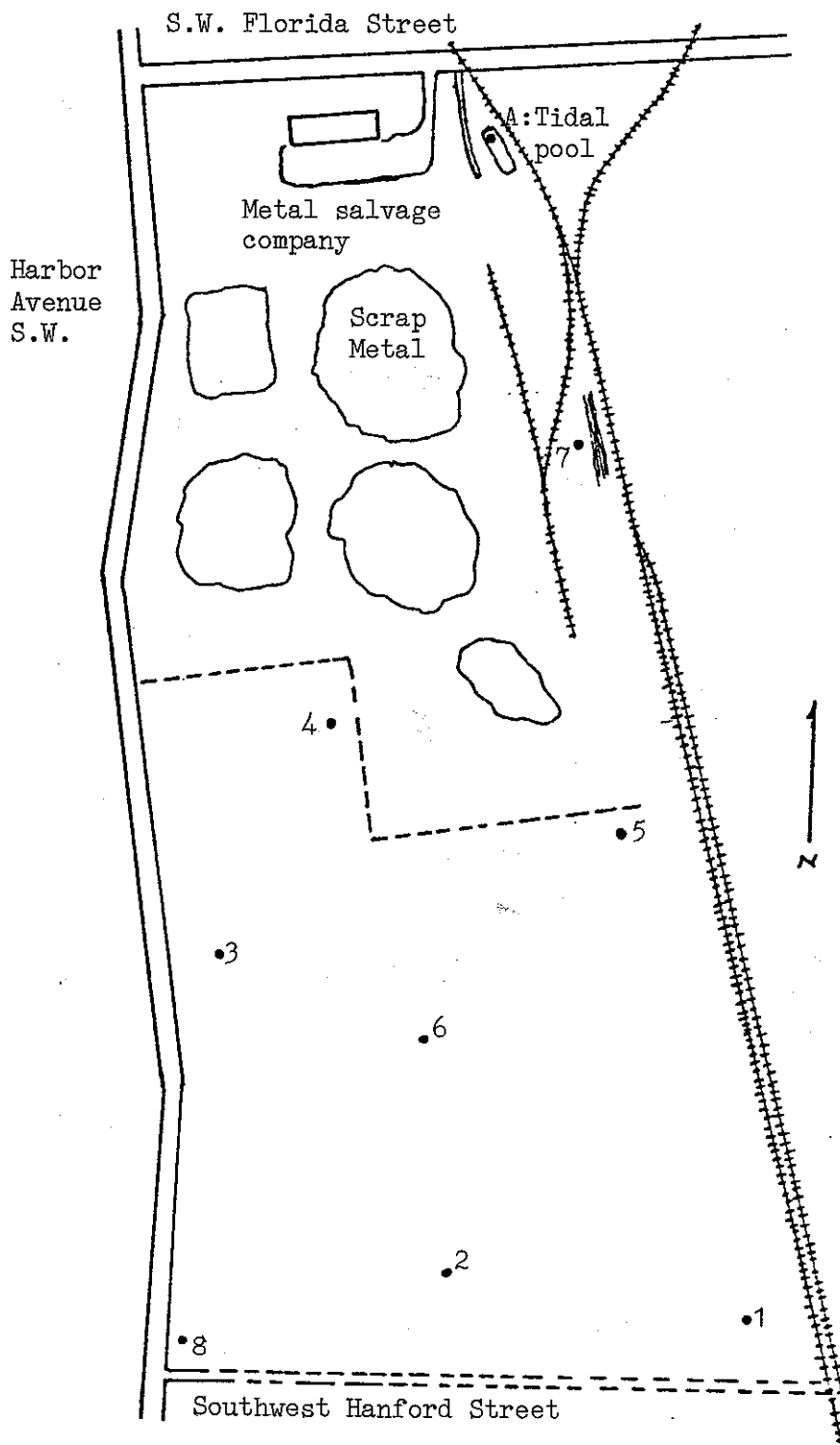


TABLE XII
 METHANE AND TRACE GAS CONCENTRATIONS
 WEST SEATTLE ABANDONED LANDFILL

<u>Site</u>	<u>Methane (%)</u>	<u>Trace Gas (ppm)*</u>
1	5	0.0
2	60	21.6
3	Trace	1.6
4	4	2.4
5	Water table	Water table
6	1.6	0.0
7	0	3.0
8	27	19.6

*Reading represents change from ambient air level

TABLE XIII
 SURFACE WATER PARAMETERS
 WEST SEATTLE ABANDONED LANDFILL

	<u>Site A</u> ⁽¹⁾
pH.....	6.7
Temperature..... °C	22.9
Dissolved..... Oxygen ppm	5.8
Electrolytic..... Conductivity m μ /cm	4.1
Turbidity..... ppm	5

(1) Sample from inland tidal pool, salt water

F. South Park Abandoned Landfill

On July 3, 1984 eleven bore holes were tested at the South Park site for methane and non-specific trace gas concentrations. Of these, two of the eleven test holes registered methane gas levels within the explosive/flammable range (4% - 18%) for methane. Both test sites were located within the north central landfill section.

Trace organic/inorganic gas levels were observed at low levels throughout the landfill area ranging from 1.0 ppm below to 1.2 ppm above the ambient background level.

A water bearing ditch was observed at the base of the landfill ridge along Occidental Avenue South. Data from a water sample taken from this ditch appears in Table XV. The measured parameters do not indicate a leachate problem.

The South Park Transfer Station is situated on the northeast quadrant of the landfill. Obvious visible signs of ground settling were not observed.

FIGURE 8

SOUTH PARK ABANDONED LANDFILL SAMPLING SITES

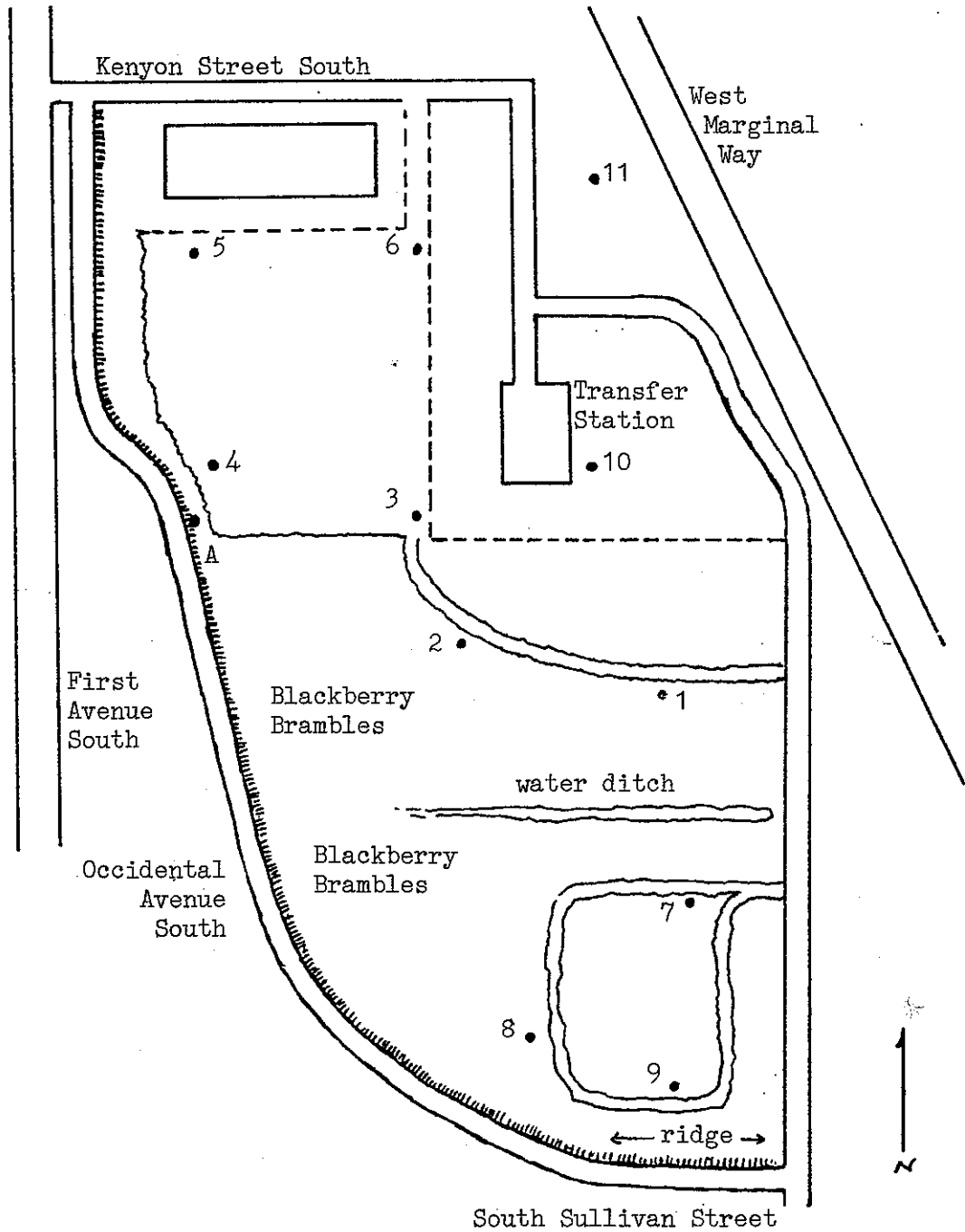


TABLE XIV

METHANE AND TRACE GAS CONCENTRATIONS
SOUTH PARK ABANDONED LANDFILL

<u>Site</u>	<u>Methane (%)</u>	<u>Trace Gas (ppm)*</u>
1	1.6	0.3
2	Trace	0.6
3	9	-0.2
4	Trace	1.2
5	0	0.8
6	14	-1.0
7	Trace	1.2
8	Trace	-0.2
9	Trace	-0.6
10	0	0.8
11	0	0.4

*Reading represents change from ambient air level

TABLE XV
 SURFACE WATER PARAMETERS
 SOUTH PARK ABANDONED LANDFILL

	<u>Site A</u> ⁽¹⁾
pH.....	6.8
Temperature..... °C	20.8
Dissolved ⁽²⁾ Oxygen ppm	(3.2)
Electrolytic..... Conductivity mv/cm	0.2
Turbidity..... ppm	30

-
- (1) Standing water in west ledge ditch
 - (2) Dissolved oxygen sensor calibrating 2.7 ppm below actual value

G. Greenlake Abandoned Landfill

For the purposes of data presentation, the Greenlake Landfill has been divided into four sampling areas as indicated by Figure 9. Sampling occurred on June 18, 1984 for areas I and II, and on June 22, 1984 for areas III and IV. Gas level data is presented in Tables XVI and XVII. Water sample parameters appear in Table XVIII.

Of the 25 bore holes tested for methane gas, only one sample located in Area I was observed with explosive range concentrations (4% to 18%) for methane.

Trace organic/inorganic gas levels were observed at low values throughout the park with the exception of one peak reading of 15.6 ppm above the air ambient level within Area I. This location corresponds to the vicinity of peak methane gas concentrations.

The five water samples taken from the lake on-site storm drain sewers revealed water parameters not indicative of landfill contamination.

These findings were not unusual in light of the landfill's age, being closed prior to the 1930's.

FIGURE 9

GREEN LAKE ABANDONED LANDFILL SAMPLING AREAS

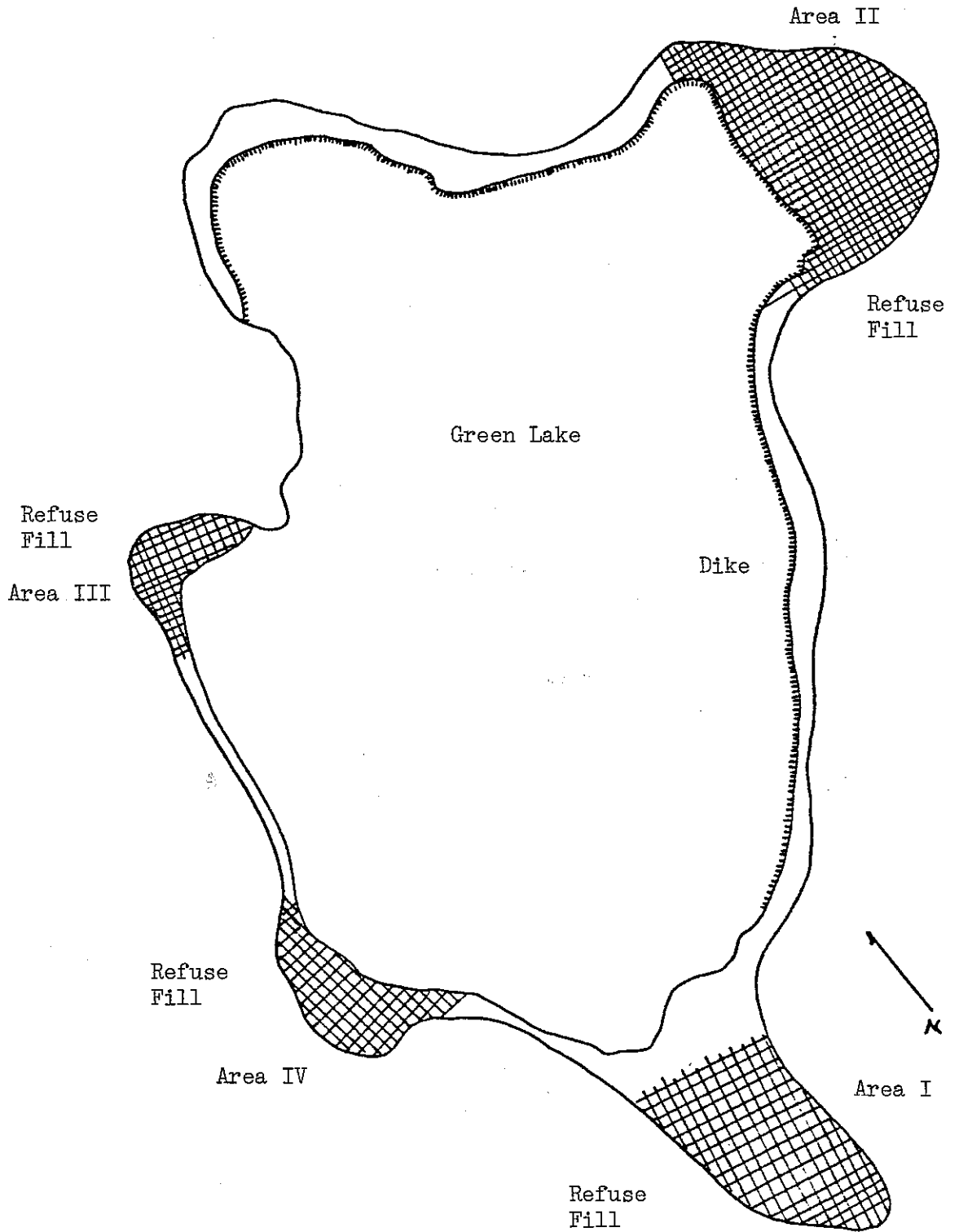


FIGURE 10

GREEN LAKE ABANDONED LANDFILL SAMPLING SITES
AREA I

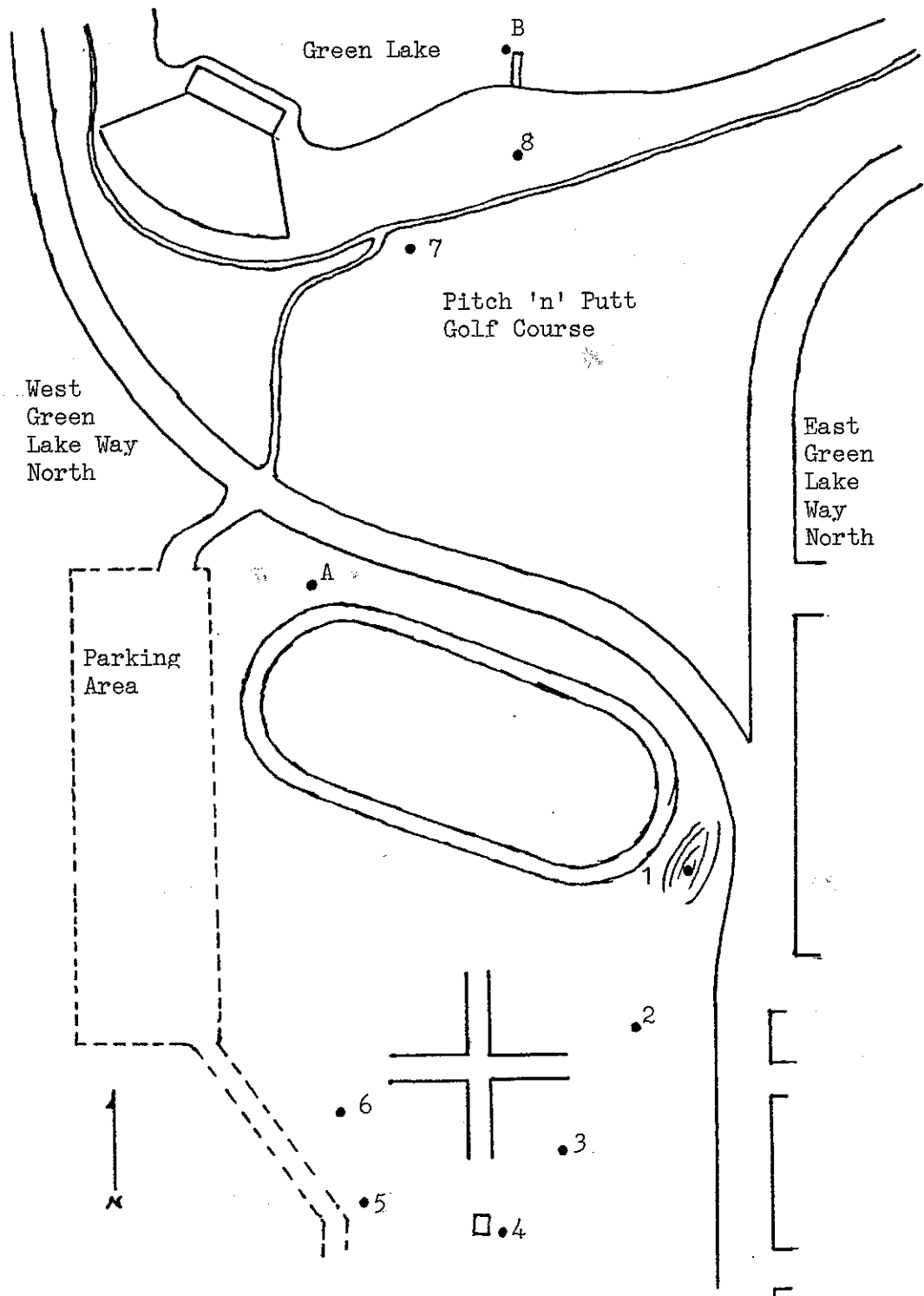


FIGURE 11

GREEN LAKE ABANDONED LANDFILL SAMPLING SITES
AREA II

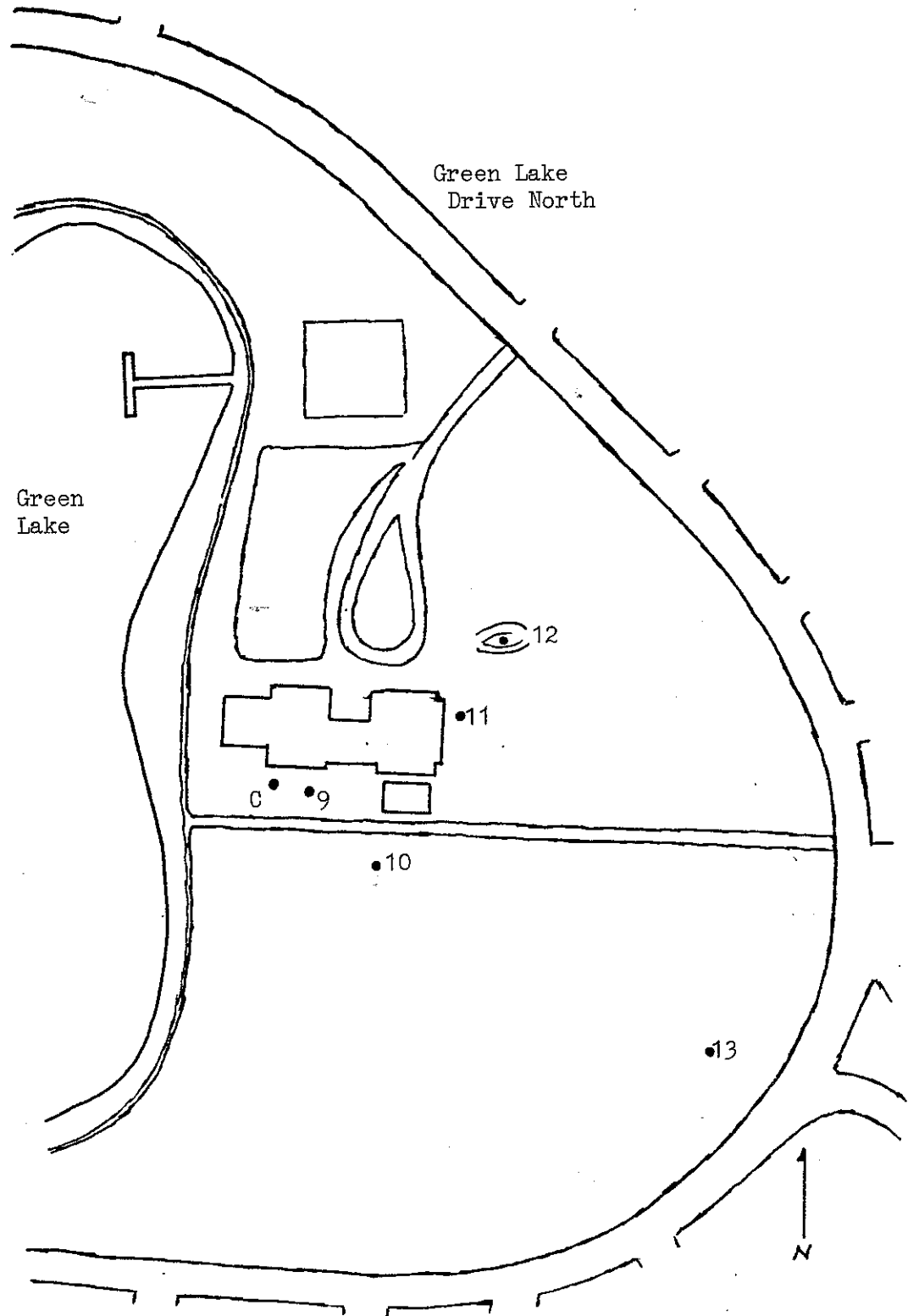


FIGURE 12

GREEN LAKE ABANDONED LANDFILL SAMPLING SITES
AREA III

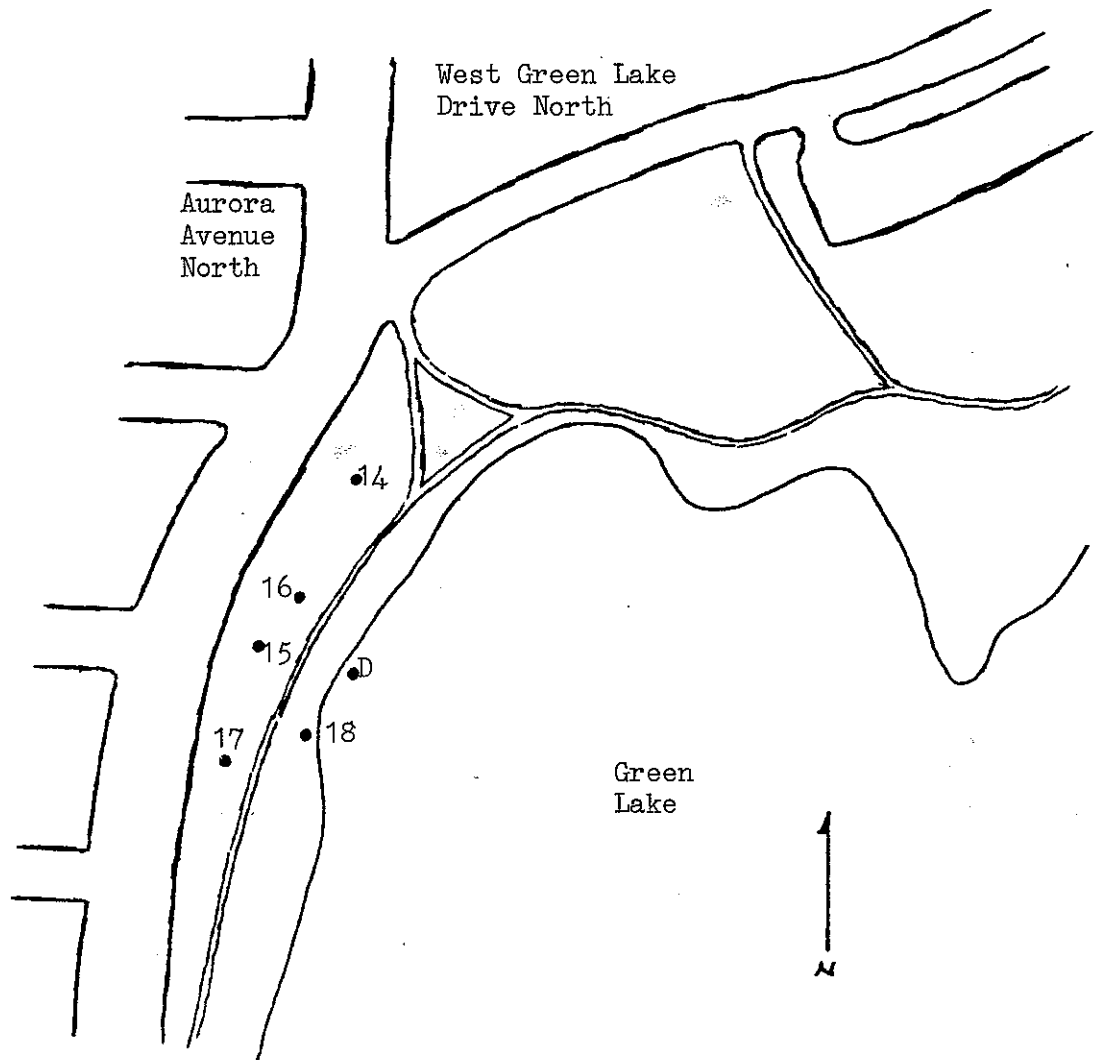


FIGURE 13

GREEN LAKE ABANDONED LANDFILL SAMPLING SITES
AREA IV

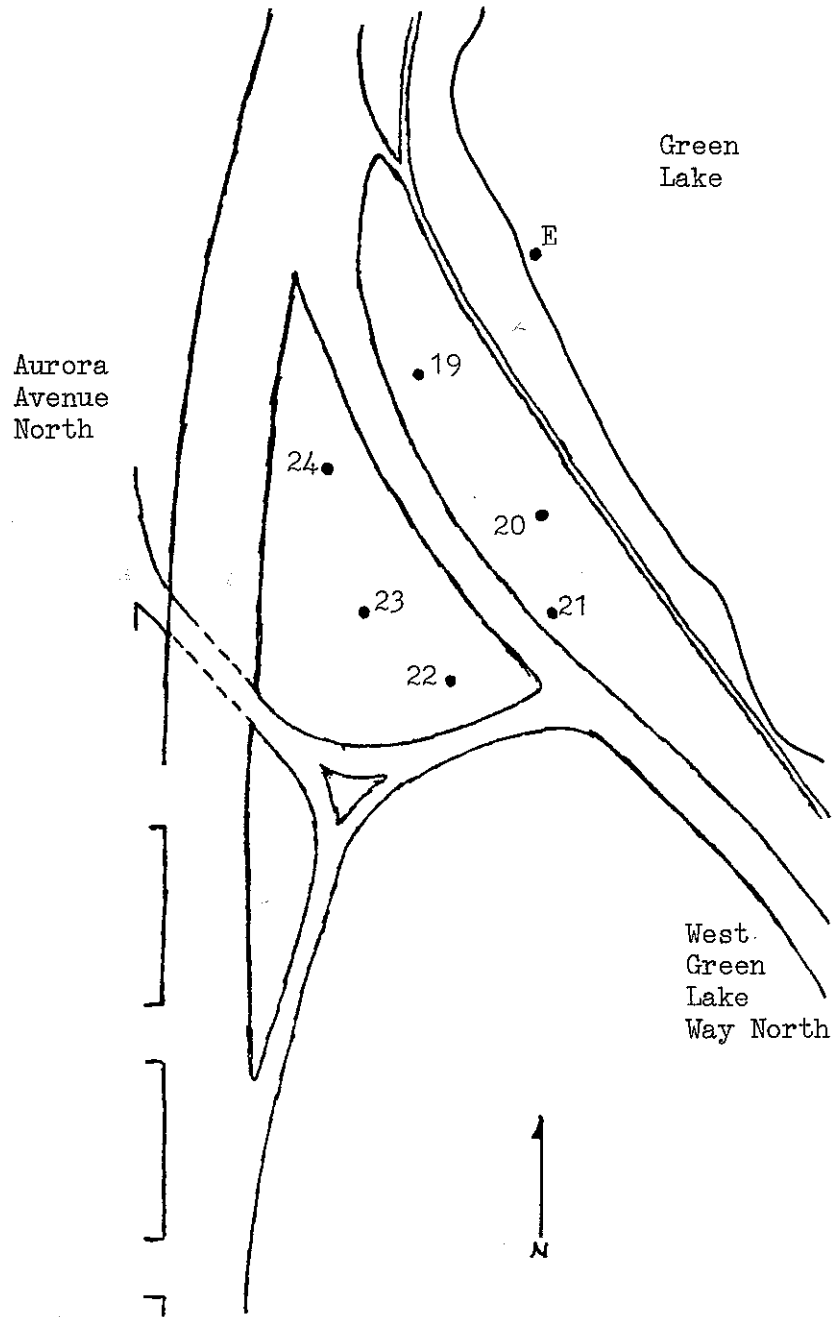


TABLE XVI

METHANE AND TRACE GAS CONCENTRATIONS
 GREEN LAKE ABANDONED LANDFILL: AREA I, II

Area I

<u>Site</u>	<u>Methane (%)</u>	<u>Trace Gas (ppm)*</u>
1	2 - 7	0.0
2	3.5	15.6
3	Trace	---
4	Trace	1.2
5	Trace	0.4
6	0	0.4
7	0	0.0
8	0	0.0

Area II

<u>Site</u>	<u>Methane (%)</u>	<u>Trace Gas (ppm)*</u>
9	0	0.0
10	0	0.0
11	0	-0.4
12	0	-0.2
13	0	-0.4

*Reading represents change from ambient air level

TABLE XVII

METHANE AND TRACE GAS CONCENTRATIONS
 GREEN LAKE ABANDONED LANDFILL: AREA III, IV

<u>Area III</u>		
<u>Site</u>	<u>Methane (%)</u>	<u>Trace Gas (ppm)*</u>
14	2.4	-0.5
15	0	-0.3
16	0	0.0
17	0	-0.2
18	0	0.0

<u>Area IV</u>		
<u>Site</u>	<u>Methane (%)</u>	<u>Trace Gas (ppm)*</u>
19	0	-0.4
20	0	0.0
21	0	-0.4
22	0	0.9
23	0	2.5
24	0	1.8

*Reading represents change from ambient air level

TABLE XVIII

SURFACE WATER PARAMETERS
GREEN LAKE ABANDONED LANDFILL

	<u>Site A</u> ⁽¹⁾	<u>Site B</u> ⁽²⁾	<u>Site C</u> ⁽³⁾	<u>Site D</u> ⁽⁴⁾	<u>Site E</u> ⁽⁵⁾
pH.....	6.3	7.1	6.2	5.7	6.8
Temperature..... °C	16.1	20.3	16.8	20.3	21.4
Dissolved..... Oxygen ppm	6.4	8.7	1.8	8.3	8.7
Electrolytic..... Conductivity mV/cm	0.5	0.1	0.4	0.1	0.1
Turbidity..... ppm	2	2	3	2	1

-
- (1) Storm drain sewer water, Area I
 - (2) Green Lake water sample, Area I
 - (3) Storm drain sewer water, Area II
 - (4) Green Lake water sample, Area III
 - (5) Green Lake water sample, Area IV

H. Judkins Park Abandoned Landfill

Eleven bore holes were tested for methane and non-specific trace gas levels at the Judkins site on June 21, 1984. Methane and trace gas data are presented in Table XIX.

Of the 11 sites tested, none produced a methane gas reading either at or above the explosive/flammable range of 4% to 18% methane. The peak methane value of 3.2% did correspond to the peak non-specific trace gas figure of 4.6 ppm from bore-hole #4 (Figure 14). All other trace gas levels were at or near that of the ambient air value.

Pooled water was observed at the park's northend. Test data for this water appears in Table XX. The water sample parameters were not indicative of leachate contamination.

The property and the buildings located on the site appeared to be stable during visual inspection.

FIGURE 14

JUDKINS PARK ABANDONED LANDFILL SAMPLING SITES

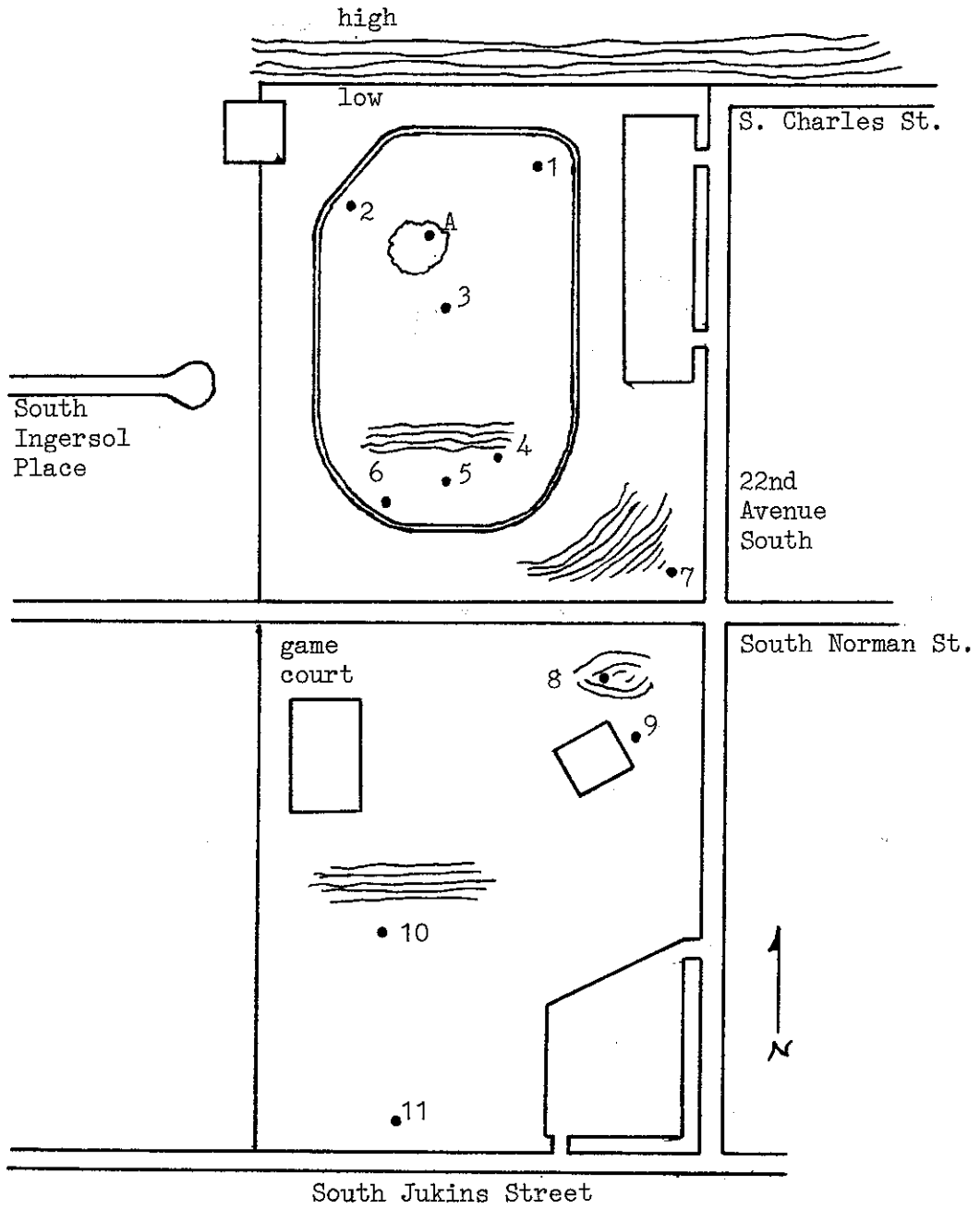


TABLE XIX

METHANE AND TRACE GAS CONCENTRATIONS
JUDKINS PARK ABANDONED LANDFILL

<u>Site</u>	<u>Methane (%)</u>	<u>Trace Gas (ppm)*</u>
1	Water table	Water table
2	0.8	0.0
3	Trace	0.0
4	3.2	4.6
5	Trace	-1.6
6	0.4	-0.5
7	0.0	-0.8
8	0.3	0.0
9	0.3	0.0
10	Water table	Water table
11	Trace	-0.5

*Reading represents change from ambient air level

TABLE XX
SURFACE WATER SAMPLE
JUDKINS PARK ABANDONED LANDFILL

	<u>Site A</u> ⁽¹⁾
pH.....	6.7
Temperature..... °C	23.2
Dissolved..... Oxygen ppm	10.8
Electrolytic..... Conductivity mv/cm	0.5
Turbidity..... ppm	5

(1) Pooled surface water

I. Washington Park Abandoned Landfill

Records indicate at least two areas of Washington Park as former landfill areas: the Foster Island site and the Arboretum Playfield. Both were tested for methane gas and non-specific trace gas levels on June 22, 1984. These data are presented in Table XXI.

None of the eight bore holes tested exhibited more than trace levels of methane gas. All methane tests at the Arboretum proved negative.

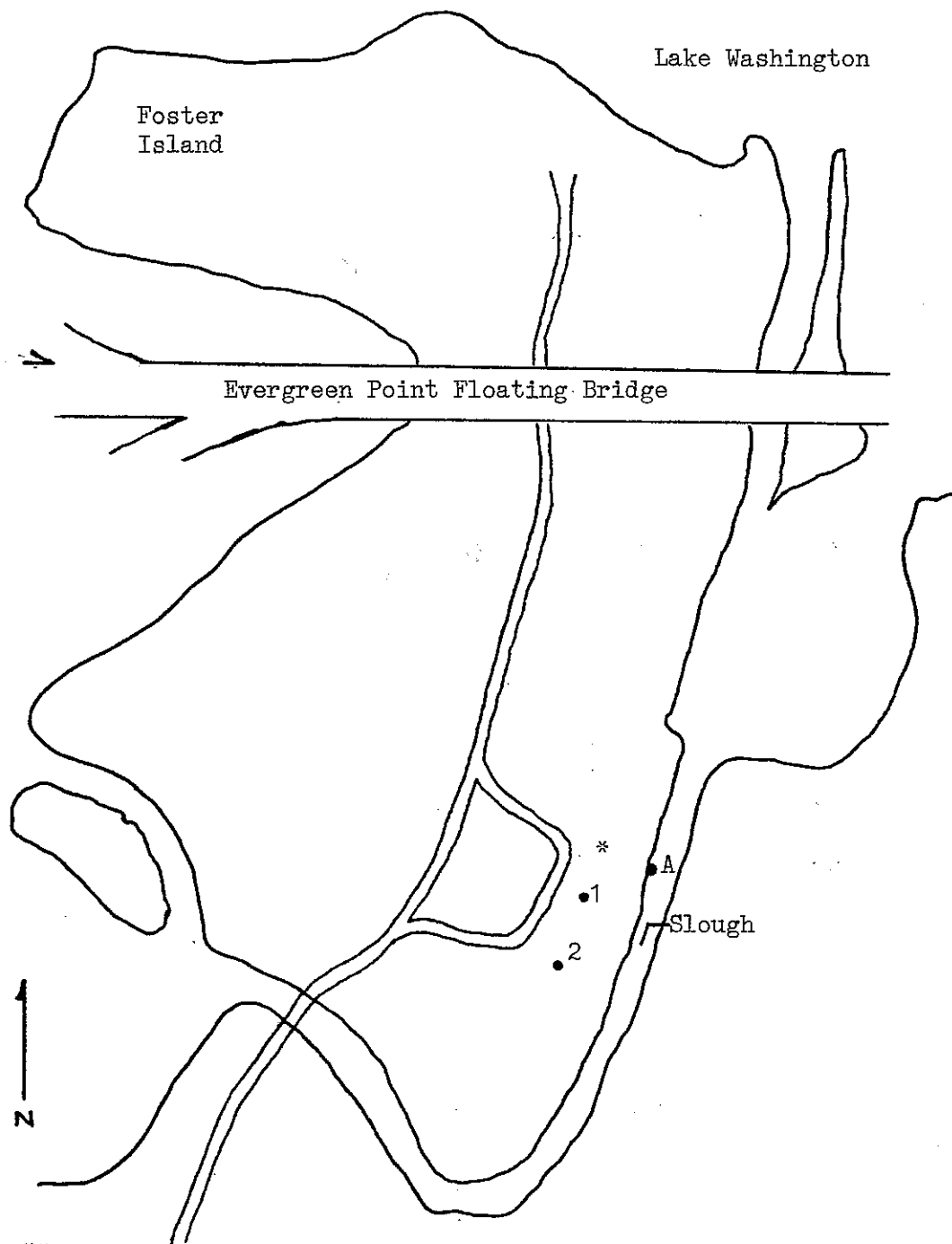
Non-specific organic/inorganic trace gas levels tested at the playfield fluctuated widely with a low of 0 ppm above the ambient air level to a peak reading of 129.4 ppm above ambient.

One water sample was retrieved from Lake Washington at Foster Island. Parameters, appearing in Table XXI, did not indicate leachate contamination.

Methane gas and water sample findings are consistent with the understanding that the landfills have been closed for at least 60 years.

FIGURE 15

WASHINGTON PARK ABANDONED LANDFILL SAMPLING SITES
FOSTER ISLAND



*Wood chip/dirt fill area currently in use

FIGURE 16

WASHINGTON PARK ABANDONED LANDFILL SAMPLING SITES
ARBORETUM PLAYFIELD

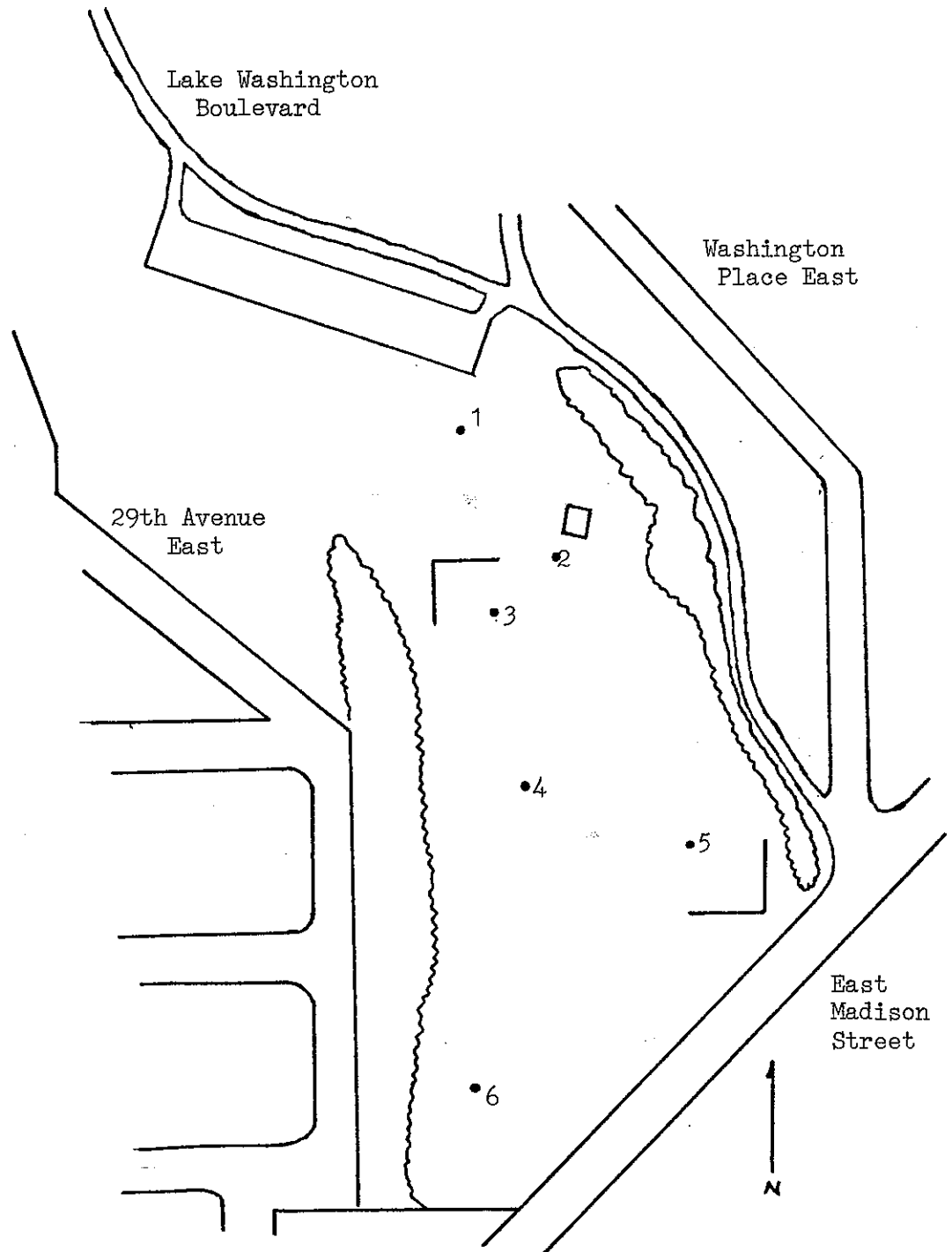


TABLE XXI

METHANE AND TRACE GAS CONCENTRATIONS
WASHINGTON PARK ABANDONED LANDFILL

Foster Island Site

<u>Site</u>	<u>Methane (%)</u>	<u>Trace Gas (ppm)</u>
1	Trace	---
2	Trace	---

Arboretum Playfield Site

<u>Site</u>	<u>Methane (%)</u>	<u>Trace Gas (ppm)*</u>
1	0	129.4
2	0	12.6
3	0	0.6
4	0	0.2
5	0	4.2
6	0	0.0

*Reading represents change from ambient air level

TABLE XXII
 SURFACE WATER SAMPLE
 WASHINGTON PARK ABANDONED LANDFILL
 FOSTER ISLAND

	<u>Site A</u> ⁽¹⁾
pH.....	6.2
Temperature..... °C	23.7
Dissolved..... Oxygen ppm	(4.8)
Electrolytic..... Conductivity mv/cm	0.4
Turbidity..... ppm	1

-
- (1) Sample from Lake Washington Arboretum slough
 - (2) Dissolved oxygen sensor calibrating 1.1 ppm below actual level

J. Rainier Playfield Abandoned Landfill

Methane and nono-specific trace gas data, collected on June 21, 1984, appear in Table XXIII. Of the nine bore holes tested for methane, none registered above a trace methane level. All non-specific trace gas measurements were observed at values less than the ambient air level.

One water sample was tested from a storm drain sewer. These data, presented in Table XXIV, indicate the absence of leachate contamination.

Visual inspection revealed some settling to the foundation of the community building located within the northeast quadrant of the park.

FIGURE 17

RAINIER PARK ABANDONED LANDFILL SAMPLING SITES

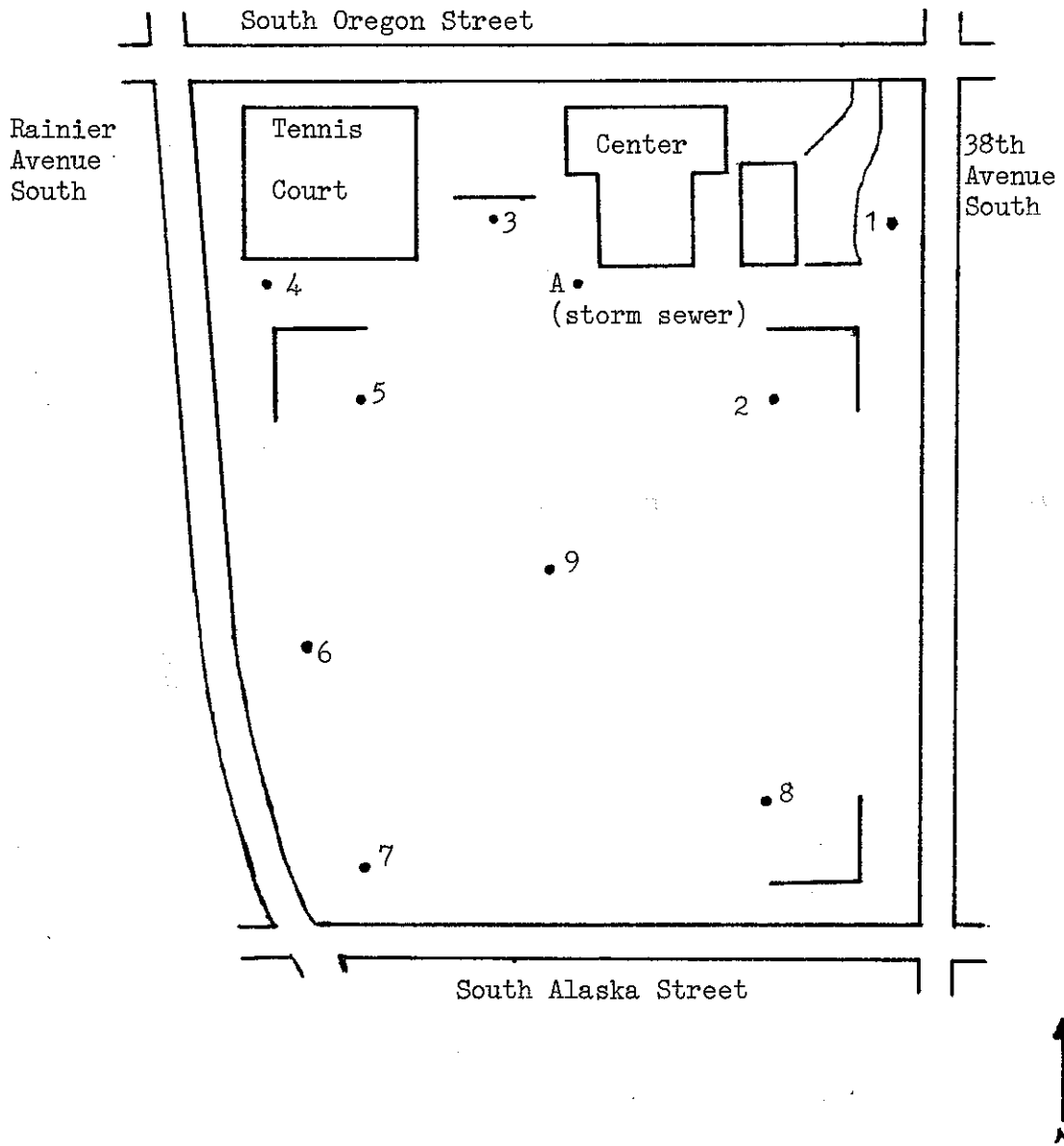


TABLE XXIII

METHANE AND TRACE GAS CONCENTRATIONS
RAINIER PLAYFIELD ABANDONED LANDFILL

<u>Site</u>	<u>Methane (%)</u>	<u>Trace Gas (ppm)*</u>
1	0	< Background
2	0	< Background
3	0	< Background
4	0	< Background
5	0	< Background
6	0	< Background
7	0	< Background
8	0	< Background
9	Trace	< Background

*Reading represents change from ambient level

TABLE XXIV
 SURFACE WATER SAMPLE
 RAINIER PLAYFIELD ABANDONED LANDFILL

	<u>Site A</u> ⁽¹⁾
pH.....	5.8
Temperature..... °C	17.2
Dissolved..... Oxygen ppm	5.8
Electrolytic..... Conductivity mv/cm	0.5
Turbidity..... ppm	58

(1) Storm sewer water sample

K. Sick's Stadium Abandoned Landfill

None of the six bore holes tested on June 29, 1984 showed a measurable reading for methane gas (Table XXV). Non-specific trace gas levels ranged between 2.2 ppm to 10.7 ppm above ambient air levels.

No surface water was observed for testing.

The photo development building, constructed about 1978, may be experiencing some settling of its concrete slab floor, as evidenced by slab cracks.

FIGURE 18

SICK'S STADIUM ABANDONED LANDFILL SAMPLING SITES

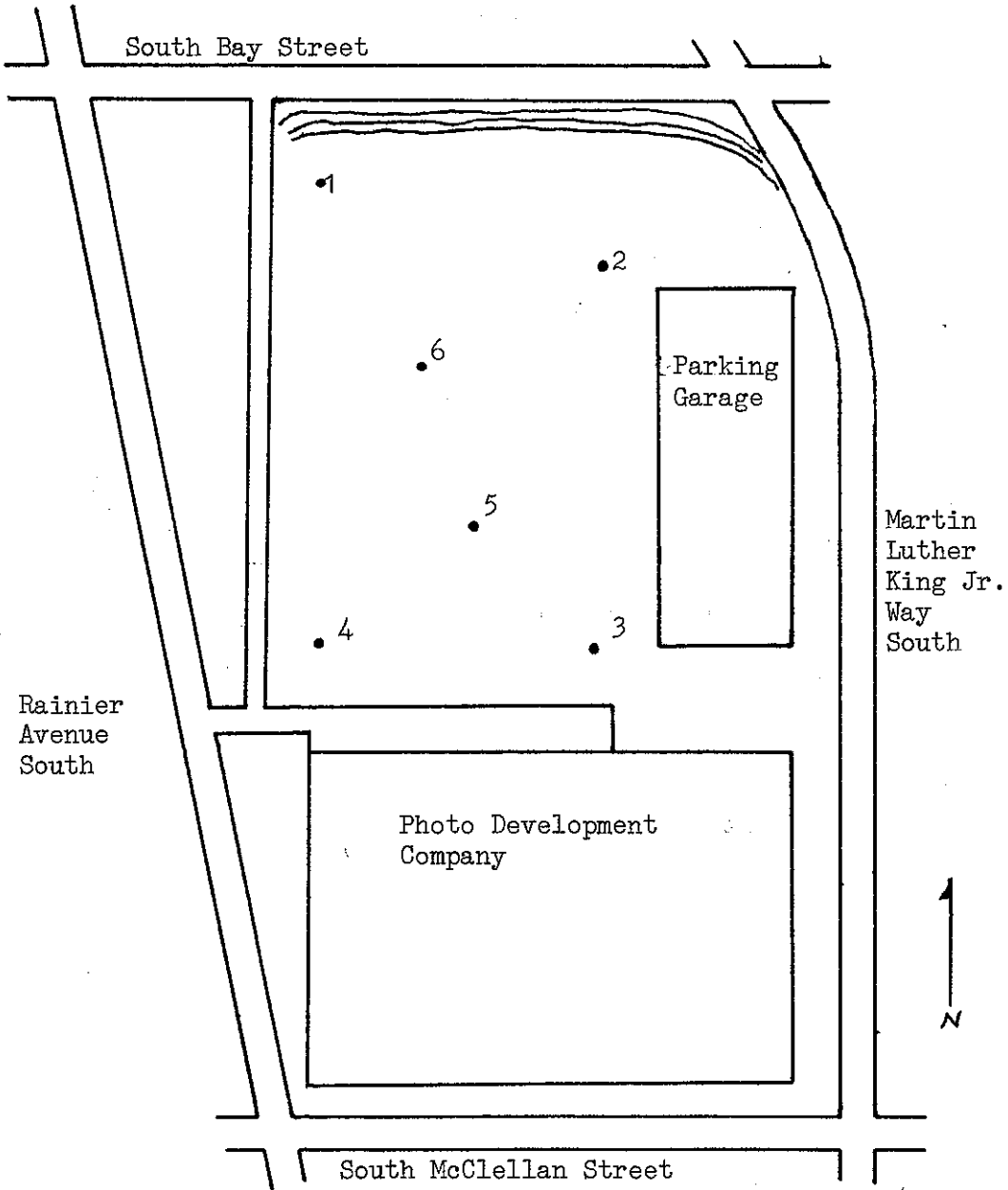


TABLE XXV

METHANE AND TRACE GAS CONCENTRATIONS
SICK'S STADIUM ABANDONED LANDFILL

<u>Site</u>	<u>Methane (%)</u>	<u>Trace Gas (ppm)*</u>
1	0	2.2
2	0	6.0
3	0	9.8
4	0	9.0
5	0	10.6
6	0	10.7

*Reading represents change from ambient air level

L. Sixth Avenue South Abandoned Landfill

It appears from the available records that dumping occurred at two locations along 6th Avenue South, one within the vicinity of the 2900 block and the other immediately south of Spokane Street at the Diagonal Avenue intersect.

No bore holes were set for testing of methane or trace gases during the July 2, 1984 survey due to the extensive paving and construction that presently exists upon each site.

Some evidence of soil settling was observed in parking lots at each location.

Research failed to reveal with any precision either the age, exact location, or size of these sites.

CHAPTER V
CONCLUSIONS AND RECOMMENDATIONS



CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The historical research and environmental sampling were conducted primarily to ascertain any public health impacts presented by abandoned landfills in Seattle. Two major questions focused our efforts.

1. Is there any evidence that contaminants potentially hazardous to health are present in the landfills?
2. If present, can these contaminants potentially reach humans?

We were also interested in issues of environmental degradation which could conceivably indirectly impact human health through the creation of hazardous conditions on or off site.

Since the legal requirement and official policy related to separation of hazardous materials from general refuse is a recent phenomenon, the earlier landfills are known to contain almost anything. While no official records are available, enough informal and anecdotal information exists to make it evident that potentially hazardous materials were buried in abandoned landfills. This is particularly anticipated in abandoned sites in the south end of Seattle, as well as at Montlake and Interbay.

The more significant question is whether these unknown contaminants can reach the public at exposure levels and over enough time to cause a negative health impact. This could be anticipated if the public were exposed through

ingestion of hazardous material, direct contact with hazardous materials, or through inhalation of hazardous materials.

Since in most cases the abandoned sites appear to be adequately capped, there is little likelihood of any direct contact. Two possible exceptions are leachate exposures in general and specific occupational exposures caused by any sewer water or building excavations. No known evidence exists for latter exposure problems. Some specific recommendations regarding leachate follows.

With respect to ingestion, the major concern would be groundwater contamination if wells were used by residents. Since the area is served by water piped from closed watersheds far removed from Seattle, there is no problem.

At this time, inhalation exposures do not appear feasible unless occupationally related, eg. excavation in a known fill area where building debris could conceivably generate dusts containing, eg. asbestos. This appears to be a remote exposure problem.

With respect to environmental degradation, the two concerns remaining are methane generation and groundwater contamination which may cause secondary exposures. Since many of the abandoned sites are on former tidelands and marsh areas there is remaining concern regarding leachate production and potential distances contaminated groundwater may flow and/or percolate or surface. Methane generation is also enhanced as water contacts decomposing refuse and the adequacy of planning for methane venting needs further study.

Specific recommendations for each of the twelve sites studied are as follows:

1. INTERBAY ABANDONED LANDFILL

This site exhibited active off gasing of both methane and non-specific organics/inorganics. Concentrated leachate is draining off-site from the steep banks on the north, west and south perimeters of the site. The relatively recent closure of the landfill and the variety of waste placed there are consistent with the field survey findings.

We recommend:

- a. No further building construction be placed on-site until the property has stabilized.
- b. Soil and surface groundwater samples be taken and analyzed for priority organics and inorganics.
- c. The banks that border three sides of the property be redesigned to prevent future groundwater seepage.

2. RAINIER VALLEY ABANDONED LANDFILL (GENESEE PARK PLAYFIELD)

This site exhibited active off gasing of methane, particularly at the east end of the school district's property. The low levels of non-specific organic/inorganic gases is consistent with the background of the landfill as a residential waste site.

We recommend:

- a. No building construction take place on the school district property until the site has stabilized and been properly capped.
- b. Because of safety precautions, school site property should have no public access until capped.
- c. Investigation of the feasibility of a leachate collection system or a comparable method to control runoff onto 46th Avenue South.
- d. Soil and surface/groundwater samples be taken and analyzed for priority organics and inorganics.

3. MONTLAKE ABANDONED LANDFILL

This site exhibited off gasing of both methane and non-specific organics/inorganics. The high levels of trace gas noted on the site are consistent with the former landfill's use as a commercial waste site in addition to residential usage.

We recommend:

- a. No further building construction take place until the property has stabilized.
- b. Allow the shorelines to settle and revegetate naturally. (As per ADHOC Committee for East Campus Development, 1972)
- c. Soil and surface/groundwater samples be taken and analyzed for

priority organics and inorganics. (This should include sediments and water from Lake Washington.)

4. HALLER LAKE ABANDONED LANDFILL

This site exhibited some active off gasing of methane and non-specific organic/inorganic gases at the southern property section. Although the site is utilized as a mobile/trailer home park, the southern site has numerous gas vent stacks placed throughout the park. This procedure is apparently effective in channeling some of the gases away from the dwelling units.

We recommend methane monitoring be periodically conducted to insure no gas buildup underneath the trailers.

5. WEST SEATTLE ABANDONED LANDFILL

This site exhibited off gasing of both methane and non specific organic/inorganic gases. This is consistent with the understanding that the site was used as both a residential and a commercial landfill. Due to the site's usage and its proximity to the Duwamish Waterway we recommend:

- a. Soil samples be taken and analyzed for priority organics and inorganics.
- b. Groundwater and tidal pool samples be taken and analyzed for priority organics and organics. Water samples should be so located that a determination can be made if the Duwamish Waterway is being adversely affected.

6. SOUTH PARK ABANDONED LANDFILL

This site failed to exhibit either the off gasing or electrolytic conductivity that would be expected from a commercial/residential waste site. Despite this preliminary lack of environmental indicators, we recommend:

- a. Groundwater and stream samples be taken and analyzed for priority organics and inorganics.
- b. Conduct additional methane and non-specific organic/inorganic testing in an effort to more completely evaluate the site.

7. GREEN LAKE ABANDONED LANDFILL

This site, which includes both the lake and surrounding Woodland Park properties revealed little evidence of off gasing of either methane or non-specific organics/inorganics. These test results are, for the most part, consistent with the age of the landfill and types of waste deposited there. We observe no significant environmental health problems at the site and recommend that no further study is warranted.

8. JUDKINS PARK ABANDONED LANDFILL

This site revealed little evidence of methane or non-specific organic/inorganic off gasing. We observed no significant environmental health problems at the site and recommend that no further study is warranted.

9. WASHINGTON PARK ABANDONED LANDFILL (ARBORETUM)

Two sites were surveyed in this park. The former Foster Island landfill

revealed no methane off gasing. The playfield at the southern section of the park revealed no methane and little non-specific organic/inorganic off gasing. Both the age of the landfill and the relatively benign wastes deposited are consistent with the low environmental health risk finding. We recommend that no further study is warranted.

10. RAINIER PLAYFIELD ABANDONED LANDFILL

This site revealed no evidence of methane or non-specific organic/inorganic off gasing. We see no significant environmental health problems at the site and recommend that no further study is warranted.

11. SICK'S STADIUM ABANDONED LANDFILL

This site demonstrated little evidence to suggest an environmental health risk. Outside of some slab settling in the on-site film development plant, no problems were apparent, and hence no recommendation for further study is appropriate.

12. SIXTH AVENUE SOUTH ABANDONED LANDFILL

This site had no test holes bored for gas testing or water sampling due to the extensive paving and construction present. The inexact age of the landfill and the uncertainty of its exact location, further prevented us from conducting a meaningful site investigation. Should research pinpoint the particulars mentioned above, then a field survey will be conducted.