SONIA ROAD LANDFILL
LEACHATE POLLUTION PLUME

TOWN OF ISLIP, LONG ISLAND, N.Y.

SUFFOLK COUNTY DEPARTMENT OF HEALTH SERVICES

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ABSTRACT

Sonia Road landfill consists of 50 acres situated on a south-sloping glacial outwash plain. Surface elevations range up to 85 feet. Surface drainage is generally toward the southwest.

The landfill is underlain by at least 80 feet of highly permeable sand and gravelly sand. Regional maps suggest that a 10-foot clay layer may exist 90 to 100 feet below the surface south of the landfill.

Groundwater flows southeasterly. Depths to the water table are in the range of 19 to 28 feet. Thicknesses up to 35 feet of landfill refuse consist of wood, concrete, metal, plastic, glass and household waste. In places, the bottom of the refuse is 11 feet below the water table.

Nineteen leachate exploration wells have been installed southwest of the landfill in locations so as to outline the leachate plume, and one well has been installed on the southeast edge of the landfill.

Water samples were collected from the wells at 10 foot intervals, and tested with a field conductivity meter. On the basis of the distribution of the wells and the conductivity of water samples, the location, size, and shape of the leachate pollution plume has been mapped.

The plume extends from the landfill for a distance of 3,800 feet toward the southeast. Its maximum width and thickness are 2,300 feet and 75 feet. It is thickest at and immediately south of the south landfill edge. However, it thins downgradient to a wedge - like termination. Since the thickness is too small to show on vertical dimension, the overall shape of the plume is described as ribbon-like.

Temperatures of groundwater decrease from the surface downward. They increase with nearness to landfill refuse, but are apparently not controlled by the degree of pollution of the water.

No evidence was found to indicate stratigraphic control of the bottom of the plume.

The front of the plume may be in a condition to static equilibrium. Four wells are being retained for future monitoring of the front.

THE LANDFILL AND SURROUNDING AREA

Location

Sonia Road Landfill is at the eastern termination of Grand Boulevard, 3,500 feet south of the Long Island Railroad in West Brentwood, Town of Islip. It is bounded on the north by Sonia Road and an industrial area along S. 4th Street, on the east by a strip of residential land along the west side of Joselson Avenue, on the south by Deer Park Street, and on the west by Howell's and Secatogue Roads. Deer Park Airport lies about 4,000 feet to the west. The geographic relations are illustrated on Figures 1 and 2.

Topography and Drainage

The site is situated on a south-sloping glacial outwash plain about four miles south of the Ronkonkoma Terminal moraine. It is in the upper reaches of a south-southwest trending valley in which flows Sampawams Creek. The head of the creek lies about 3,400 feet southwest of the landfill, but the valley continue northerly for an additional 1,500 to 2,000 feet above the head of the creek. This dry portion of the valley extends to within 800 feet of the landfill.

The topography of the region surrounding the landfill slopes gently toward the south and southwest except close to the creek where

the land slopes creekward. Elevations in the area range from about 55 to 85 feet above sea level, with the lowest elevations in the south and west. Therefore, the surface drainage trends generally southwesterly and towards Sampawams Creek.

The landfill area is elongate east-west. It consists of approximately 50 acres, with dimensions of 1,700 x 1,300 feet. The north, east and south borders are accentuated by berma which separate the landfill area from adjacent lands. Also, a north-south trending berm extends across the landfill dividing it into a smaller, and perhaps older eastern portion consisting of about 17 acres and a larger western portion consisting of about 33 acres.

Within the eastern portion of the landfill the grass covered surface slopes gently toward several shallow interior basins. Precipitation of small to moderate amounts tends to be absorbed by the soil from which it is partly evaporated and partly used by plants. However, during heavy precipitation, excess water moves into the shallow basins and ultimately into the basin of lowest elevation at the southeast corner of the landfill.

The apparently younger, and still active western portion of the landfill supports only sparse weedy vegetation. The surface of this portion if characterized by a sharp westerly slope. Heavy precipitation is in part absorbed by the soil and in part flows downslope

toward Grand Boulevard, though part of the runoff may be temporarily ponded and recharged at the west landfill boundary.

A small part of that precipitation which falls on the south-central part of the landfill may move through a gap in the east-west berm and into the right-of-way along the north side of Deer Park Street.

Subsurface Formations

The stratigraphy of Suffolk County is described by Jensen and Soren (2). Information contained in their north-south cross sections, when projected to the Sonia Road landfill area, indicates that the landfill and its environs are underlain by approximately 100 feet of highly permeable glacial outwash sand and gravelly sand. The Gardiners clay formation, having a thickness of 10 to 20 feet, underlies the outwash from Long Island's south shore to the approximate latitude of the landfill. Under the Gardiners clay are older formations consisting of unconsolidated sand, clayey sand and clay.

The Water Table and Groundwater

Figure 1 contains surface elevation contour lines and water table elevation contour lines. These show that surface elevations southeast of the landfill vary from about 60 feet above sea level in the vicinity of Thompson Drive and Lakeland Street to about 68 feet along Deer Park

Street. Surface elevations within the landfill rise 10 or 12 feet above Deer Park Street because of landfill cover and the berms.

Figure 3 shows Longitudinal Section A ——— A' drawn along the length of the leachate plume. It presents a side view of the plume with the observer looking toward the northeast. Surface and water table elevations along the section can be read in reference to the vertical scale.

Figures 4 and 5 are vertical sections B ——— B' and C ——— C' drawn across the leachate plume with the observer looking northwesterly. These also show surface and water table elevations in reference to the vertical scale.

Water table elevations at the south edge of the landfill vary from about 48 feet on the east to 49 feet on the west. The elevations decline with a gentle gradient toward the southeast. At the southern extremity, or distal end of the leachate plume the elevation of the water table is 42 to 43 feet.

The Refuse Pile

Holzmacher, et al (1) have estimated, on the basis of Islip Town records and three test borings, that by the end of 1974 at least 111,500 cubic yards of refuse with intermixed sandy cover material had been deposited on the landfill area.

Two of the test borings were drilled in the smaller, eastern portion of the landfill and one in the larger, western portion of the landfill. The locations of the borings are illustrated on Figure 2.

Borings "A" and "B", in the northeastern and southwestern corners of the smaller portion, reveal the presence of at least 29 feet of refuse lying upon a natural formation of grayish brown sand. Some refuse lies 6 feet below the water table.

Boring "C", in the southwestern corner of the larger, western portion of the landfill indicates the presence of at least 35 feet of refuse lying upon natural brown sand. Some refuse lies 11 feet below the water table.

Character of the Refuse

Refuse in the eastern portion of the landfill consists of wood, roots, glass, plastic, metal and general rubbish (1). However, dumping ceased in this area some years ago. The surface has been covered with sand, graded, landscaped, and converted into a park with playing fields. With the exception of parts of playing fields and parking areas it is now grass-covered.

In the western portion, the refuse consists of wood, glass, plastic, metal, cardborad, concrete and household wastes. As of 1974, parts of the area were still receiving rubbish, automobile bodies and demolition wastes (1). The remainder has been covered with sand and graded, but not landscaped. Vegetation is of the ragweed type.

THE LEACHATE EXPLORATION WELLS

Description of the Wells

A total of twenty leachate exploration wells have been installed at dispersed locations downgradient, southeast of the landfill. The wells, illustrated on Figure 2, are located so as to outline the full length and width of the leachate plume. They are approximately 80 feet deep and finished with plastic casings of 2-inch diameter. Plastic screens two feet long and two inches in diameter are fastened to the lower ends of the casings.

Pumping and Testing

Depth from the surface to the water table varies according to topography between the wells from approximately 18 to 28 feet.

Each well was pumped immediately upon its completion with a 3.5 H.P. gasoline motor using a suction hose. The pumping rate varied from 10 to 30 gal/min depending upon local conditions. Pumping was continued for 15 to 20 minutes in order to evacuate all development water before starting the sampling and testing procedure.

Sampling and testing of water in the wells was done in a series of steps beginning with the well screen at its deepest position,

about 80 feet below the surface. After a period of pumping sufficient to eliminate contaminated water, a water sample was collected and tested for temperature and specific conductivity. The well screen was then raised 10 feet by hoisting the entire casing. The well was pumped at the new screen elevation for a period of time sufficient to eliminate non-ambient water. Then a second water samples was collected and tested. This procedure was continued, raising the screen by 10-foot intervals, until the final screen setting was attained immediately below the water table.

The length of time devoted to pumping to eliminate non-ambient water at each screen setting was determined by observing changes in temperature and conductivity of the water. When temperature and conductivity settled down to constant values for that screen setting the water was deemed to be ambient. The official water samples for that screen setting was then collected and tested.

THE LEACHATE PLUME

The results of conductivity testing of water at various depths in the leachate exploration wells indicate that a zone of leachate containing a high level of pollution occurs under the refuse pile, and as a plume extending about 1,200 feet downgradient toward the south-southeast. Water containing high level pollution exhibits specific conductivity in excess of 2,000 micro-mhos and temperatures ranging from 15° to 25° C. A plan view of this portion of the plume is illustrated by the cross-hatched area on Figure 2.

Almost enclosing the zone of high level pollution is a zone of medium level pollution exhibiting specific conductivity from 801 to 2,000 micro-mhos and temperatures ranging from 13° to 25° C. This zone extends about 1,200 feet downgradient from the zone of high level pollution, or about 2,400 feet south-southeast of the refuse pile. It is illustrated on Figure 2 by the area of parallel lines.

Almost enclosing the previously described zones is a zone of low level pollution exhibiting specific conductivity from 400 to 800 micro-mhos and temperatures ranging from 11° to 18° C. This extends about 1,500 feet downgradient from the zone of medium level pollution or about 3,800 feet south-southeast of the refuse pile. It is illustrated on Figure 2 by the parallel rows of small circles.

All water outside of the leachate plume is considered ambient groundwater. Water of this category was found exhibiting specific conductivity as low as 78 micro-mhos and as high as 393 micro-mhos, and with temperatures ranging from 11° to 18° C.

The line of Section A ——— A' is shown on Figure 2 parallel to the length of the leachate plume, through its approximate center. Four wells are shown in line close to the line-of-section. These furnish partial control data for the top and bottom of the plume. Landfill Wall #9 (LF #9) provides information which proves that the zone of high level pollution is underlain by the zone of medium level pollution. This relationship suggests that medium level pollution may in turn be underlain by low level pollution and ambient water.

A striking fact about the leachate plume is that although it has large length and width, i.e. 3,800 x 2,300 feet, it has only small thickness. Its overall shape is ribbon-like. For this reason the plume cannot be illustrated on vertical sections without exaggerating the vertical dimension.

The plume's greatest thickness is at the landfill's south edge, and immediately south of the south edge of the refuse pile. The thickness here, as shown on Section A ——— A' of Figure 3, is approximately 75 feet. The thickness decreases in the downgradient direction, with the bottom of the plume sloping upward and the top of the plume sloping downward, so that the distal or downgradient end of the plume tapers to a wedge-like edge.

Groundwater temperatures tend to be higher in the vicinity of the landfill than away from it. The temperatures decrease gradually downgradient. However, there does not appear to be any demonstrable relationship between the temperature of the water and its level pollution. The temperatures also tend to decrease from the surface downward.

No evidence was found to indicate that the Gardiners clay, or any other fine grain layer has acted as a stratigraphic control for the bottom of the leachate plume.

It is hoped that future monitoring at the distal end of the plume will provide evidence as to whether the front is advancing, retreating, or static. No formula presently being used by hydrologists to explain the rate of movement of leachate through groundwater systems is adequate to explain the present location of the Sonia leachate front. Until evidence indicating movement at the front is received, the writer assumes that the front of the plume is in a condition of static equilibruim.

PLAN FOR FUTURE MONITORING

Exploration Wells #8, #9, and #10 in the zone of low level pollution, and Well #13 on Longitudinal Section A ——— A', just southeast of the distal end of the plume, are retained to monitor possible future movements of the front of the plume. These wells have respectively been designated S 62718, S 62719, S 62720, and S 62721.

REFERENCES

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2. Jensen, H. M., and Soren, J., 1974, Hydrogeology of Suffolk County, Long Island, New York: Atlas HA-501, U.S. Geol. Survey, Washington, D. C.

3. Kimmel, G. E., and Braids, O. C., 1974, Leachate plumes in a highly permeable aquifer: Ground Water, Vol. 12, no. 6, pages 388 - 392.

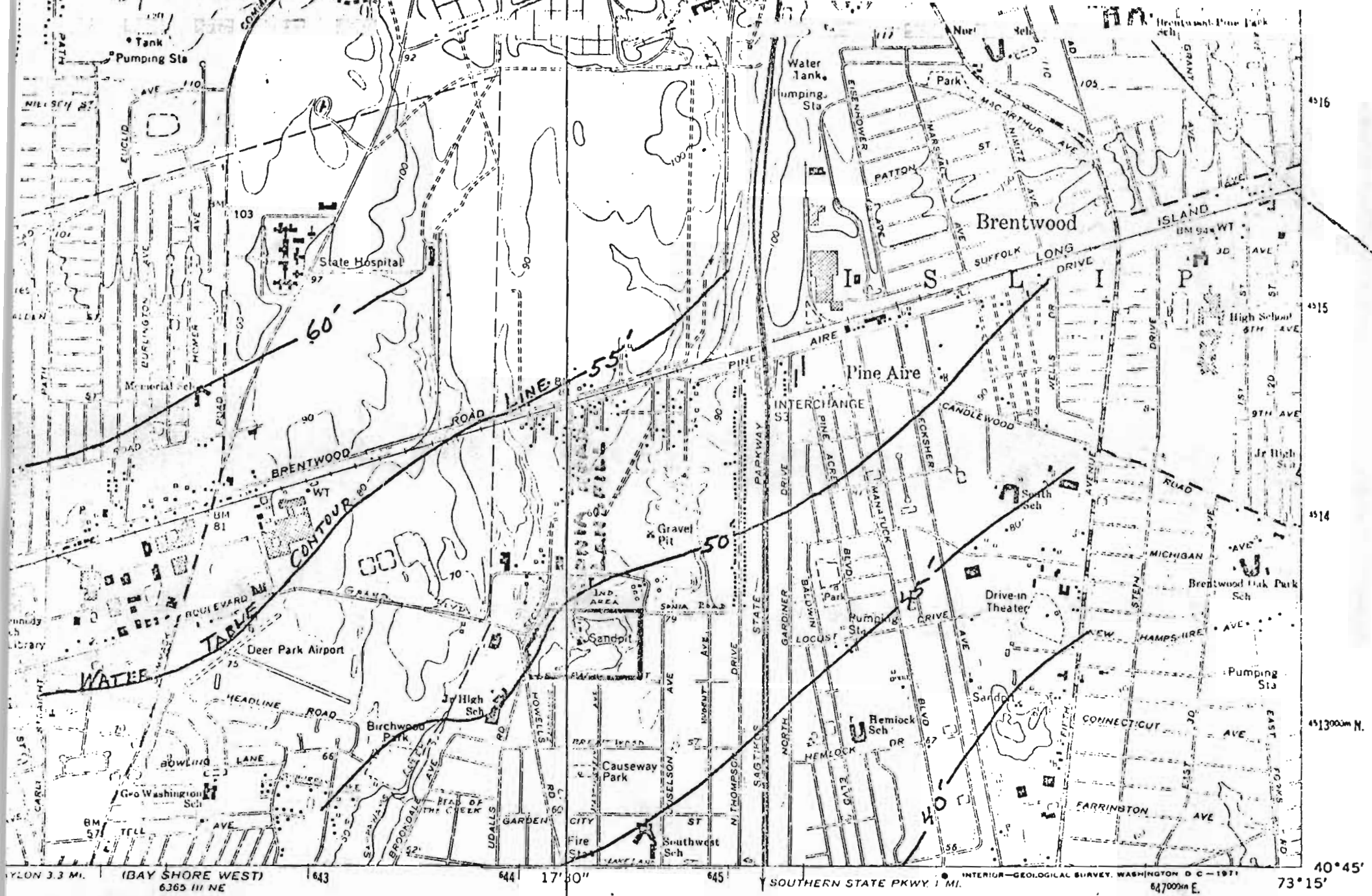


FIG 1
LOCATION MAP
S.E. GREENLAWN QUAD.

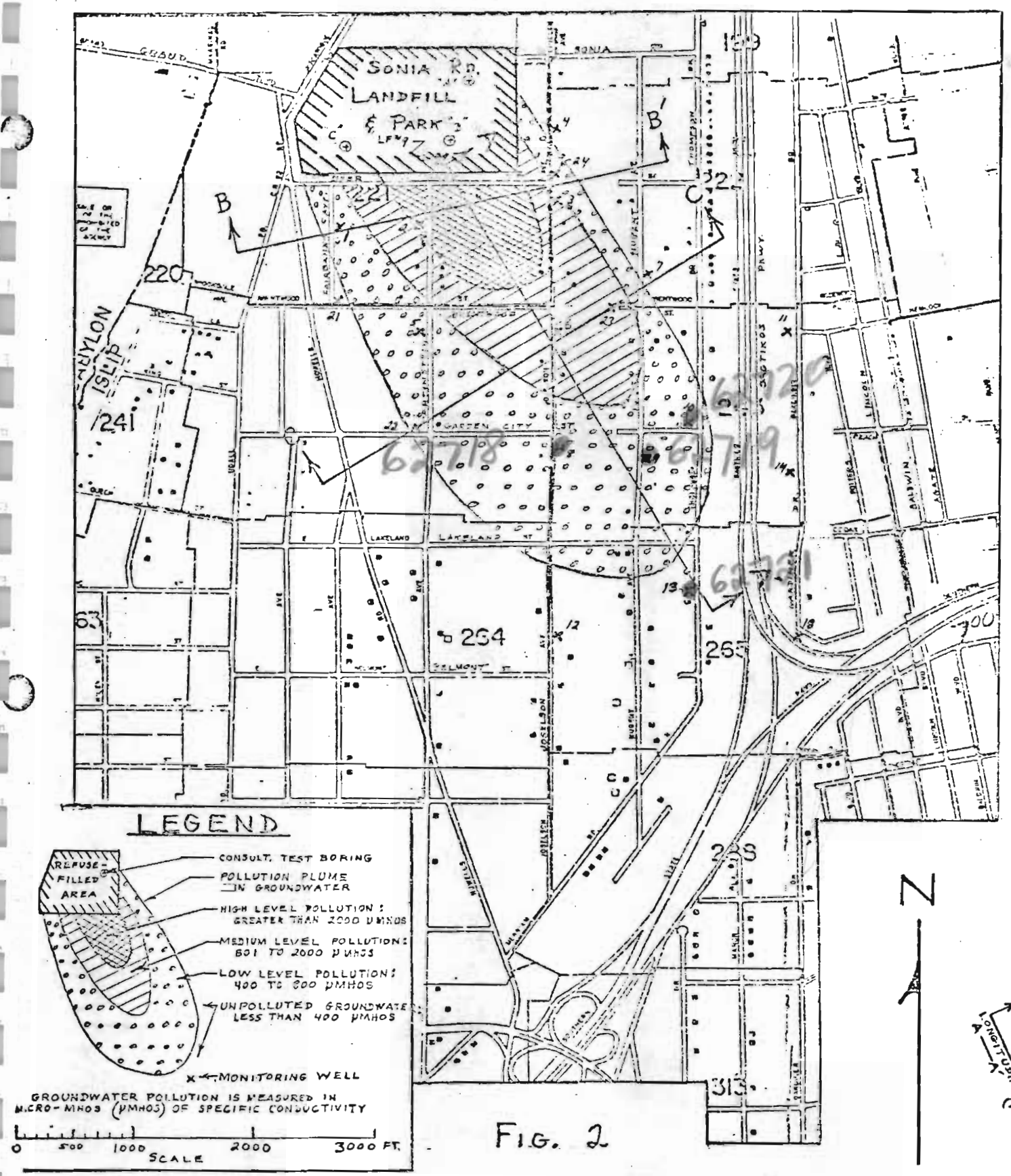
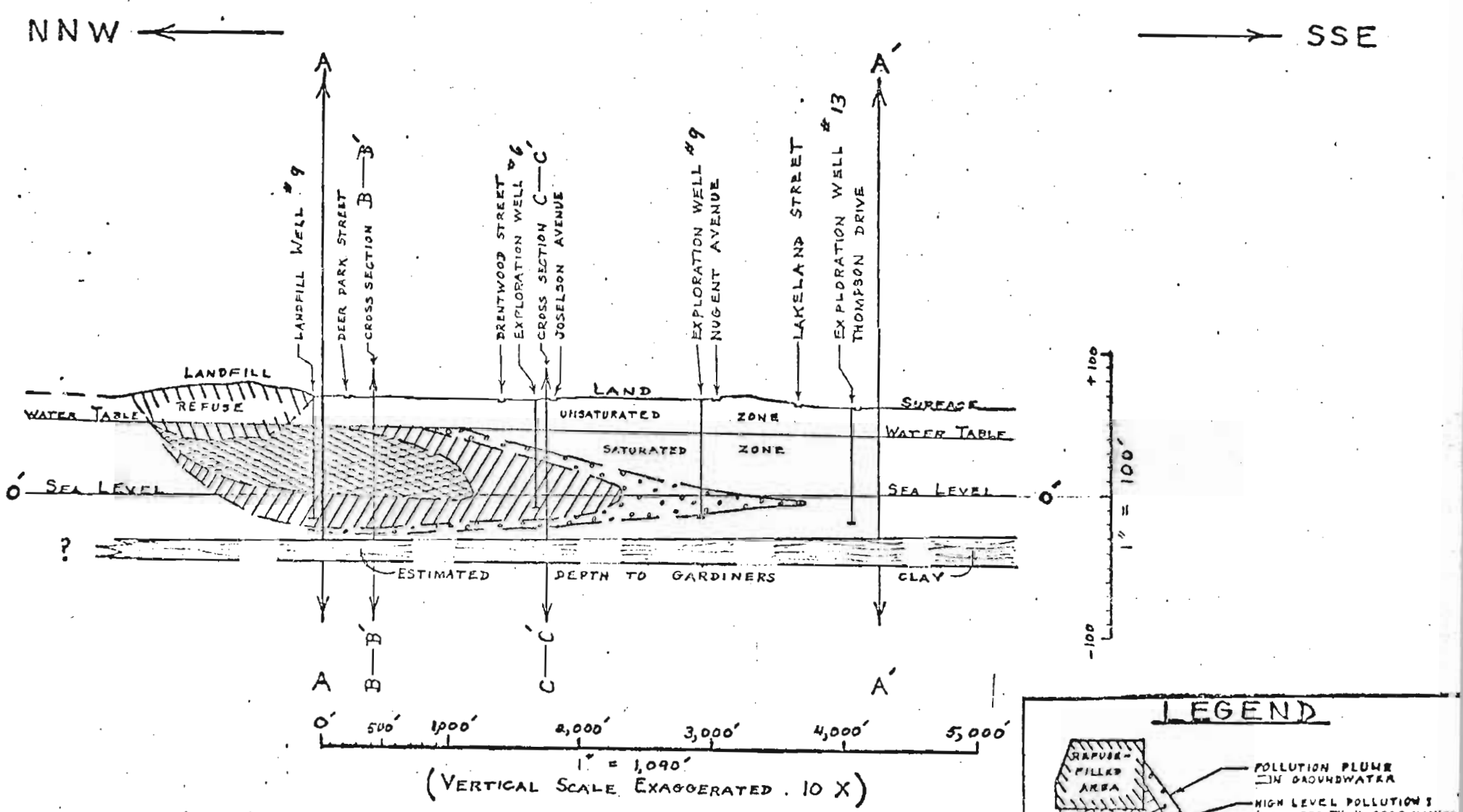


FIG. 2

MAP VIEW OF LEACHATE POLLUTION PLUME SOUTHEAST OF SONIA ROAD LANDFILL AND PARK WEST BRENTWOOD, TOWN OF ISLIP, N.Y.



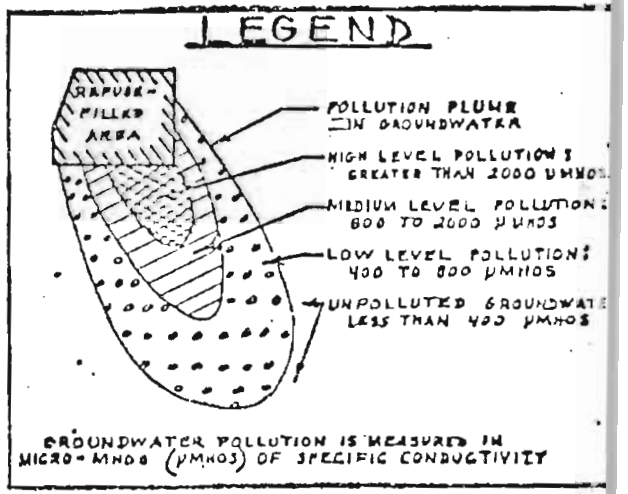
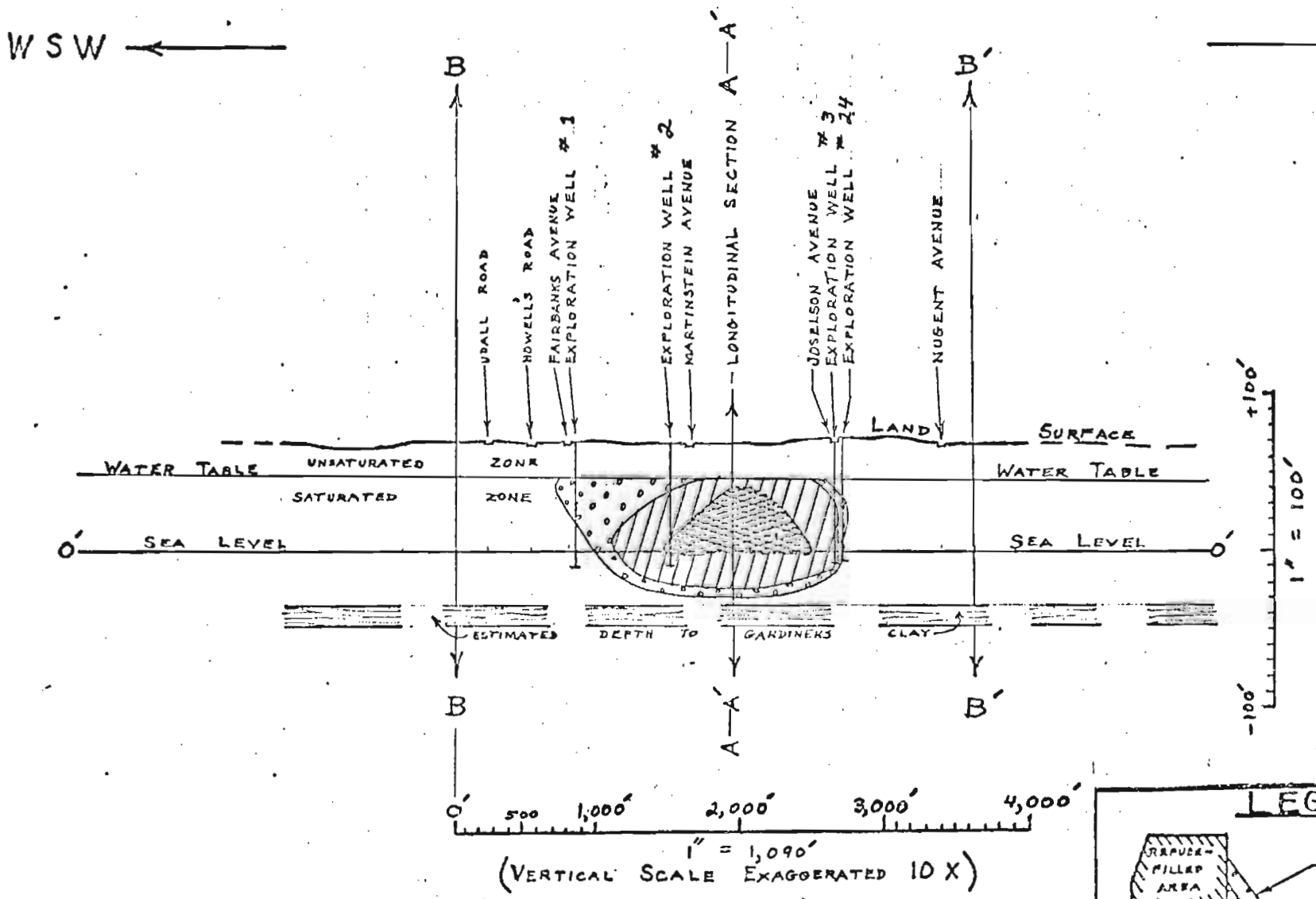


FIG. 3 —— LOOKING NORTHEASTERLY

LONGITUDINAL SECTION THRU LEACHATE PLUME

SOUTHEAST OF SONIA ROAD LANDFILL



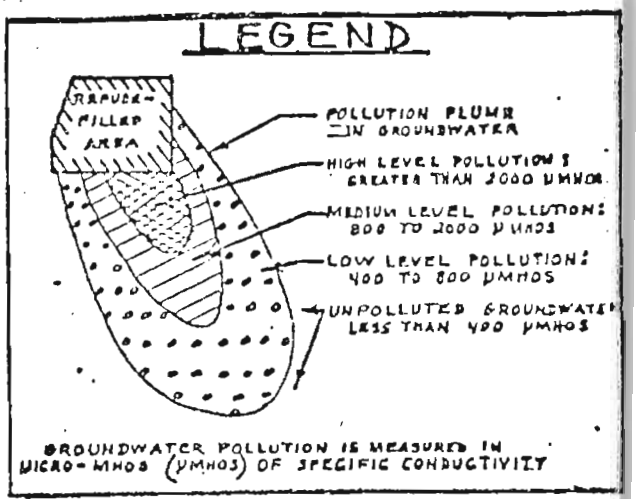


FIG. 4 —— LOOKING N. NORTHWESTERLY

SECTION B—B' ACROSS POLLUTION PLUME

SOUTHEAST OF SONIA ROAD LANDFILL

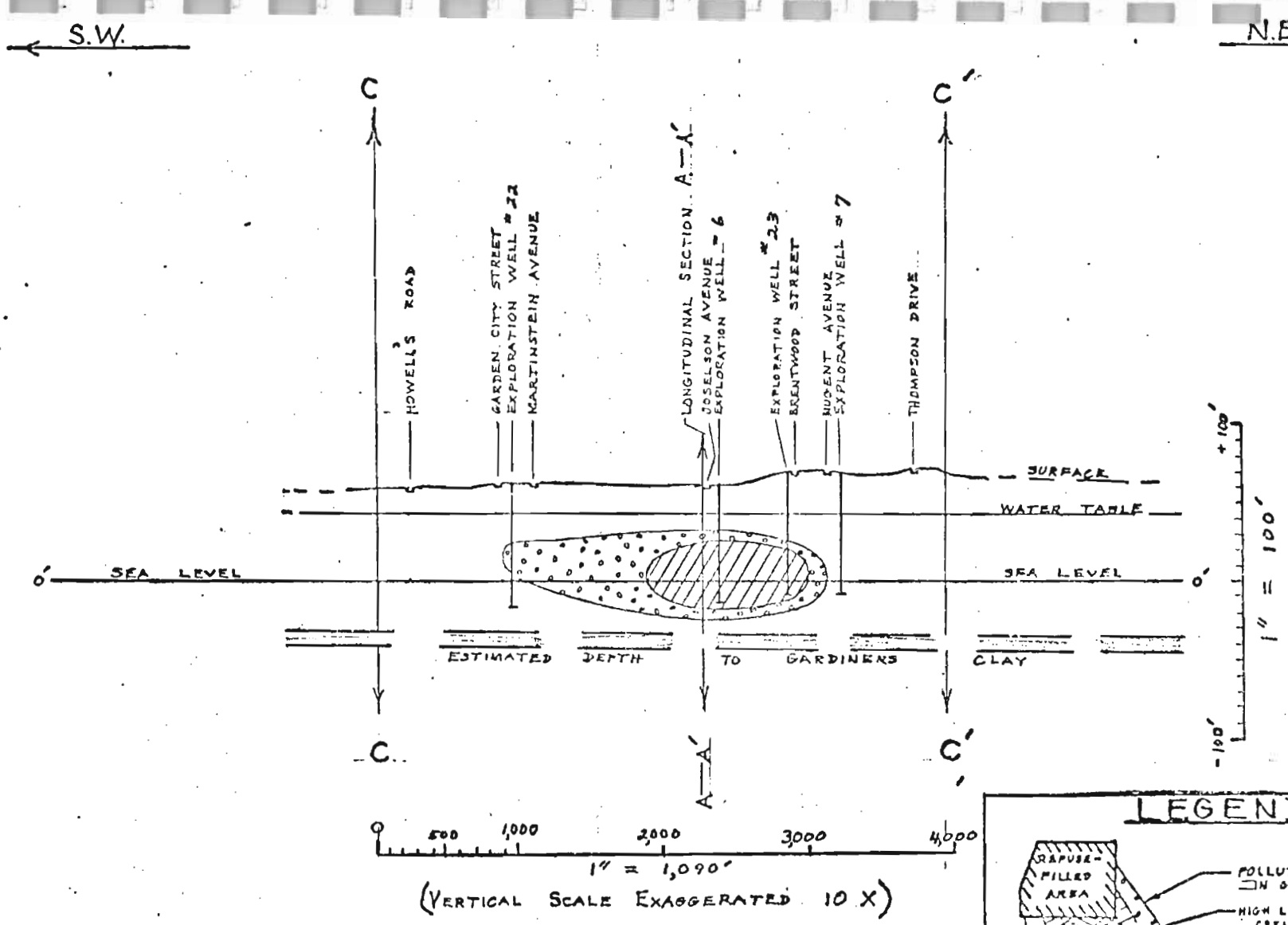


FIG. 5 —— LOOKING NORTHWESTERLY

SECTION C—C' ACROSS POLLUTION PLUME

SOUTHEAST OF SONIA ROAD LANDFILL

A.H.S. 1-19-77

SONIA ROAD LANDFILL

uMHOS CONDUCTIVITY IN MONITORING WELLS

WELL # 1 DEPTH	CONDUCT.	WELL # 2 DEPTH	CONDUCT.	WELL # 3 DEPTH	CONDUCT.	WELL # 4 DEPTH	CONDUCT.
22-24 =	420 18°C.	23-25 =	540 17°C.	24-26 =	300 18°C.	32-34 =	245 17°C.
32-34 =	690 17°	32-34 =	1500 16°	31-33 =	770 17°	43-45 =	330 13°
43-45 =	800 15°	44-46 =	1850 15°	42-44 =	940 17°	53-55 =	220 13°
54-56 =	300 15°	55-57 =	1850 15°	53-55 =	1300 17°	64-66 =	122 13°
64-66 =	225 14°	65-67 =	2250 15°	63-65 =	1170 17°	75-27 =	155 12°C.
75-77 =	175 14°	76-78 =	1000 15°C.	71-73 =	990 17°		
78-80 =	195 14°C.			78-80 =	1600 17°C.		

WELL # 5 DEPTH	CONDUCT.	WELL # 6 DEPTH	CONDUCT.	WELL # 7 DEPTH	CONDUCT.	WELL # 8 DEPTH	CONDUCT.
21.6-23.6 =	395 14°C.	21-23 =	310 17°C.	33.3-35.3 =	109 14°C.	21-23 =	180 14°C.
32-34 =	240 14	32-34 =	340 16°	43.3-45.3 =	174 14	31-33 =	190 12°
42-44 =	469 14	43-45 =	1560 16°	53.3-55.3 =	228 14	41-43 =	300 12°
53-55 =	780 13	53-55 =	1652 15°	63.3-65.3 =	188 14	51-53 =	430 11°
65-67 =	680 13	65-67 =	1750 15°	73.3-75.3 =	141 14	62-64 =	410 12°
78-80 =	520 13°C.	74-76 =	2,000 15°C.	76-25-78.25 =	138 14°C	73-75 =	290 12°
						76-78 =	320 12° C.

WELL # 9 DEPTH	CONDUCT.	WELL # 10 DEPTH	CONDUCT.	WELL # 11 DEPTH	CONDUCT.	WELL # 12 DEPTH	CONDUCT.
		26-28 =	330 14°C.	27-29 =	360 17°C	22-24 =	250 15°C
31-33 =	176 14°C.	32-34 =	170 14°	34-36 =	217 15°	32-34 =	230 15°
42-44 =	137 13	43-45 =	175 12°	44-46 =	260 14°	43-45 =	220 13°
53-55 =	180 12	54-56 =	156 12°	54-56 =	161 14°	56-58 =	210 13°
64-66 =	130 12	65-67 =	310 12°	64-66 =	192 14°	67-69 =	143 13°
75-77 =	415 13	75-77 =	460 14°	74-76 =	140 14°	78-80 =	98 13° C.
78-80 =	290 13°C.	78-80 =	410 14°C	80-82 =	92 14°		

WELL # 13 DEPTH	CONDUCT.	WELL # 14 DEPTH	CONDUCT.	WELL # ~~15~~ 21 DEPTH	CONDUCT.	WELL # ~~15~~ 22 DEPTH	CONDUCT.
22-25 =	220 13°C.	26-28 =	381 14°C	22-25 =	225 15°C.	23-25 =	290 13°C.
33-36 =	330 13°	34-36 =	188 14°	32-35 =	220 14°	33-35 =	390 13°
44-47 =	210 12°	44-46 =	201 14°	43-46 =	185 14°	44-46 =	400 13°
54-57 =	200 12°	54-56 =	212 13°	55-57 =	148 13°	55-57 =	410 12°
64-67 =	200 11°	64-66 =	150 13°	65-67 =	143 13°	65-67 =	200 12°
77-80 =	78 11° C.	74-76 =	130 13°	77-79 =	125 13° C.	77-79 =	180 12°C.
		78-80 =	126 13°C.				

(ON THE LANDFILL) WELL LF 9 DEPTH	CONDUCT. (ON THE LANDFILL)	WELL # 18 DEPTH	CONDUCT.	WELL # ~~19~~ 23 DEPTH	CONDUCT.	WELL # ~~20~~ 24 DEPTH	CONDUCT.
		24-26 =	161	32-35 =	170 13°C	32-34 =	400 14°C
29.5-31.5 =	4,100 19°C.	34-36 =	231	42-45 =	680 13°	43-45 =	500 14°
39.5-41.5 =	4,000 14°	45-47 =	189	53-56 =	1020 13°	54-56 =	200 14°
49.5-51.5 =	4,000 23°	55-57 =	166	63-66 =	1120 14°	64-66 =	340 13°
59.5-61.5 =	4,500 22°	65-67 =	134	75-78 =	1102 13°C	76-78 =	190 13°C
69.5-71.5 =	2,000 25°	75-77 =	140				
79.5-81.5 =	2,000 21°C.	78-80 =	139				
		(Chem. Lab. Anal.) (DEC)					
SEE FIG. 1 FOR LOCATION							

FIG 6

OBSERVED CONDUCTIVITIES AND TEMPERATURES