

THE PENNSYLVANIA STATE UNIVERSITY
ENERGY AND MINERAL ENGINEERING
ENVSE 408 CONTAMINANT HYDROLOGY
ASSIGNMENT 7

The investigation of the Smithville site has continued and an array of monitoring wells has been added. The extent of migration within the upper and lower aquifers is defined for February/March 1989 as shown on the attached figures. The inferred extent of DNAPL apparent in boreholes that penetrate the upper aquifer only is shown on the figures.

Recall that the parent DNAPL comprises 50% polychlorinated biphenyl (PCB), 10% trichlorobenzene (TCB), 2% trichloroethene (TCE), with the remainder as a mixture of mineral oils.

Field Parameters

Aquifer	Hydraulic Gradient (<i>m/m</i>)	Hydraulic Conductivity (<i>cm/s</i>)	Overall Porosity (-)	Fracture Spacing (<i>m</i>)
Upper Limestone Aquifer	.01 – .005 (horiz)	5×10^{-3}	.01 – .05	.1 – .2
Intermediate Aquiclude (shale)	.3 – .8 (vert)	1×10^{-7}	.15 – .20	.05 – .1
Vinemount Aquifer	.002 – .005 (horiz)	$4 \times 10^{-2} - 2 \times 10^{-1}$.01 – .15	.3 – .5

DNAPL Properties

	Solubility in water (<i>mg/L</i>)
TCE	1060
TCB	19
PCB	0.2

Assignment

1. From knowledge of the organic fraction as $f_{oc} = 0.1\%$, estimate the distribution coefficient, K_d , and retardation factor, R , of the plume from the available tabulated data for TCE, TCB and PCB. Define and justify any assumptions you make.
2. From the observed plumes, estimate the distribution coefficient, K_d , and retardation factor, R , appropriate to the site for TCE and TCB, for each of the upper and lower aquifers. Recall that the facility was opened in March 1978. Define and justify any assumptions you make.
3. Compare the magnitudes evaluated using the empirical (1.) and field (2.) methods and discuss any similarities and differences.
4. From the concentration data available, estimate the volume of parent DNAPL that has been removed from free phase at the source for the two compounds TCE and TCB. Recall the average thicknesses of the upper and lower aquifers are 3*m* and 4*m*, respectively. Ignore the volumes locked in the till and aquiclude.

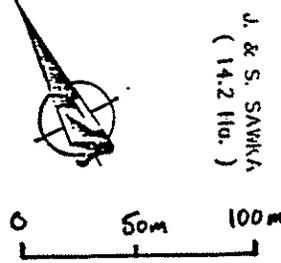
SHALLOW AQUIFER TCE

LATE MARCH 1989

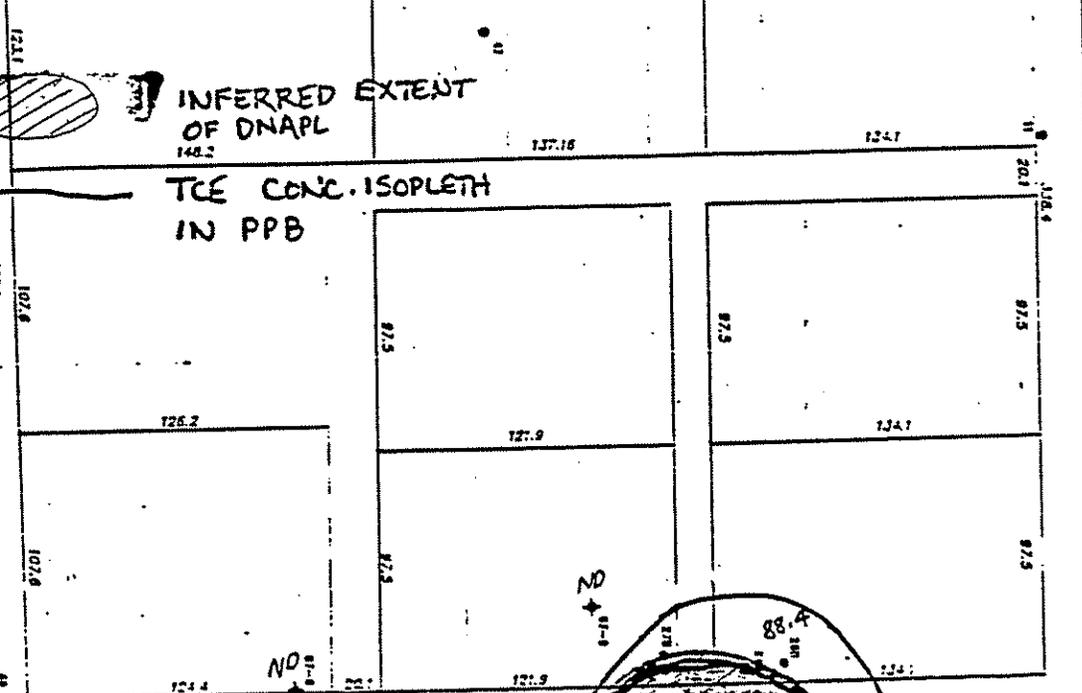


INFERRED EXTENT OF DNAPL

TCE CONC. ISOPLETH IN PPB

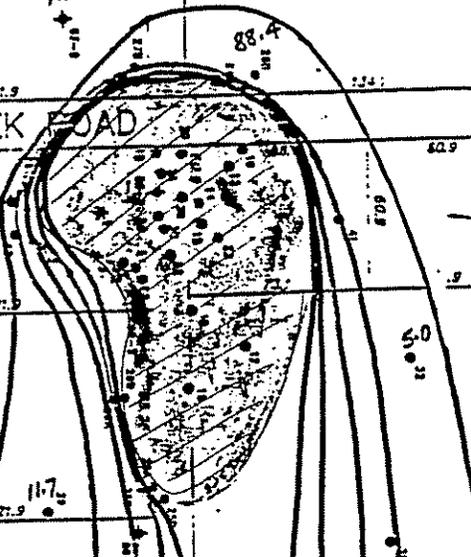


J. & S. SARKA (14.2 Ha.)



SPRING CREEK ROAD

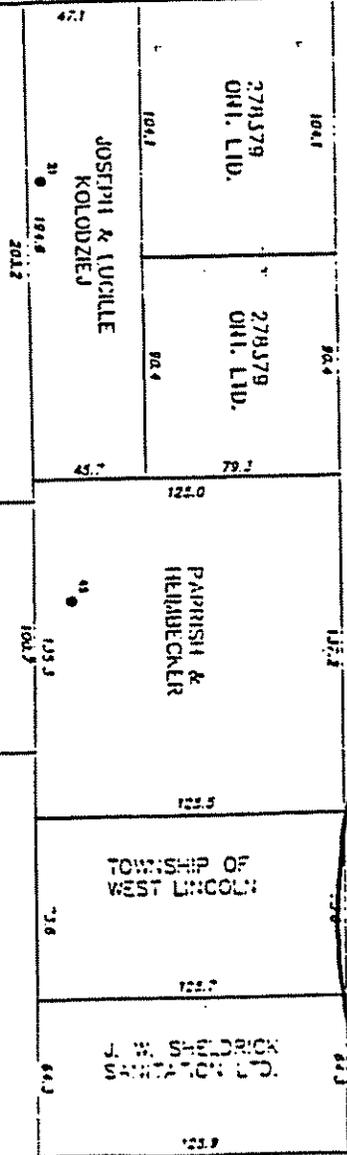
SMITHVILLE CWAAL SITE (0.81 Ha.)



ROBERT MURCAIRO'YD

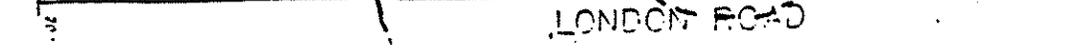
INDUSTRIAL PARK ROAD

OF CALUDA LTD. (68.7 Ha.)



THOMPSON AVENUE

LONDON ROAD



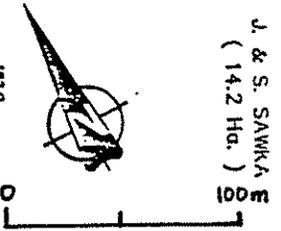
SHALLOW AQUIFER TOTAL TCB LATE MARCH 1989



INFERRED EXTENT OF DNAPL

148.2

TOTAL TCB CONC. ISOPLETH PPB



J. & S. SAWKA
(14.2 Ha.)

357.1

107.6

107.8

123.4

126.2

121.9

134.1

316.4

302.0

97.5

134.7

97.5

97.5

60.9

60.9

404.0

412.1

348.0

348.0

412.1

348.0

348.0

1007.8

378.0

378.0

SPRING CREEK ROAD

SMITHVILLE
CIVIL
SITE
(0.81 Ha.)

ROBERT MURCAIROID

278379
ONT. LTD.

JOSEPH & LUCILLE
KOLODZIEJ

278379
ONT. LTD.

PARISH &
HEHBECKER

THOMPSON AVENUE

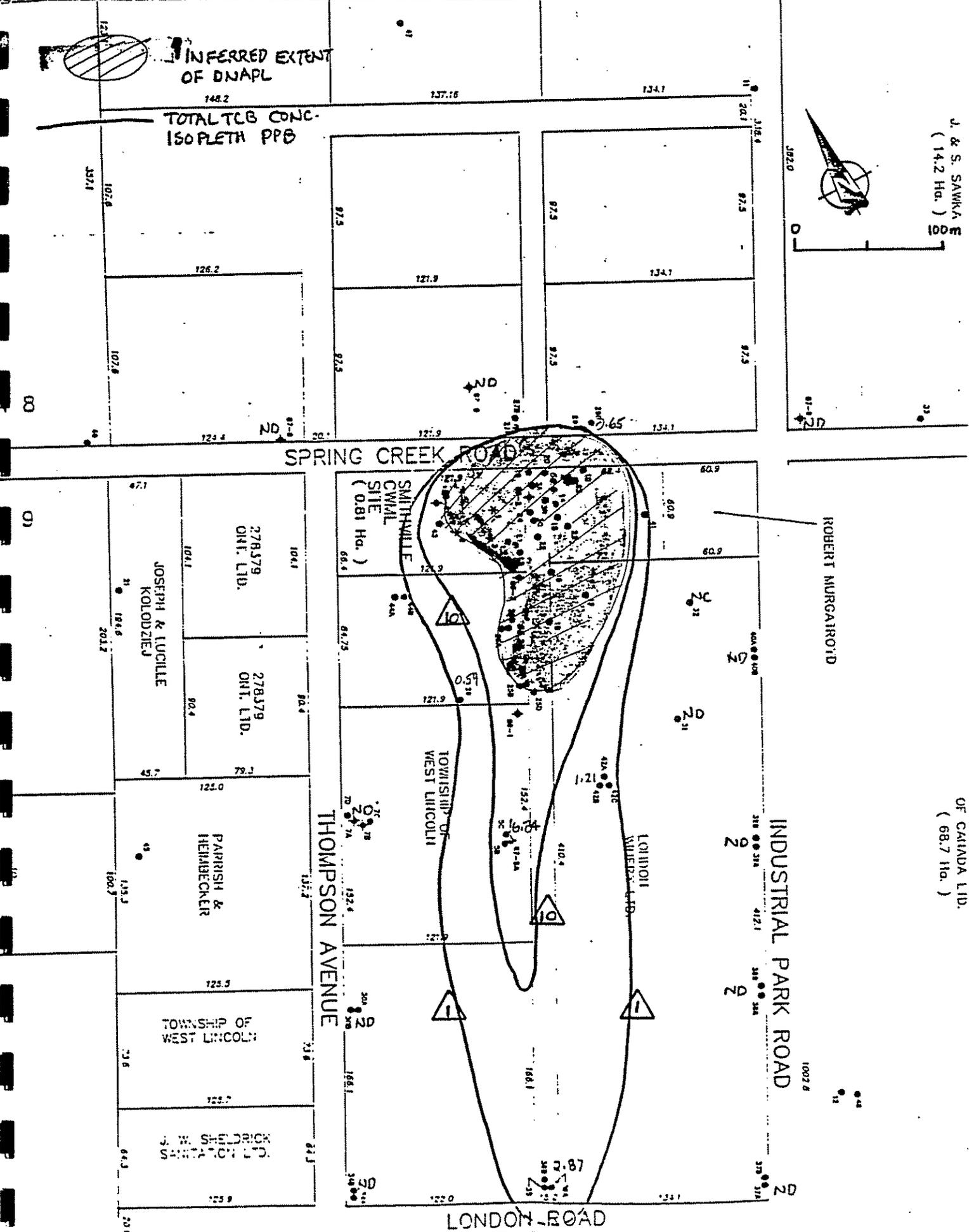
TOWNSHIP OF
WEST LINCOLN

LONDON
WILSON LTD.

INDUSTRIAL PARK ROAD

OF CANADA LTD.
(68.7 Ha.)

LONDON ROAD

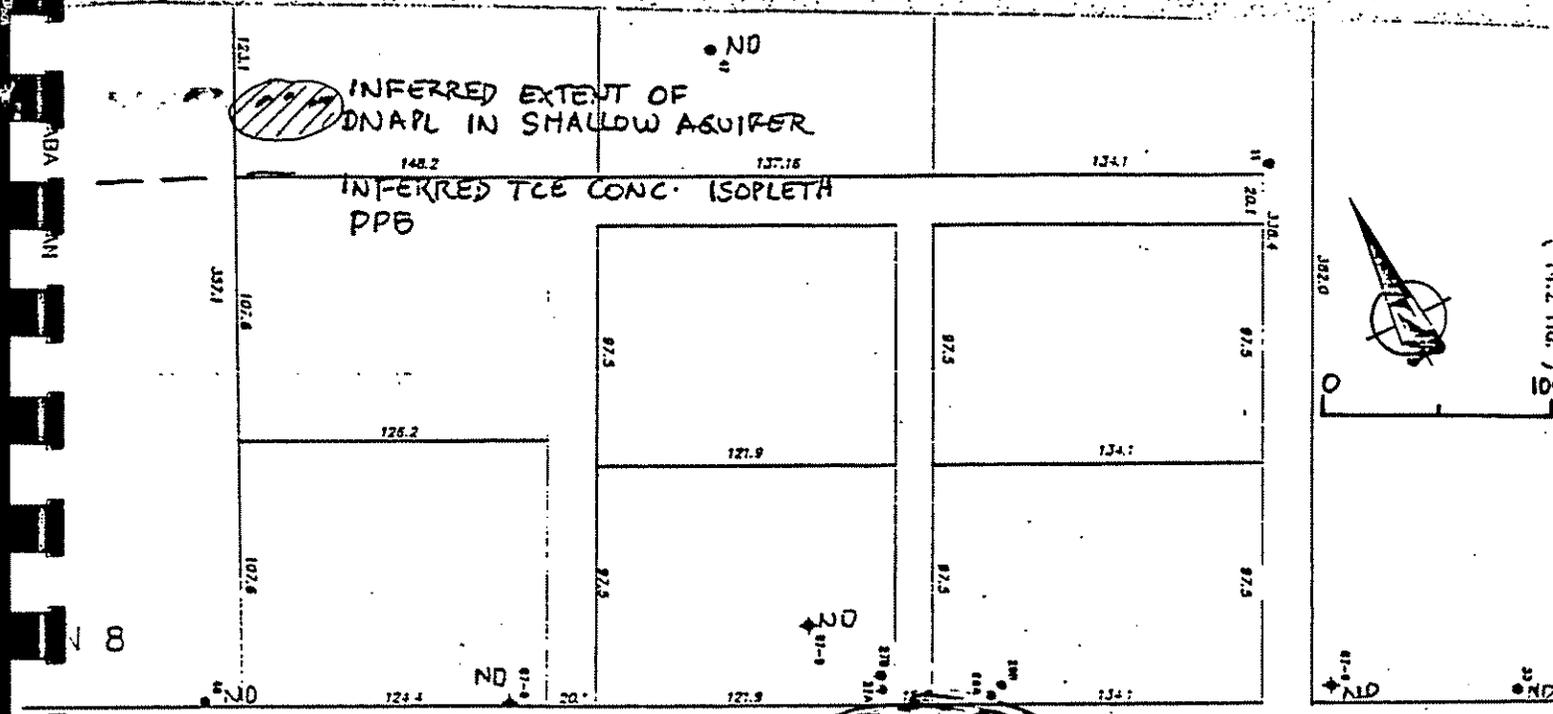
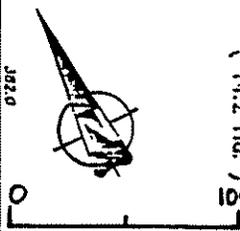


DEEP AQUIFER TCE

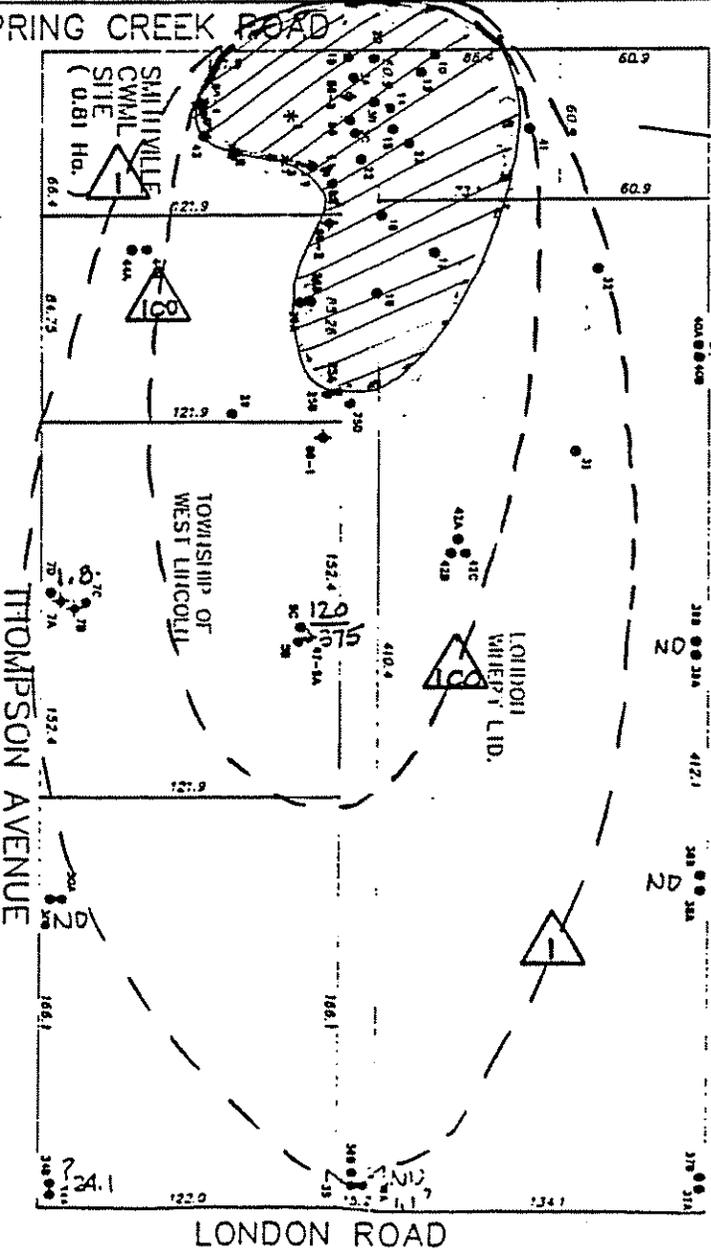
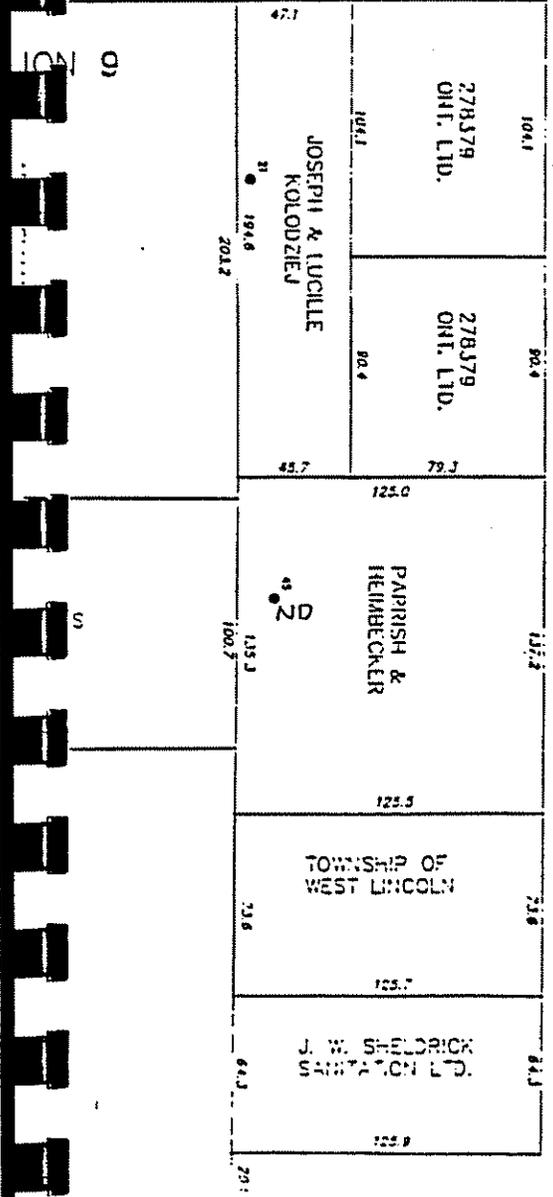
LATE FEB / EARLY MARCH 1989

INFERRED EXTENT OF DNAPL IN SHALLOW AQUIFER

INFERRED TCE CONC. ISOPLETH
PPB



SPRING CREEK ROAD



ROBERT MURCATROID

INDUSTRIAL PARK ROAD

THOMPSON AVENUE

LONDON ROAD

(68.7 Ho.)

ND

