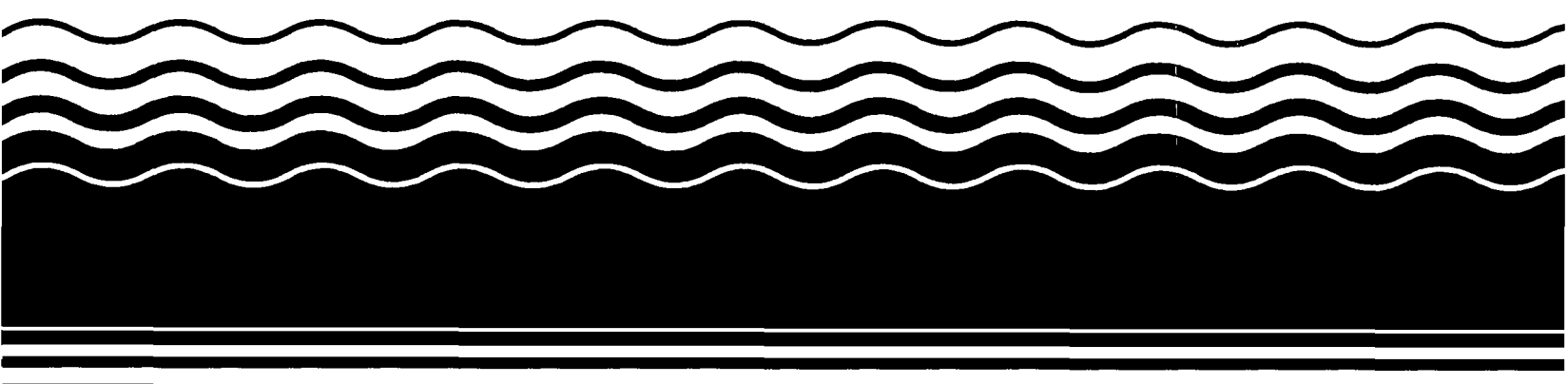




# **Superfund Record of Decision:**

**Packaging Corporation of  
America, MI**



<b>REPORT DOCUMENTATION PAGE</b>		<b>1. REPORT NO.</b> EPA/ROD/R05-93/236	<b>2.</b>	<b>3. Recipient's Accession No.</b>							
<b>4. Title and Subtitle</b> SUPERFUND RECORD OF DECISION Packaging Corporation of America, MI First Remedial Action - Final				<b>5. Report Date</b> 09/24/93							
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<b>12. Sponsoring Organization Name and Address</b> U.S. Environmental Protection Agency 401 M Street, S.W. Washington, D.C. 20460				<b>13. Type of Report &amp; Period Covered</b> 800/800							
				<b>14.</b>							
<b>15. Supplementary Notes</b>  PB94-964118											
<b>16. Abstract (Limit: 200 words)</b>  The 700-acre Packaging Corporation of America site is an inactive wastewater disposal site located in Stronach Township, Manistee County, Michigan. Land use in the area is predominantly mixed industrial and residential, with the Manistee National Forest located to the east of the site. The primary surface water body near the site is Manistee Lake, which borders the Packaging Corporation of America (PCA) site to the west. In addition, there is an unconfined upper aquifer that underlies approximately 5 miles of land under and surrounding the site. No residences exist within the area of the contaminated ground water plume, and all drinking water wells within the boundary of the plume have been replaced with an alternate water supply. Site features include eight seepage lagoons and four seepage areas. From 1949 to 1951, the American Box Board Company (ABBCo) discharged spent cooking liquor, from a wood pulping process called the neutral sulfite semichemical (NSSC) process, to Manistee Lake. The discharge depressed the dissolved oxygen in the lake and, as a result, caused a fish kill in 1950. After the State held a public hearing, ABBCo was required to dispose of the waste liquor on land in seepage lagoons. In response, ABBCo purchased 700 acres of land, which make up the site, for the disposal of the NSSC waste. Subsequent to purchasing the land, ABBCo merged with two companies to form PCA and continued to  (See Attached Page)											
<b>17. Document Analysis</b> <table border="0"> <tr> <td><b>a. Descriptors</b></td> <td>Record of Decision - Packaging Corporation of America, MI First Remedial Action - Final Contaminated Medium: None Key Contaminants: None</td> </tr> <tr> <td><b>b. Identifiers/Open-Ended Terms</b></td> <td></td> </tr> <tr> <td><b>c. COSATI Field/Group</b></td> <td></td> </tr> </table>						<b>a. Descriptors</b>	Record of Decision - Packaging Corporation of America, MI First Remedial Action - Final Contaminated Medium: None Key Contaminants: None	<b>b. Identifiers/Open-Ended Terms</b>		<b>c. COSATI Field/Group</b>	
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<b>b. Identifiers/Open-Ended Terms</b>											
<b>c. COSATI Field/Group</b>											
<b>18. Availability Statement</b>		<b>19. Security Class (This Report)</b> None		<b>21. No. of Pages</b> 24							
		<b>20. Security Class (This Page)</b> None		<b>22. Price</b>							

Abstract (Continued)

discharge over 7,000,000,000 gallons of spent cooking liquor, evaporator condensate, and primary clarifier sludge into the onsite seepage lagoons. In 1972, PCA constructed a secondary treatment plant and stopped disposing of the pulp to the lagoons. All of the lagoons and seepage areas are currently empty with the exception of lagoon 3, which is a company-owned solid waste landfill, and lagoon 2, which contains primary clarifier sludge. From 1980 to 1983, PCA performed some hydrogeological investigations which identified heavy metals, including arsenic and chromium in the onsite ground water. The site has been divided into two OUs for remediation. This ROD addresses a final remedy for the ground water at the site, as OU2. Studies indicate that private wells in East Lake and Stronach are not currently contaminated, and since the source of the contamination has been removed, and 95% of the plume has already vented into Manistee Lake, the wells are not threatened with future contamination. The risks calculated using a reasonable exposure scenario are within the acceptable risk range; therefore, there are no contaminants of concern affecting this site.

The selected remedial action for this site is no further action with continued monitoring of ground water, surface water, and residential wells. EPA has determined that exposure to site related contaminants does not pose a current or potential risk to human health or the environment, and that a remedial action is not warranted.

PERFORMANCE STANDARDS OR GOALS:

Not applicable.

## **DECLARATION FOR THE RECORD OF DECISION**

### **SITE NAME AND LOCATION**

Packaging Corporation of America, Filer City, Michigan.

### **STATEMENT OF BASIS AND PURPOSE**

This decision document presents the selected remedial action for Ground Water Operable Unit at the Packaging Corporation of America site, in Filer City, Michigan, which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and to the extent practicable with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based upon the contents of the Administrative Record for the site.

The State of Michigan does not concur with this Record of Decision.

### **DESCRIPTION OF THE SELECTED REMEDY**

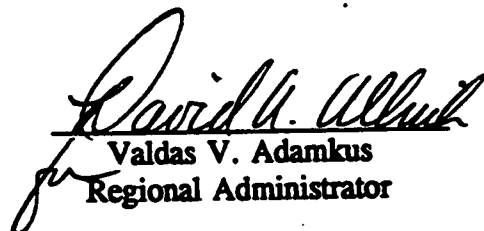
U.S. EPA (EPA) has selected the "No Remedial Action" Alternative, with groundwater and lake monitoring. -

### **DECLARATION**

EPA has determined that conditions at the site pose no current or potential unacceptable risk to human health or the environment. While the Packaging Corporation of America site does appear to exhibit elevated levels of heavy metals and some organics, calculations of potential future risk indicate that the contamination does not appear to pose an unacceptable risk to human health or the environment. Accordingly, no remedial action for the ground water operable unit is necessary to ensure protection of human health and the environment. EPA will however, continue to monitor Manistee Lake and the contaminants in the groundwater until the contaminated plume has fully discharged into the lake.

EPA has determined that no remedial action is necessary for the ground water operable unit at this site. As this is a decision for "No Action", the requirements of CERCLA Section 121 for remedial actions are not applicable and no statutory five year review will be undertaken. However as deemed prudent by the U.S. Environmental Protection Agency, annual monitoring will apply to this site.

9/24/93  
DATE

  
Valdas V. Adamkus  
Regional Administrator

**PACKAGING CORPORATION OF AMERICA**

**FILER CITY, MICHIGAN**

**SUMMARY OF REMEDIAL ALTERNATIVE SELECTION**

**GROUNDWATER OPERABLE UNIT**

**AUGUST 1993**

## **DECISION SUMMARY**

### **I. SITE NAME, LOCATION, AND DESCRIPTION**

The Packaging Corporation of America Site (PCA) is located in Stronach Township, Manistee County, Michigan. The site consists of approximately 700 acres of land in and adjoining Section 17 of Stronach Township (T21N, R16W). The site is bordered by the Village of Eastlake to the north, the Village of Stronach to the south, Manistee Lake to the west, and Manistee National Forest to the east. The Site has eight seepage lagoons and four seepage areas. The seepage lagoons, seepage areas, and the land between them comprise approximately 280 acres. The area surrounding the site is mixed industrial and residential. The nearest resident is in the Village of Stronach approximately 500 feet from the site. The Site is shown in Figure 1.

### **II. SITE HISTORY AND ENFORCEMENT ACTIVITIES**

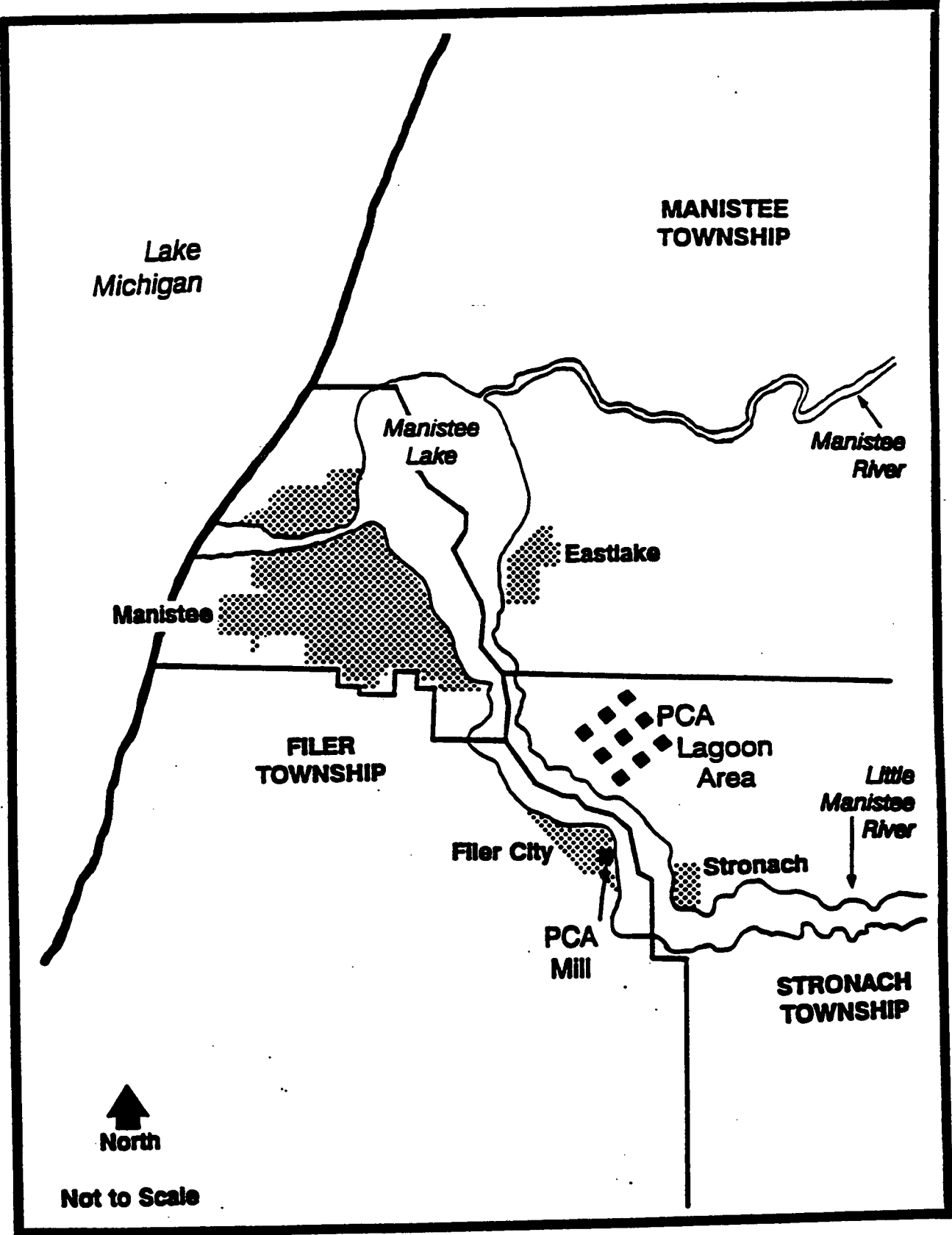
In July 1947, the American Box Board Company (ABBCo) bought a pulp and paper mill located at Filer City, Michigan. From 1947 to 1949 the mill used the "Kraft" cooking process to produce wood pulp. The wood pulp was used to make corrugating medium for corrugated boxes. In late 1949, ABBCo changed their pulping process to the neutral sulfite semichemical (NSSC) process. The NSSC process uses a solution of sodium sulfite and sodium carbonate to cook wood. The cooking, or pulping process, dissolves the lignin in wood that binds the cellulose fibers together; the fibers are then reformed into paper products.

From 1949 to 1951, the spent cooking liquor from the NSSC process was discharged to Manistee Lake. The discharge depressed the dissolved oxygen in the lake and a fish kill occurred in May of 1950. The Michigan Water Resources Commission held a public hearing and ordered the company to dispose of the waste liquor on land in seepage lagoons. ABBCo then purchased the 700 acres of land, which make up the Site, for the disposal of the NSSC waste. The wastewater lagoons were constructed from natural depressions in the land. A pipeline was installed from the plant under Manistee Lake to the lagoons. Spent pulping liquor was discharged into the lagoons beginning February 15, 1951.

A new mill was constructed in 1956 which used the Kraft process to digest wood. In the Kraft process, spent cooking liquor is evaporated and recovered. Evaporator condensate, which is very dilute liquor, was also discharged to the lagoons. Eight seepage lagoons were used for disposal.

A clarifier was installed in 1958 which removed cellulose fibers from the general mill wastewater. The fiber or primary clarifier sludge was also disposed of in the lagoons. In 1959, ABBCo merged with Central Fibre Products and Ohio Box Board Company to form Packaging Corporation of America (PCA). PCA continued to discharge spent cooking liquor, evaporator condensate, and primary clarifier sludge into the seepage lagoons until 1972. In 1972, PCA constructed a secondary treatment plant and lagooning of the pulping liquor stopped. In 1974 and 1975, clean water was pumped into the lagoons to keep the pipeline from freezing.

**Figure 1**  
**Site Location Map**  
**Packaging Corporation of America**



All of the lagoons and seepage areas are currently empty with the exception of lagoon 3 which is a company owned solid waste landfill, and lagoon 2 which contains primary clarifier sludge. Figure 2 shows the locations of the lagoons.

PCA performed some hydrogeological investigations in 1980 through 1983. These studies identified heavy metals, including arsenic and chromium in the groundwater. In August 1982, the Site was ranked by U.S. EPA under the Hazard Ranking System. The Site was proposed for placement on the National Priorities List (NPL) on December 19, 1982, and placed on the NPL on September 8, 1983. A potentially responsible party search was completed on January 25, 1983 and PCA was identified as the only potentially responsible party.

On May 14, 1985, an Administrative Order on Consent for a Remedial Investigation and Feasibility Study (RI/FS), was executed between the sole PRP, PCA, and U.S. EPA. In April 1991, a final RI report was submitted to the U.S. EPA. On December 20, 1991, the U.S. EPA informed PCA that the site would be divided into two operable units, Ground Water Management and Source Control. PCA was directed to move forward with the Feasibility Study for the groundwater management operable unit, while the State of Michigan and PCA resolve the issues associated with closure of the solid waste landfill. These two operable units together will comprise the final remedy for the site. In June of 1992 a Feasibility Study for the groundwater operable unit was concluded. In August of 1993 the State completed an additional lake study.

### **III. HIGHLIGHTS OF COMMUNITY PARTICIPATION**

The local residents of the Manistee Lake area, many of whom have resided in the area for years, have been aware of pollution resulting from the PCA lagoons for 30 or more years. The increased level of heavy industry in the Manistee Lake area has generated environmental problems.

The announcement of the PCA site on the NPL was published in the Manistee News Advocate on December 20, 1982, the Detroit Free Press on December 21, 1982, and by the MDNR publication, Natural Resources Register, also on December 21, 1982.

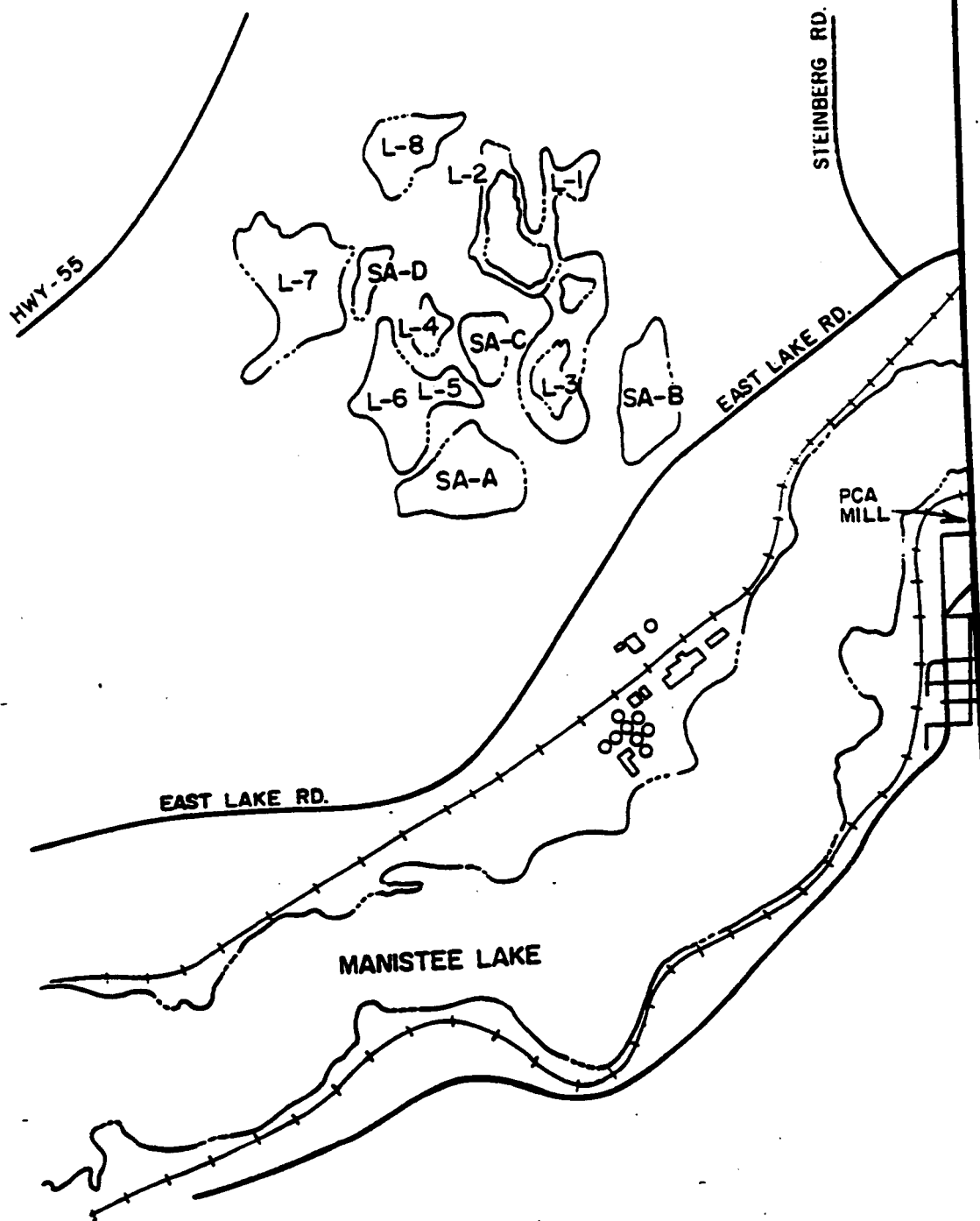
PCA held an informational meeting about its Superfund status on February 25, 1983. The Manistee News-Advocate reported the events of that meeting on February 28, 1983. Community relations efforts have been taken by other entities. The Martin Marietta Company had its wells tested by the Michigan Department of Health, and informed employees of the water's safety after receiving the results. The City of Manistee also informed City water users of favorable results following extensive state testing of the city water in 1983.

U.S. EPA sponsored a public meeting on October 25, 1985, in Stronach Township to discuss the upcoming RI/FS process and activities. On May 15 and 16, 1991, a U.S. EPA Community Relations Coordinator conducted community interviews with public officials of Manistee County, Manistee Township, Filer City Township, the Village of Eastlake, and residents.

On June 30, 1992 the U.S. EPA sponsored a public meeting to discuss the results of the RI/FS. The Proposed Plan was released for public comment on July 21, 1993. The notice published



FIGURE 2



LEGEND

L-1 = SEEPAGE LAGOON NUMBER  
SA-A = SEEPAGE AREA LETTER

**WASTEWATER SEEPAGE  
LAGOON LOCATION MAP**

on July 16, 1993 in the Manistee News-Advocate and on July 22, 1993 in the Manistee Observer announced the beginning of the 30 day comment period. On August 10, 1993, the Lake Michigan Federation requested a 30 day extension to the comment period. The comment period was extended for 14 days on August 20, 1993 to September 3, 1993. A Public Meeting to discuss the preferred alternative was held in the Stronach Township Hall on August 10, 1993.

The public participation requirements of CERCLA sections 113 (k) (2) (B) (i-v) and 117 have been met in the remedy selection process. This decision document represents the selected remedial action for the PCA Site in Michigan, chosen in accordance with CERCLA, as amended by SARA and, to the extent practicable, the NCP. This decision is based on the administrative record.

#### **IV. SCOPE & ROLE OF RESPONSE ACTION**

This Record of Decision (ROD) addresses the final groundwater remedy for the site. U.S. EPA recommends that no remedial action be taken for the groundwater operable unit, at the Packaging Corporation of America Site for the following reasons. An action through CERCLA, as amended by SARA, is not triggered because the risks calculated using a reasonable exposure scenario are within the acceptable risk range. Institutional controls including a public health moratorium prohibit the future drilling of wells into the contaminated groundwater. Should this control fail, the groundwater itself is dark brown in color and has a strong odor and taste and would preclude its use for human consumption. The property above the plume is zoned industrial and demographic studies indicate that the population in the area is decreasing. All indications are that the area will remain industrial. The source of the contamination has been removed and 95% of the contaminated plume has already vented into Manistee Lake. Studies indicate that the plume is actually shrinking and private wells in East Lake and Stronach are not contaminated or threatened with contamination. The concentration of contaminants in the plume are expected to reach MCLs in 60 years. Although some evidence suggests that the plume could have an adverse impact on benthic organisms, the contaminants should not pose a long term problem for the lake.

U.S. EPA has determined that exposure to site related contaminants does not pose an unacceptable risk to human health or the environment and that a remedial action under Superfund is not warranted. However the Site will continue to be monitored. The monitoring shall include annual monitoring of residential wells in the area as well as monitoring of the plume itself. Annual monitoring of the fish and sediments in Manistee Lake shall also be conducted. If review of the Site information indicates that the No Action Alternative is no longer protective of human health or the environment, the Agency will reevaluate this decision.

#### **V. SITE CHARACTERISTICS**

Pursuant to the authorities under CERCLA, as amended, and the National Oil and Hazardous Substance Pollution Contingency Plan (NCP), an RI was conducted at the site. The RI began in January 1985 and was completed in April 1991. The RI also included a Risk Assessment to evaluate the level of risk to human health and the environment. This section summarizes the analysis presented in the RI report.

#### **A) Site Topography**

The seepage lagoons are located in natural closed depressions or kettles located on the land surface. Except for these kettles, the land surface on the site is nearly flat at an elevation of approximately 670 feet mean sea level (msl). The topography drops near the shore of Manistee Lake to approximately 585 msl.

#### **B) Site Geology**

The geology of the site consists of surficial unconsolidated glacial drift and underlying bedrock formations. The glacial drift extends in depth from the surface to greater than 600 feet. The drift is composed of glacial outwash, clay-rich glacial till and lacustrine deposits. The surficial deposits throughout most of the site consist of sand and gravel. These sediments were deposited by the glacial melt water associated with the Michigan Ice Lobe.

The surficial and uppermost geologic unit on the site consists of a relatively permeable sand that varies in thickness from 60 to greater than 250 feet. Although this unit primarily consists of fine-to-medium-grained sand, it also contains interbedded lenses and layers of clay, gravel and silt. These layers do not extend laterally for any significant distance.

The uppermost sand unit is underlain by a second and third unit, a lacustrine clay and a massive clay-rich glacial till unit, respectively. The second and third units are of special interest because they act as hydrological barriers that prevent downward migration of groundwater contamination.

#### **C) Site Surface Water Hydrology**

The primary surface water body near the site is Manistee Lake. Manistee Lake is recharged by two rivers, the Little Manistee River at the southern end and Manistee River at the northeast end. Direct natural sources of water for the southern portion of Manistee Lake include the Little Manistee River, direct precipitation, and groundwater discharge. Surface water runoff into the lake is expected to be minimal given the flat lying porous nature of the soils surrounding the lake. Surface water flow in Manistee Lake is from south to north, then exits west into the Manistee River to Lake Michigan.

#### **D) Site Hydrogeology**

The upper aquifer is the primary recipient of the PCA effluent, and is unconfined throughout the site with the exception of localized areas near the lakeshore where discontinuous clay layers exist. The upper aquifer underlies approximately five square miles of land bordered by Little Manistee River to the south, Manistee Lake to the west, Manistee River to the north, and Franklin Road and Manistee National Forest to the east. Groundwater flow direction is generally west, horizontally towards Manistee Lake. Regional groundwater flow is radial, south to the Little Manistee River, west toward Manistee Lake, and north toward Manistee River.

Both horizontal and vertical groundwater flow and transport models for the PCA site were completed. The models indicate that the plume is expected to continue to migrate toward and discharge into Manistee Lake. The concentrations of contaminants and their maximum flux into the lake are also expected to decrease with time. The horizontal extent of the plume has reached its maximum extent and should decrease with time. The maximum concentration of nonattenuated solutes in the groundwater at the eastern edge of Manistee Lake is predicted to decrease with time. The PCA plume, since it is slightly denser than the surrounding uncontaminated groundwater, will tend to sink. The vertical model indicates that there is sufficient vertical flow for the plume to discharge upward into Manistee Lake. Overall, the plume is expected to reduce in both size and concentration and is not expected to flow underneath Manistee Lake. Figure 3 shows a vertical profile of the contaminated groundwater plume.

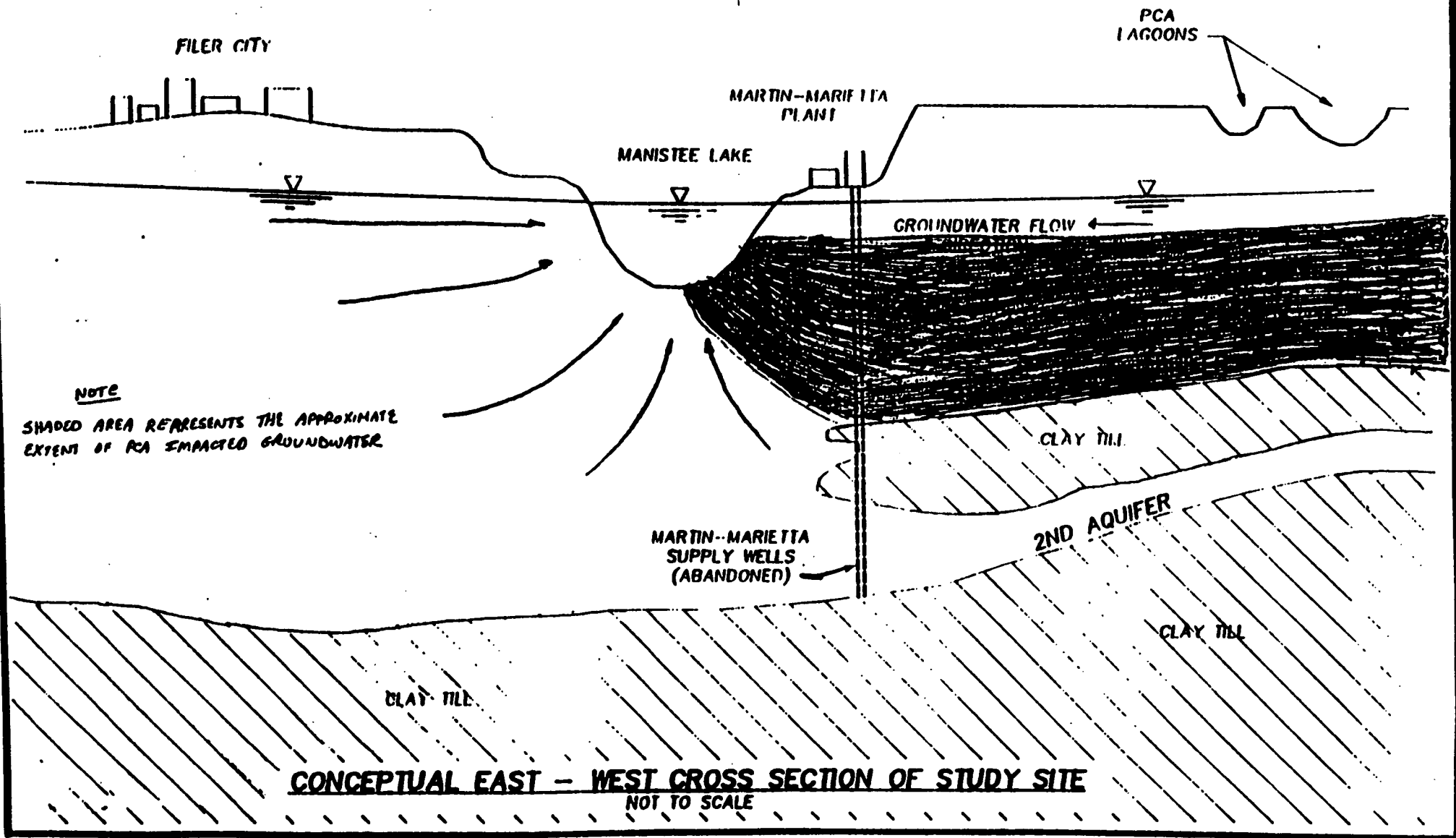
#### **E) Extent of Contamination**

During the RI, several monitoring wells and residential wells were sampled. A sampling summary is provided in Table 1 and monitoring well locations are provided in Figure 2. No contamination was found in residential wells. The groundwater from the monitoring wells is dark brown in color and has a very strong odor and taste. Analytical results indicate the presence of several organic and inorganic compounds listed in Table 2. The organic contamination, including several tentatively identified compounds, is believed to be the degradation products derived from wood lignin and the pulping process. The metals, with the exception of the sodium and magnesium, are believed to be leaching from the background soils as the contaminated groundwater moves through them. The sodium is from the cooking process used in the PCA mill. The magnesium and chlorides are from a brine plume associated with operations at Martin Marietta. Martin Marietta is located on the eastern shore of Manistee Lake. A brine plume underneath the Martin Marietta Corporation mixes with a portion of the PCA plume before the groundwater reaches Manistee Lake. Additional characteristics of the PCA impacted groundwater include elevated total dissolved solids (TDS), and high biological oxygen demand (BOD).

**TABLE 1  
SAMPLING SUMMARY**

	<b>SAMPLE LOCATIONS</b>	<b>NUMBER OF SAMPLES</b>
<b>Groundwater</b>	<b>50</b>	<b>61</b>
<b>Residential Water</b>		
<b>East Lake Village</b>	<b>2</b>	<b>2</b>
<b>Stronach Township</b>	<b>2</b>	<b>2</b>
<b>Filer City</b>	<b>1</b>	<b>1</b>
<b>Martin Marietta</b>	<b>1</b>	<b>1</b>

**FIGURE 3**



**TABLE 2**

**SUMMARY OF CHEMICALS IN THE GROUNDWATER\***

<u>Inorganic Chemicals</u>	<u>Organic Chemicals</u>	<u>TICs</u>
Arsenic**	2-Butanone	Butanoic Acid
Barium	Benzoic Acid	Hexanoic Acid
Chromium**	2-Methylphenol	
Copper	4-Methylphenol	
Lead**	Phenol	
Manganese		
Nickel		
Vanadium		

\* Other characteristics of the groundwater include high concentrations of sodium, chlorides, and magnesium

\*\* Concentration exceeds safe drinking-water standards

Groundwater flow direction is toward Manistee Lake. Before entering the lake the contaminated groundwater mixes with a brine plume from Martin Marietta. Over 7 billion gallons of waste were discharged to the lagoons from 1951 through 1976. Approximately 95% of the nonreactive or nonattenuated constituents have already discharged to Manistee Lake. Figure 4 shows the extent of contamination and monitoring well locations at the PCA site. Figures 5, 6, and 7, show the arsenic, chromium, and lead concentrations in the groundwater, respectively.

Based on exceedences of Maximum Contaminant Levels for arsenic, chromium, and lead, a Feasibility Study for the PCA site was developed. The Feasibility Study should be consulted for an in depth discussion of the other remedial alternatives developed for the site.

## **VI. SUMMARY OF SITE RISKS**

The analytical data collected during the RI indicated the presence of both organic and inorganic contaminants in the groundwater. A baseline risk assessment was performed, pursuant to the NCP, based upon present and potential future conditions at the site. The baseline risk assessment determines actual or potential risks or toxic effects the chemical contaminants at the site pose under current and future land use assumptions. The risk assessment assumes no corrective action will take place and that no site use restrictions or institutional controls such as fencing, groundwater use restrictions or construction restrictions will be imposed.

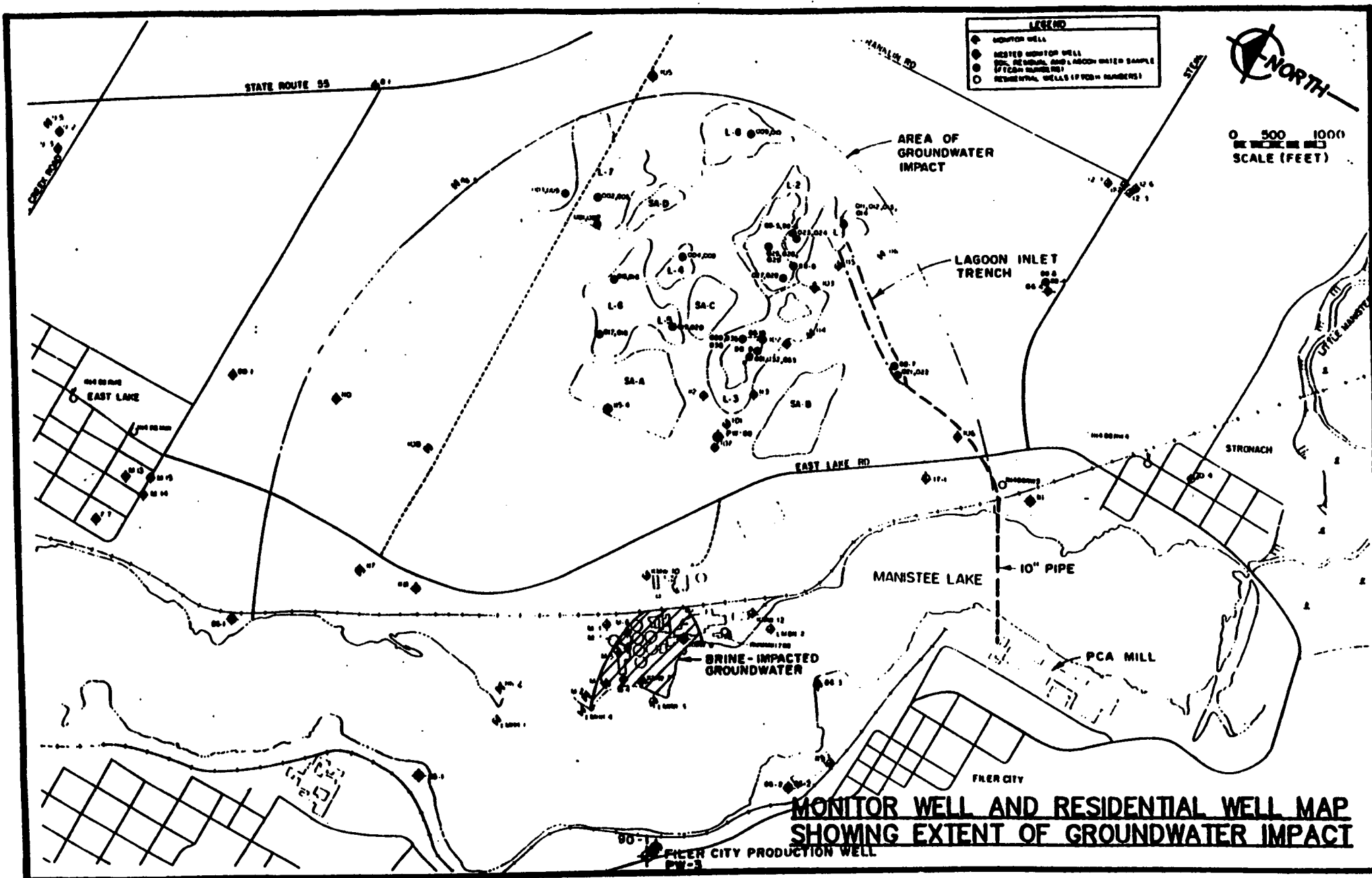
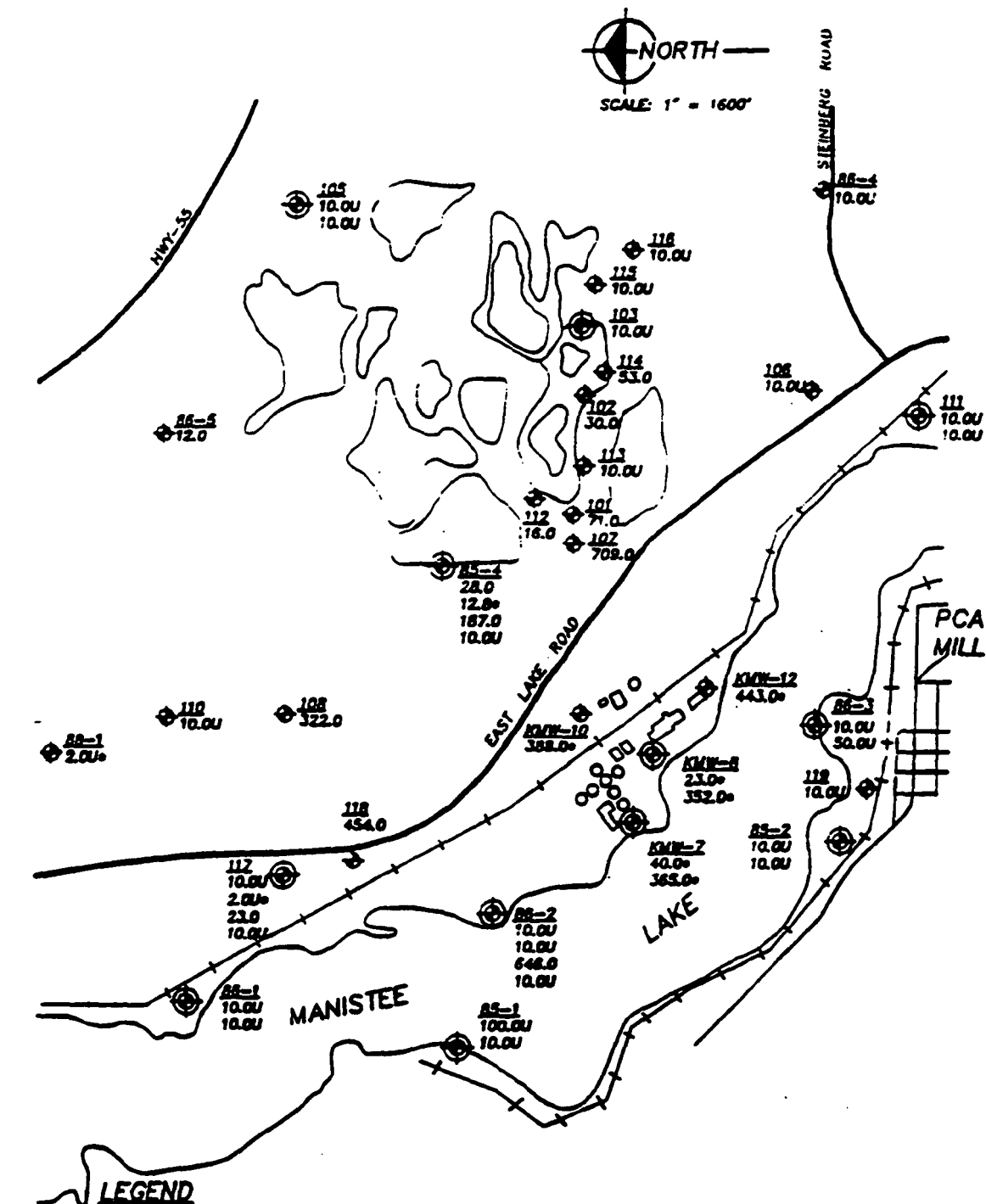


FIGURE 4

FIGURE 5



**LEGEND**

◆ SINGLE MONITOR WELL  
 ⊕ NESTED MONITOR WELL  
 XXX MONITOR WELL NUMBER.  
 5.0 } SAMPLE RESULTS LISTED  
 5.0 } IN ORDER OF RELATIVE  
 50.0 } DEPTH FROM SHALLOW  
 52.0 } TO DEEP WELL

\* ALL WELLS USE 1987 DATA UNLESS  
 INDICATED WITH AN ASTERISK (\*).  
 WELLS INDICATED WITH AN ASTERISK  
 USE 1989 DATA.  
 U = DETECTION LIMIT

**ARSENIC CONCENTRATIONS IN GROUNDWATER  
(RESULTS IN  $\mu\text{g/l}$ )**



FIGURE 6

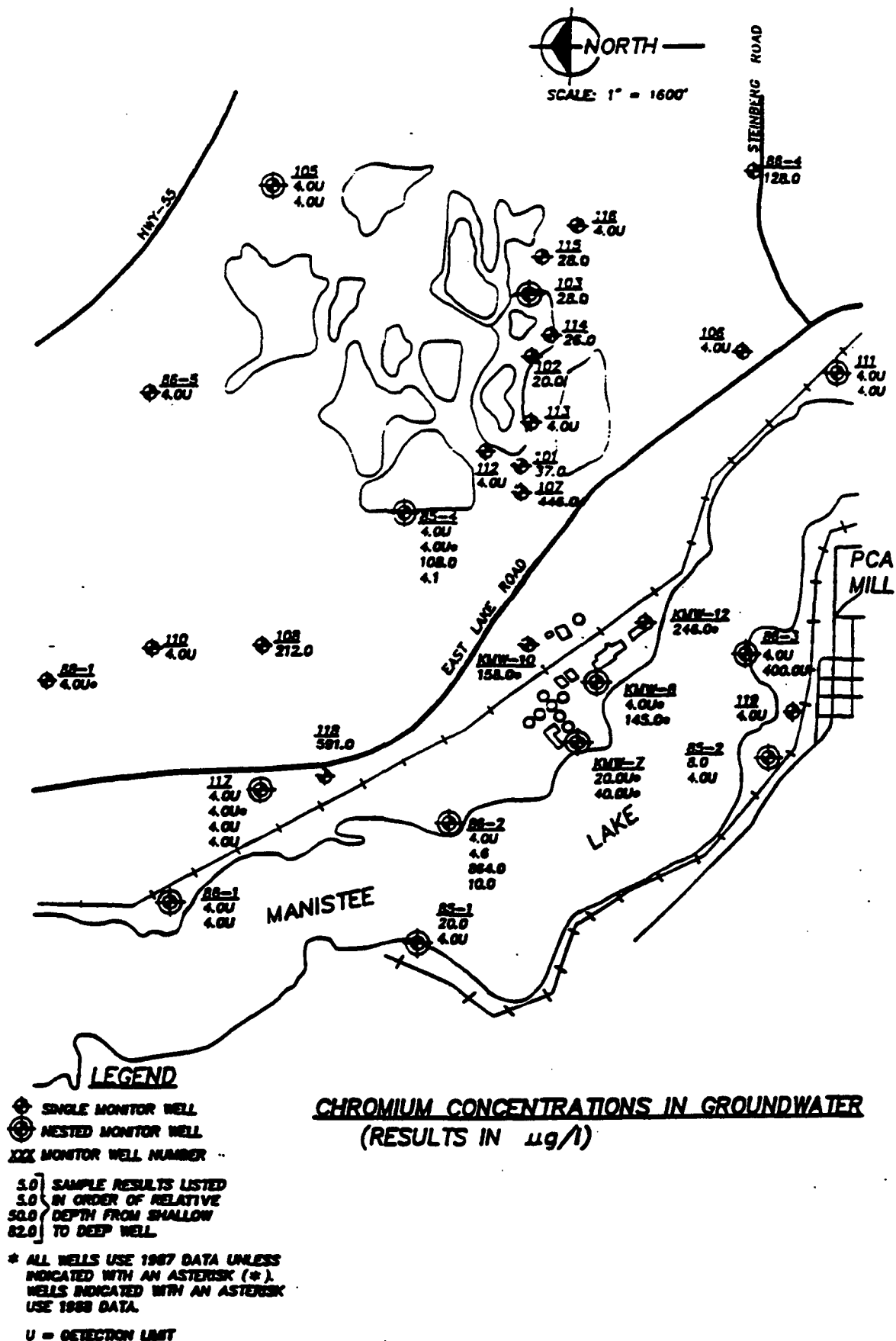
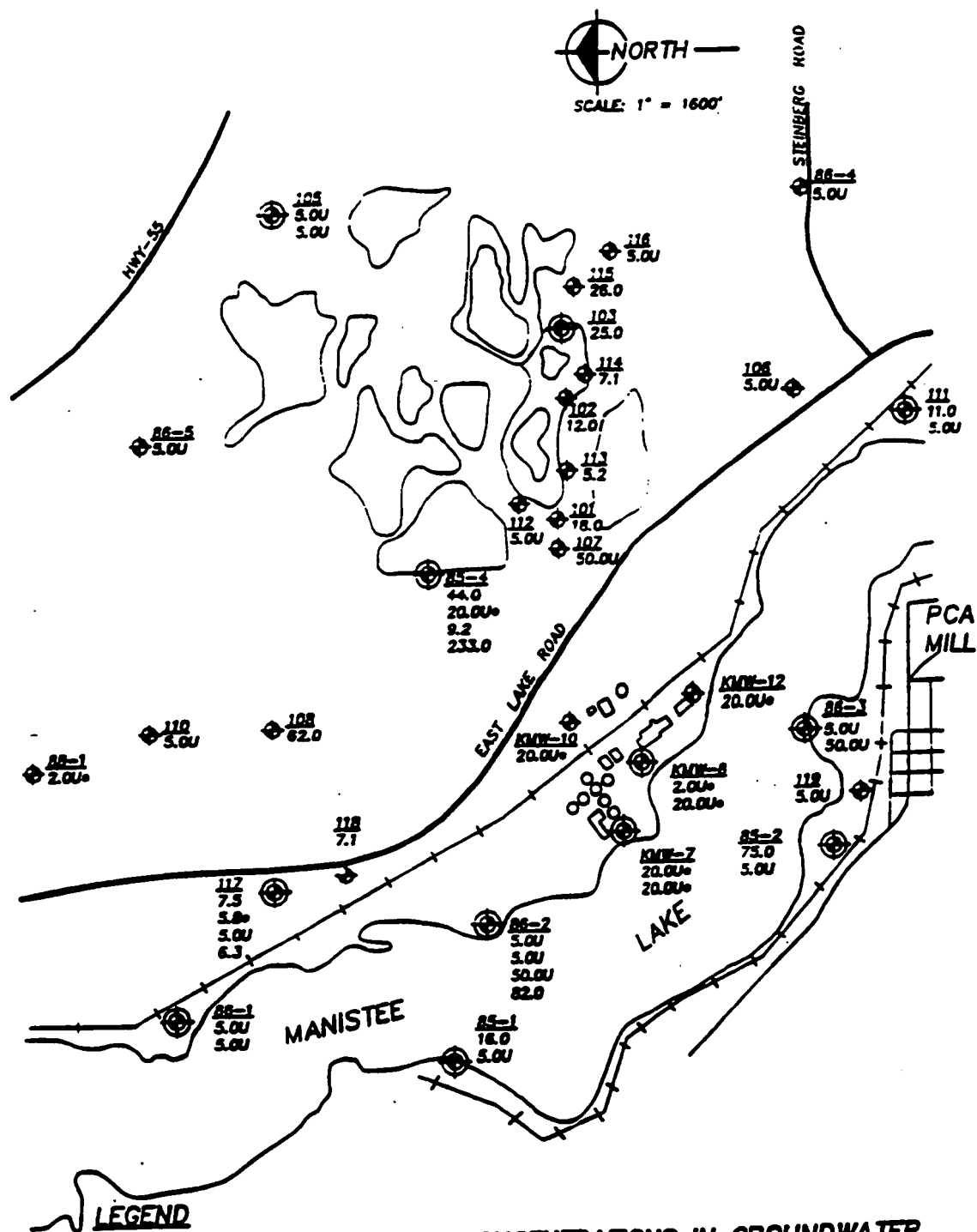


FIGURE 7



**LEAD CONCENTRATIONS IN GROUNDWATER  
 (RESULTS IN  $\mu\text{g/l}$ )**

## **1) Chemicals of Potential Concern**

The groundwater data collected during the RI for the PCA site was evaluated to identify which chemicals detected at the site will be the focus of the risk assessment. The finding of very few target compound list organic constituents in the groundwater necessitated the inclusion of all but one constituent in the quantitation of risk. Refer to Table 2 for a list of the chemicals of potential concern in the groundwater. The maximum observed concentrations were used in the risk assessment instead of the mean concentrations. This practice tends to overstate the chronic toxicity health risks at the site.

## **2) Exposure Assessment**

Exposure to the contaminated groundwater by daily ingestion over a long period of time is improbable at the PCA site due to the discoloration of the water, the odor, and the unpleasant taste. The area of the plume is zoned industrial and demographic studies indicate that the population is decreasing. The source of the contamination has been removed, and 95% of the contaminated plume has already vented into Manistee Lake. Studies indicate that the plume is shrinking and private wells in East Lake and Stronach are not contaminated or threatened with contamination. Groundwater encountered at the plume boundary is brown in color due to the presence of the pulping liquor. The discoloration corresponds to color of approximately 50 color units. Correlation studies have shown that at less than 50 color units, chromium and arsenic are at background levels. In addition to the color and odor, the groundwater plume from the PCA site mixes with a brine plume underneath the Martin Marietta Corporation before venting into Manistee Lake. The increased levels of magnesium and chlorides associated with the brine contamination causes the groundwater to have a strong unpleasant taste. Encountering groundwater of this nature while drilling for a potable well supply would result in the rejection of its use for that purpose.

There are no residential homes within the area of the plume. All drinking water wells within the boundary of the plume have been replaced with an alternate water supply. Groundwater north of the plume in East Lake and south of the plume in Stronach is currently uncontaminated and modeling and studies show that the plume is receding from these areas. Municipal wells in Filer Township, located west of Manistee Lake, have not been and are not expected to be affected. Modeling and sampling show that the plume has not migrated underneath Manistee Lake and is not expected to in the future because the groundwater flowing into the lake from the west side forms a hydraulic barrier to underflow. The Michigan Department of Public Health has forbidden the drilling of any new wells on the contaminated property. All of the land above the plume is zoned industrial. The Village of East Lake has park land above the plume; deed restrictions limit the use of this property to park and recreational. It is unlikely that land use patterns will change in the future; demographics show a declining population growth.

The plume has been determined to be venting to Manistee Lake. For this reason, the exposure pathways of fish ingestion, recreational use of the lake, and aquatic toxicity impact were also evaluated. These exposures were based on flux rates of the chemicals of concern into the lake. Actual lake water sample results for arsenic, chromium and lead were used for quantification of health risks associated with exposure to lake water. Exposure to lagoon sediments and soils by a hunter or trespasser was also evaluated. According to Agency guidance, actions at superfund sites should be based on an estimate of the reasonable maximum exposure (RME)

expected to occur under both the current and future land-use conditions. Consequently the Agency believes that a reasonable maximum exposure scenario is a one day groundwater ingestion scenario. This scenario assumes the receptor ingests two liters of contaminated groundwater only once.

### 3) Toxicity Assessment

For each exposure pathway evaluated, carcinogenic and noncarcinogenic health risks were characterized for each risk scenario.

Cancer potency factors (CPFs) have been developed by U.S. EPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CPFs, which are expressed in units of  $(\text{mg/kg-day})^{-1}$ , are multiplied by the estimated intake of a potential carcinogen, in  $\text{mg/kg-day}$ , to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CPF. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Cancer potency factors are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied (e.g. to account for the use of animal data to predict effects on humans).

Reference doses (RfDs) have been developed by U.S. EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting non-carcinogenic effects. RfDs, which are expressed in units of  $\text{mg/kg-day}$ , are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemicals ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse non-carcinogenic effects to occur.

Potential concern for non-carcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's reference dose). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media. Any Hazard Index value greater than 1.0 suggests that a non-carcinogen potentially presents an unacceptable health risk.

There were only two suspect carcinogens among the chemicals of concern, arsenic and bis(2-ethylhexyl)phthalate. Arsenic is classified as a human carcinogen based on an epidemiological study of ingestion of water containing high concentrations of arsenic. The type of cancer linked with this contaminant is skin cancer. Skin cancers have a high cure rate in the United States because of ease of detection and efficacy of treatment. Bis(2-ethylhexyl)phthalate has exhibited an increased incidence in dosed animals in toxicity studies. The endpoint health effect is liver cancer.

All of the other constituents are systematic toxicants with threshold doses. Threshold doses refer to a concentration at which no adverse health effects are observed. The major health effects that established the reference doses for the site constituents were skin pigmentation (arsenic), decreased fetal body weight (phenol), and decreased weight (cresols). At higher concentrations the major health effect was neurotoxicity and anemia.

#### **4) Ecological Assessment**

The effect of site contaminants on lake water was studied by performing a bioassay test on lake water samples. The samples were collected from those areas of the lake, both top and bottom, that would likely be most severely impacted by the plume. No test stations exhibited toxicity relative to the Little Manistee River which provides the majority of the influent water for the lake, and represented background water quality.

The State did an additional lake study to assess the environmental impact the plume was having on the lake, and although some evidence suggests the plume could have an adverse impact on benthic organisms, the contaminants should not pose a long term problem for the lake. The plume is dark brown in color and is contaminated with both organic and inorganic contaminants. Since the color in the ground water is mainly due to lignin and other recalcitrant organic compounds leached from wood, we do not expect these substances to demonstrate the kind of bioaccumulative properties which can be a problem for higher trophic level organisms, other than those which dwell in sediments. Since these types of contaminants are not likely to be highly bioaccumulative, they therefore should not present a biomagnification problem.

Manistee Lake has been surrounded by industry for the past 150 years. Over that time, several industries and discharges have impacted the sediments in the lake. Studies of Manistee Lake have been performed by the MDNR over the past several decades. These studies indicate that the lake was seriously degraded prior to the time when the contaminated groundwater from the PCA site reached the lake. Evidence suggests that over time the conditions in the lake are improving. Since the majority of the contaminated plume has already vented into the lake, the U.S. EPA believes that this trend of improvement will continue.

#### **5) Risk Characterization**

The aggregate chronic and acute health risks were calculated for each of the complete pathways. The complete pathways include contaminated groundwater ingestion, hunter/trespasser exposure to lagoon soils and water, fish consumption from Manistee Lake, and recreational use of Manistee Lake. No residential wells are currently being impacted by the contaminated plume, and no future development of the area is expected. Exposure to the contaminated groundwater at the PCA site by daily ingestion over a long period of time is improbable. In addition to the above factors, the nature of the contaminated groundwater, its dark color, strong odor, and salt taste, should preclude human consumption. Accordingly the most reasonable, yet conservative, future risk scenario is a one day exposure scenario during which a person ingests two liters of contaminated water only once. The risks associated with the one-day exposure scenario are summarized below.

The risks associated with a potential lifetime exposure to the contaminated groundwater were also calculated. Within this exposure scenario the estimated cancer risk level is  $3 \times 10^{-4}$  and the total noncancer hazard index is 20. In this scenario, the cancer risk associated with the PCA site is mainly attributable to exposure to arsenic in the groundwater by drinking two liters of contaminated groundwater, containing arsenic at the reasonable maximum exposure concentration for a period of thirty years. Arsenic and the phenols are also the major contributors to the hazard index. Refer to the Baseline Risk Assessment for an in depth discussion of the risk scenarios associated with the PCA site.

**TABLE 3**  
**SUMMARY OF CANCER RISKS AND HAZARD INDICES**  
**FOR GROUNDWATER AND SURFACE WATER EXPOSURES**  
**(POTENTIAL ONE DAY EXPOSURE)**

EXPOSURE PATHWAY	THI	CRI
<b>Residential Use of Groundwater</b>		
Drinking water	.07	$3 \times 10^{-3}$
Household Use	$8 \times 10^{-6}$	—
<b>TOTAL RESIDENTIAL</b>	.07	$3 \times 10^{-3}$
<b>Recreational Use of Lake (GW Disch)</b>		
Inadvertent Ingestion (boating)	$9 \times 10^{-6}$	$1 \times 10^{-10}$
Dermal Absorption (boating)	$2 \times 10^{-7}$	—
Fish Ingestion	$4 \times 10^{-3}$	$4 \times 10^{-3}$
<b>TOTAL RECREATIONAL</b>	$4 \times 10^{-3}$	$4 \times 10^{-3}$
<b>TOTAL</b>	.07	$7 \times 10^{-3}$

## **VII. STATUTORY AUTHORITY FINDING**

**EPA has determined that conditions at the site pose no current or potential threat to human health or the environment. While the Packaging Corporation of America site does appear to exhibit elevated levels of heavy metals and some organics, calculations of potential future risk indicate that the contamination does not appear to pose an unacceptable risk to human health or the environment. Accordingly, no remedial action for the groundwater operable unit is necessary to ensure protection of human health or the environment. EPA will however, continue to monitor Manistee Lake and contaminants in the groundwater.**

**EPA has determined that no remedial action is necessary for the groundwater operable unit at this site. As this is a decision for "No Action", the requirements of CERCLA Section 121 for remedial actions are not applicable and no statutory five year review will be undertaken. However as deemed prudent by the U.S. Environmental Protection Agency, annual monitoring will apply to this site.**

## **VIII. EXPLANATION OF SIGNIFICANT CHANGES**

**There are no significant changes from the recommended alternative described in the proposed plan.**