United States
Environmental Protection
Agency

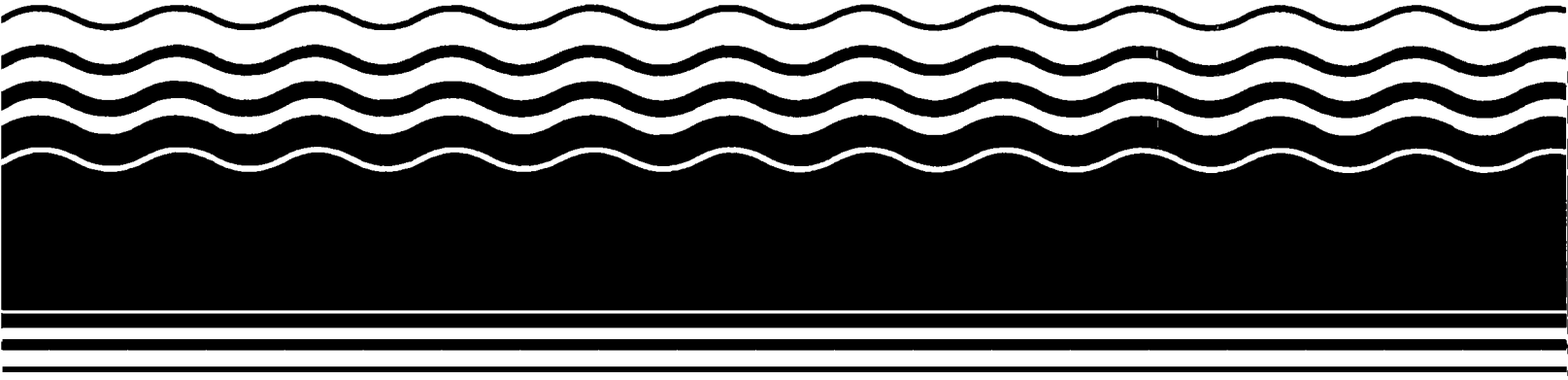
Office of
Emergency and
Remedial Response

EPA/ROD/R05-93/241
September 1993

EPA

Superfund Record of Decision:

Mason County Landfill, MI



50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA/ROD/R05-93/241	2.	3. Recipient's Accession No.

4. Title and Subtitle
SUPERFUND RECORD OF DECISION
Mason County Landfill, MI
Second Remedial Action - Final

5. Report Date 09/27/93

6.

7. Author(s)

8. Performing Organization Rept. No.

9. Performing Organization Name and Address

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(G)

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U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

13. Type of Report & Period Covered
800/800

14.

15. Supplementary Notes
PB94-964119

16. Abstract (Limit: 200 words)

The 18-acre Mason County Landfill site is an inactive, sanitary landfill located in Pere Marquette Township, Mason County, Michigan. Land use in the area is predominantly rural, with a wetlands area, woodlands, and orchard areas located to the southwest, east, and south of the site, respectively. Surface water in the site area includes Iris Creek, which discharges into Pere Marquette River and, subsequently, into Lake Michigan. The estimated 1,112 people who reside within three miles of the site use a municipal water supply to obtain their drinking water. In addition, there are 14 residential wells located within a half-mile radius of the landfill. Beginning in 1972, Acme Disposal operated the landfill, under contract with the State, until it reached capacity and was closed in 1978. Disposal at the landfill included slurry and sludge waste from local industries. In 1981, Mason County purchased the property as part of the settlement of a suit filed by the property's owner. Public concerns over water quality in nearby Iris Creek prompted the State to review closure activities. Beginning in 1982, several State and EPA investigations indicated VOC contamination in ground water samples. In 1984 and 1985, the State implemented improvements to the landfill, which included the construction of a clay cap, berms, storm drains, two surface aerators, and 15 gas vents. A 1988 interim ROD addressed the contaminant

(See Attached Page)

17. Document Analysis a. Descriptors
Record of Decision - Mason County Landfill, MI
Second Remedial Action - Final
Contaminated Medium: None
Key Contaminants: None

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 30
	20. Security Class (This Page) None	22. Price

(See ANSI-Z39.18) *See Instructions on Reverse* OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

Abstract (Continued)

source areas and required installation of a RCRA compliant soil/clay cap and four new monitoring wells, ground water monitoring, and implementation of institutional controls, including deed restrictions. In late 1991, dedicated submersible pumps were installed in each monitoring well. This ROD addresses the onsite ground water contamination, as OU2. EPA investigations indicated that previous remedial actions and natural processes significantly have reduced the onsite contamination to acceptable levels. As a result, EPA determined that no further action is necessary to protect human health and the environment; therefore, there are no contaminants of concern affecting this site.

The selected remedial action for this site is no further action, with long-term ground water, and sediment monitoring for up to 30 years. This remedial action will allow for further assessment of the effectiveness of the clay cap in reducing the amount of contamination reaching ground water. The estimated present worth O&M cost for this remedial action is $500,000 for 30 years.

PERFORMANCE STANDARDS OR GOALS:

Not applicable.

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Mason County Landfill, Ludington, Michigan

STATEMENT OF BASIS

This decision document presents the selected remedial action for the Mason County Landfill, in Ludington, 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, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for the site.

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

DESCRIPTION OF THE SELECTED REMEDY

The United States Environmental Protection Agency (EPA) has selected "No Action with Monitoring"

DECLARATION

EPA has determined that no further remedial action is necessary at this site. Therefore, the site now qualifies for inclusion in the "sites awaiting deletion" subcategory of the Construction Completion category of the National Priorities List.

As this is a decision for "No Action", the statutory requirements of CERCLA Section 121 for remedial actions are not applicable and no five year review will be undertaken, although a five year review will be performed at this site due to the previous Record of Decision which required upgrading the clay cap for the landfill.

9/27/93
DATE

David A. Ullrich
Valdas V. Adamkus
Regional Administrator

DECISION SUMMARY

I. Site Name, Location, and Description

The Mason County Landfill Site is located three miles south of the City of Ludington and one mile east of Lake Michigan (see Figures 1 and 2). The Site occupies approximately eighteen acres of a predominantly rural area in Pere Marquette Township; approximately ten acres of the Site is landfilled.

Ludington, Michigan has a population of about 9,500. The population of Mason County was estimated at 26,400 based on the 1980 census. The population within a three mile radius of the Site was estimated at 1,112.

As Figure 3 indicates, just north of the Site is heavily wooded and orchards are located to the east and south of the Site. The local topography varies from relatively level upland areas south and east of the landfill to steep valleys north of the landfill. Figure 3 shows both the 1990 topography and Site topography before landfilling began in 1971. Comparison of the topographic contours indicates that an estimated 140,000 cubic yards (+/20,000 cubic yards) of fill is buried in the landfill. The landfill is generally a valley fill with a maximum depth estimated to be 40 to 50 feet.

Surface waters in the Site area are Iris Creek, the Pere Marquette River, Pere Marquette Lake, and Lake Michigan (see Figure 2). The headwaters of Iris Creek are located less than 500 feet from the landfill and consist of a wet, marshy area southwest of Babbin Road (see Figure 3). Water from the marshy area drains into Babbin Pond, which discharges directly into Iris Creek. Iris Creek discharges into Pere Marquette River, which discharges into Lake Michigan. A pumped-storage power reservoir operated by Consumers Power Company is located approximately one half mile south of the Site.

Lake Michigan is the main drinking water source in the area and is the City of Ludington's water supply. In rural Pere Marquette Township, residents generally depend on small domestic wells screened in sand and gravel aquifers for potable water supplies. There are fourteen residential wells within about a half mile radius of the landfill that vary in depth from 30 to 150 feet below ground surface (bgs).

Other water uses in the area include large capacity wells that produce salt brine for industrial use. A salt brine well about 1,000 feet west of the landfill is screened in an aquifer at a depth of 450 feet bgs. The brine aquifer is separated from the overlying aquifers used for potable water by more than 300 feet of low permeability glacial till.

Mason County is underlain by bedrock formations at depths from 300 to 700 feet. Mississippi Age Coldwater Shale lies beneath the landfill Site at a depth of 650 feet. The formation is predominantly shale with occasional interbeds of sandstone and limestone.

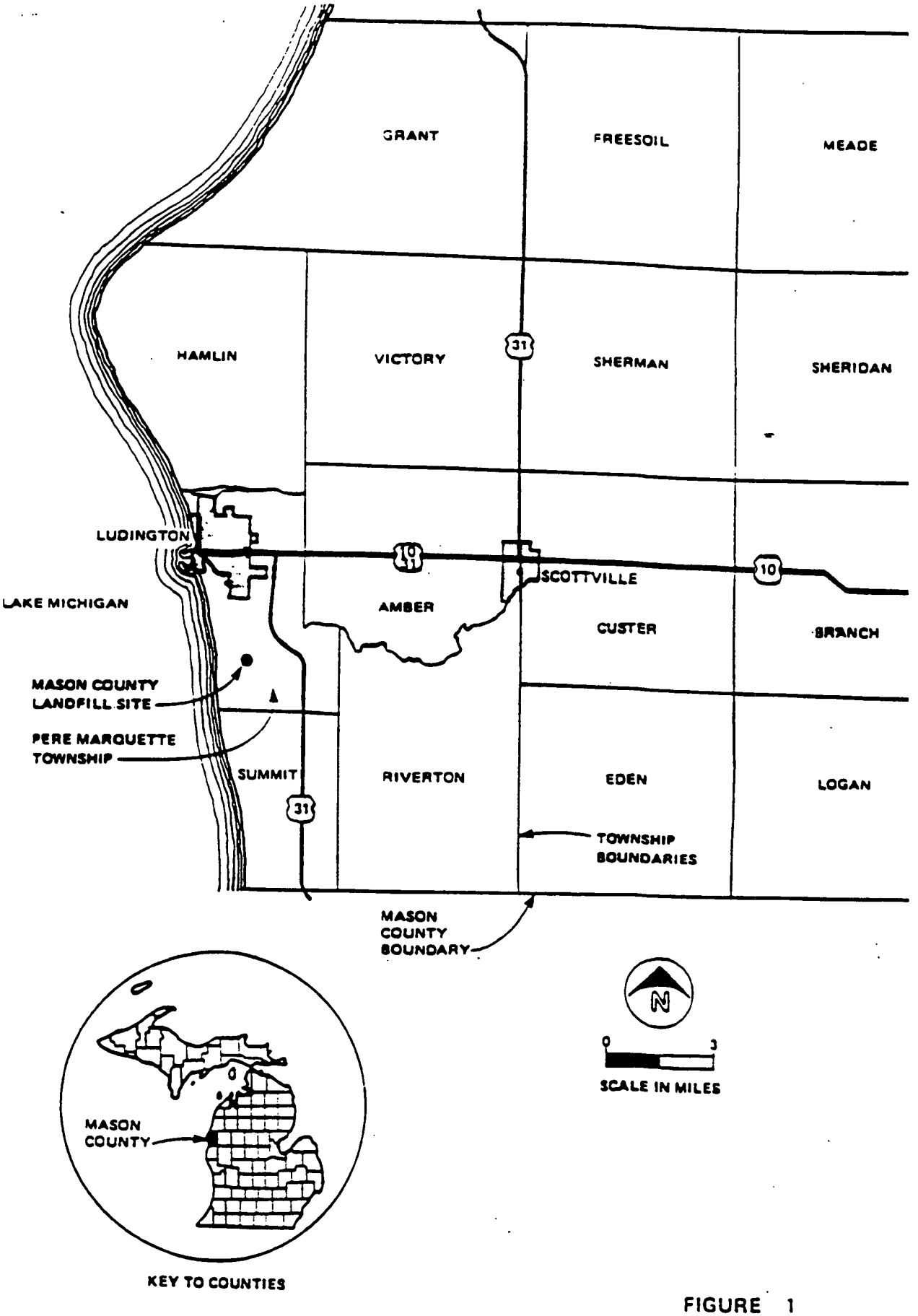
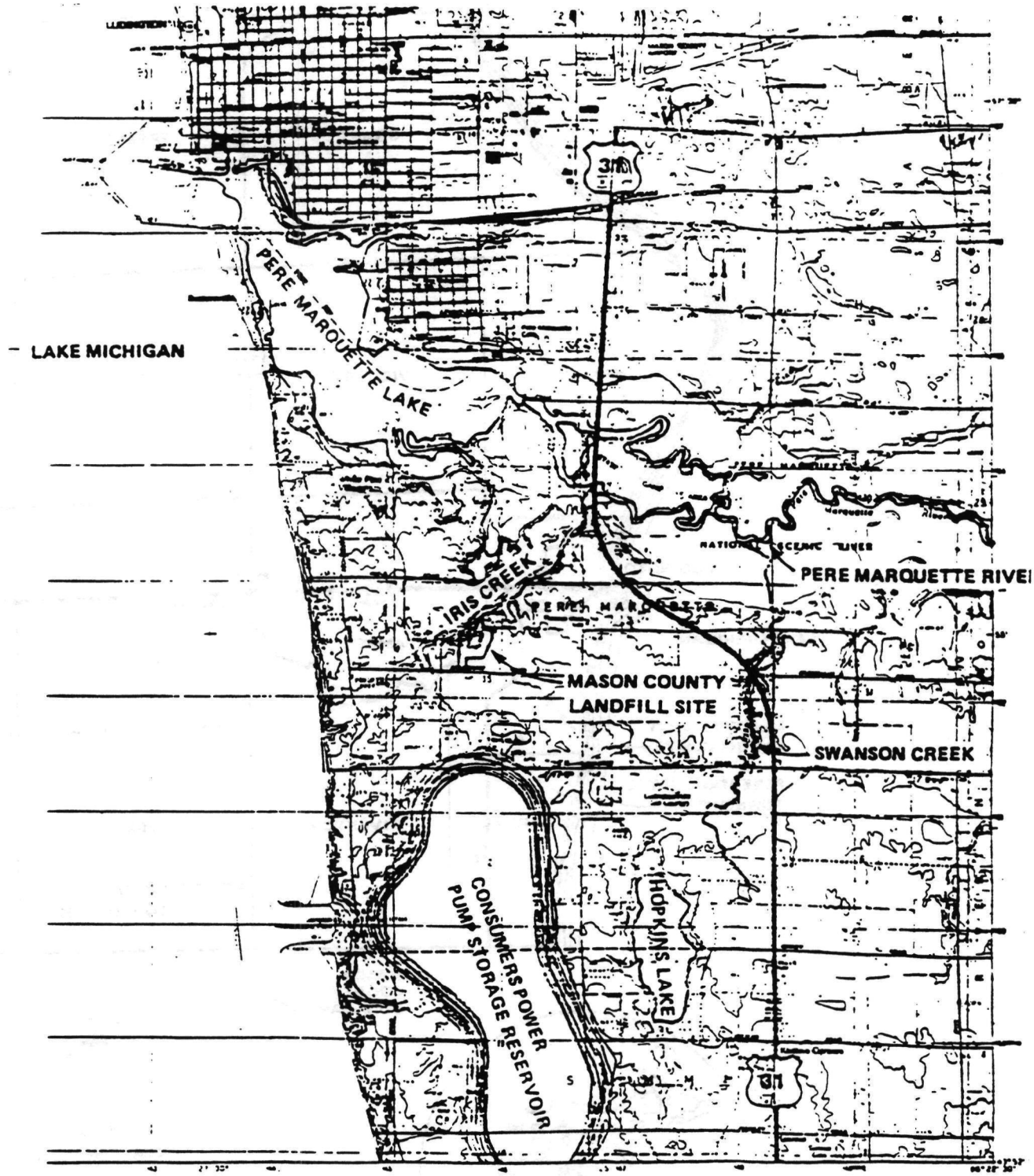
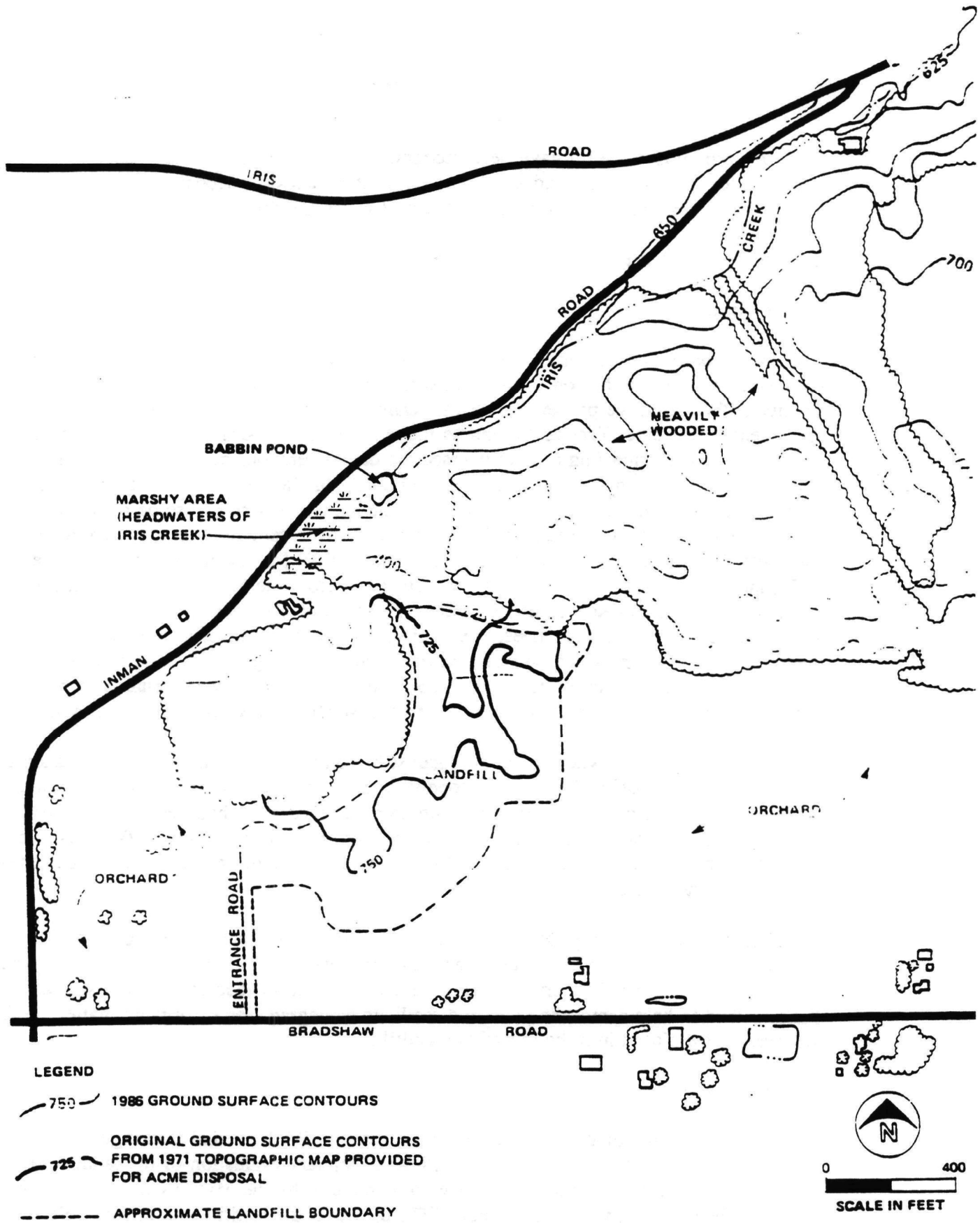


FIGURE 1
LOCATION MAP
MASON COUNTY LANDFILL RI



SOURCE: U.S.G.S 7.5' TOPOGRAPHIC MAP
OF LUDINGTON, MICHIGAN QUADRANGLE.

FIGURE 2
VICINITY MAP



SOURCE: MASON Co. DPW

CONTOUR INTERVAL = 25 FEET

NOTE: Approximate landfill boundary based on Mason County DPW legal property desciption.

FIGURE 3
SITE MAP WITH ORIGIN
SITE TOPOGRAPHY
MASON COUNTY LANDFILL RI

Three or four subsurface till have been recognized in the immediate Site vicinity. The upper three tills are relatively thin and are separated by thick outwash deposits. A conceptual model of the regional geology near the Mason County Landfill is depicted in Figure 4.

II. Site History and Enforcement Activities

A. Site History

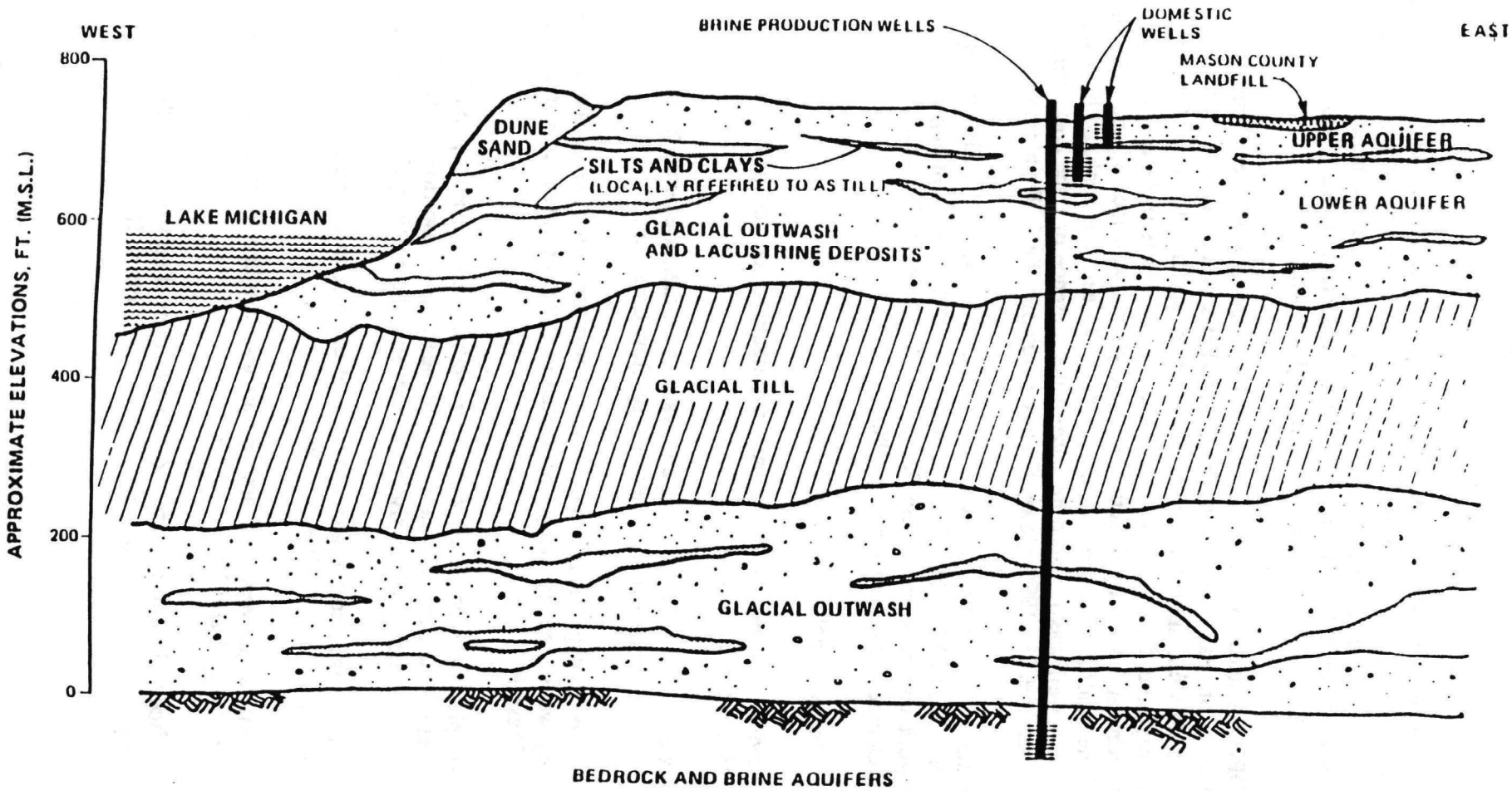
The Site property was originally owned by Edward Dains when it was selected for use as a sanitary landfill by the Mason County Department of Public Works (DPW). In 1971, Mason County DPW leased the property from Mr. Dains and subsequently entered into an agreement with Acme Disposal to operate the landfill. Mr. Dains was hired by Acme Disposal as a sanitation Engineer to oversee the daily operations of the landfill from 1972 until 1978. The Michigan Department of Public Health (MDPH) approved Acme's Solid Waste Disposal Area license in 1971 with the stipulations that no refuse be disposed of below the 710 foot elevation mean sea level, that the final cover contain at least twenty-percent clay, and that monitoring wells be installed. The original Site topography is in Figure 3. In 1973, landfill licensing and oversite were transferred from the MDPH to the Michigan Department of Natural Resources (MDNR). The MDNR documented that the slurry and sludge wastes from local industries, were being dumped at the landfill, allowed to dry, and then covered. The Site's license was renewed annually through 1977; it was closed in August 1978 when it reached capacity. Public concerns over the water quality in nearby Iris Creek prompted the Mason County DPW and the MDNR to review closure activities.

In 1981, two property owners filed suit against Mason County. One, a neighbor, alleged that the landfill run off had damaged property and deteriorated the groundwater quality, while the other, the owner of the landfill property, alleged there had been a breach of contract regarding the property lease agreement with the Mason County DPW. As part of the settlement with both parties, Mason County purchased both properties and is currently the owner of the landfill property.

In 1983, the Mason County DPW received a grant from the State of Michigan for improvements to the landfill. A clay cap was completed and berms and storm drains were constructed to improve Site drainage (Figure 5). Two surface aerators were installed in Babbin Pond to help aerate the pond and facilitate biodegradation of organic matter. Fifteen gas vents were placed into the top of the landfill.

B. Past Studies

Site studies and investigations, previous to the formal EPA Remedial Investigations at the Mason County Landfill, began in 1971 with a preliminary evaluation of the landfill Site and have continued through the Site closure work completed by the Mason County DPW in 1984-85. The EPA Field Investigation Team (FIT) inspected the landfill Site in May 1982, sampling and analyzing the existing monitoring wells. After the FIT data was evaluated the



–NOT TO SCALE–

FIGURE 4

Site was assigned a ranking system score of 34.18, a score high enough to qualify it for inclusion on the National Priority List (NPL). This score was given because of the presence in groundwater of ethyl-benzene, pentachlorophenol, trichloroethene, 1,2 trans-dichloroethene, and 1,1-dichloroethene and the associated toxicity and persistence of these compounds. The Site was put on the final NPL in 1982.

The MDPH replaced S. Dains's and May's residential wells (see Figure 5) in September 1987 because of health risks identified by MDPH sampling done in the fall of 1986. S. Dains's old well, approximately 400 feet from the landfill and screened at a depth of 130 feet, was replaced by a well 348 feet deep. The well was replaced because of the presence of 2-butanone and 4 methyl-2-pentanone. May's old well located approximately 1,200 feet north of the landfill and screened at a depth of 60 feet, was replaced by a well 218 feet deep. The old May well was replaced because of the presence of trace concentration of tetrachloroethane. In 1990 Mason County purchased the S. Dain's property.

A Remedial Investigation (RI) at the Site was conducted by the EPA through the use of its contractor, CH2MHill. The RI consisted of two phases or sampling events. Phase I of the RI fieldwork was conducted from September to November 1986 and Phase II was conducted between October 1987 and January 1988.

The RI at the Site included the following:

1. Review, and evaluation of past investigations as well as historical practices and other records relating to the Site. (RI Phase-I)

2. Extensive aquifer sampling and water level measurements (in both the upper and lower aquifers) to determine groundwater quality, flow directions

3. An electromagnetic geophysical survey was conducted to evaluate whether existing landfill monitoring wells were properly- positioned to interpret potential plumes originating from the Site. (RI Phase I)

4. Samples were collected within the wetland, Babbin Pond, and Iris Creek to define the Site's effect on the surface waters and sediment. The base flow in Iris Creek was determined to help estimate groundwater discharge rates into the creek. (RI Phase I and II)

5. Soil borings and the gama logging of existing monitoring wells was conducted to help define the geology of the Site. (RI Phase-I and II)

6.The Site's gas vents and ambient air was sampled to determine the Site's impact on air quality. (RI Phase I and II)

7. Surface soil samples were taken to determine if erosion along the northern side of the Site presents a pathway of contaminant migration. (RI Phase II)

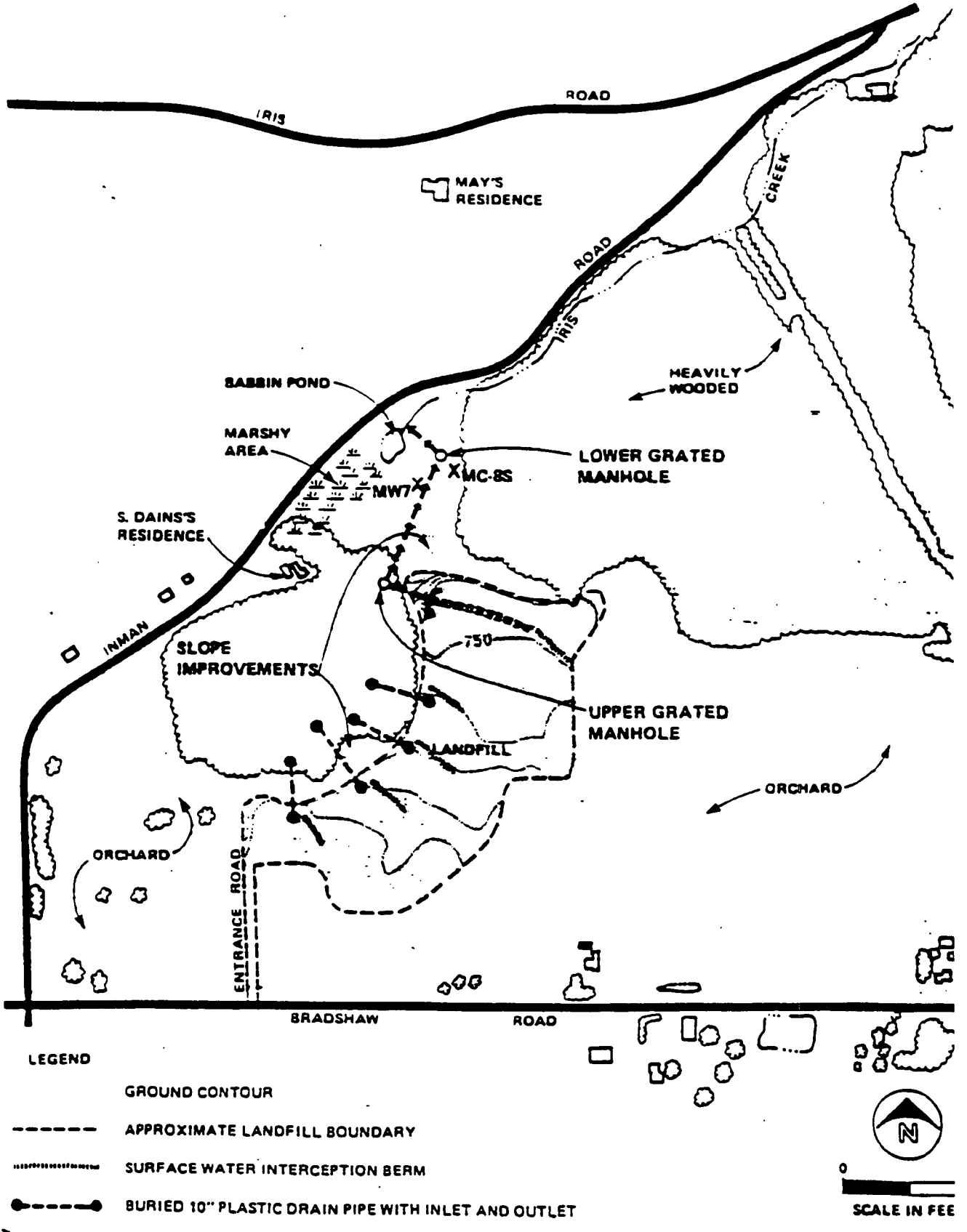


FIGURE 5
SITE IMPROVEMI
OF 1982 AND 19

The results of the RI are detailed in the RI Report (July 1988). The Site Feasibility Study (FS) was completed in July 1988. The FS documents in detail the development and evaluation of an array of remedial action alternatives for the Mason County Landfill Site. A summary of the physical and chemical characteristics of the Site from the Phase I and II investigation are discussed below.

The upper aquifer - Thirteen monitoring wells and four residential wells were screened in the upper aquifer at the time of the study. Fourteen volatile organic compounds (VOCs) and ten semi-volatile organic compounds (SVOCs) were detected in the five downgradient monitoring wells within 400 feet of the landfill.

In general, the target compound list (TCL) or priority pollutant compounds that can be attributed to the landfill were predominantly VOCs. Six chlorinated volatile hydrocarbons were detected in at least one phase of the remedial investigation at concentrations ranging from 1 to 59 parts per billion (ppb). The highest concentration (59 ppb of 1,1-dichloroethene) was detected at MW1, during Phase I (refer to Figure 8 for all residential and monitoring well locations). 1,1-dichlorothene was not detected in Phase II, and only chloroethane, 1,1-dichloroethane, and tetrachloroethane were detected in both Phase I and Phase II. Benzene, ethylbenzene, xylene, 2- butanone, and 4-methyl-2-pentanone were found in both phases in concentrations ranging from 2 to 300 ppb. Toluene and 2-hexanone were detected only during Phase I at MW1 with concentrations of 75 and 19 ppb, respectively.

The concentrations of iron, manganese, and sodium were at least one order-of-magnitude above upgradient levels in MW1, MW3, and MW7 for both investigative phases. These wells are located within 400 feet of the landfill.

The lower aquifer - Seven monitoring wells and seven residential wells are screened in the lower aquifer in Phase I, no TCL organic contaminants were detected in the three residential wells and therefore these wells were not sampled in Phase II. During Phase I, five VOCs and three SVOCs were detected in RW06. The State of Michigan replaced RWO6 (screened at about 130 feet below ground surface) with a new well screened at about 365 feet, and no TCL organic contaminants were detected in that new well during Phase II. RW10 was also replaced between Phase I and Phase II. That well and all other residential wells screened in the lower aquifer did not contain organic contaminants.

Trace concentrations of five VOCs were detected in two of the three monitoring wells located along Inman Road. Benzene and tetrachloroethene were detected in MC3D and MC4D at concentrations of 2 ppb and 1 ppb, respectively. The other compounds detected in at least one of these wells are 1,1-dichloroethane (1 ppb), 1,2-dichloroethene (2 ppb), and trichloroethene (1 ppb). These results suggested that Site-related organic contaminants are being transported into the lower aquifer.

Manganese was detected at levels one order-of-magnitude greater than upgradient levels in MC4D and RW06 (Phase I). This is consistent with organic data indicating that contaminants are migrating to the lower aquifer.

C. Current Site Status

A Resource Conservation and Recovery Act (RCRA) subtitle C compliant soil/clay cap as directed by the September 1989 interim ROD for the landfill operable contents (disposed refuse), began construction on November 13, 1990 and was completed September 23, 1991 by Mason County. Institutional controls along with deed restrictions were enacted in late 1991 at the Site by Mason County. Groundwater monitoring (Phase III) for the site began October 9, 1989 and semi-annual sampling has been performed by EPA since that time. During the week of October 18, 1991, Mason County installed four new monitoring wells at the site. The new wells are numbered 22 through 25 and are located on the north side of the landfill. (see Figure 8). Monitoring well 23 was screened in the deep aquifer, and all other wells were screened in the shallow aquifer. Dedicated submersible pumps were installed in each monitoring well in November 1991.

D. CERCLA Enforcement

Notice letters informing potentially responsible parties (PRPS) of their potential liabilities and offering them the opportunity to perform the RI/FS were mailed via certified mail in August of 1985 to six PRPS, including the Site's owners, operators and waste generators. On September 6, 1985, the EPA decided to use Federal funds to conduct the RI/FS due to the PRPs refusal to participate. The EPA, contracted with CH2M Hill to conduct the RI/FS under contract number 68-01-7251, work assignment number 0065LE3.0.

Negotiations for the remedial design/remedial action (RD/RA) with the PRPs were conducted but no settlement was reached. On April 10, 1989 a Unilateral Administrative Order pursuant to 106 of CERCLA was issued to Mason County to perform the RD/RA for the clay cap. On April 24,1991, a complaint was filed by the Department of Justice against Straits Steel and Wire and was later amended to include Citation Walther for past costs associated with the project. The litigation is currently on-going.

III. Highlights of Community Participation

A RI/FS public hearing was held on November 13, 1986 to inform the local residents of the Superfund process and the work to be conducted under the RI. No major issues were raised by the community at this meeting.

An information repository has been established at the Ludington Library, at 217 E. Ludington in Ludington, Michigan. According to Section (113)(k)(1) of CERCLA, the Administrative Record is available to the public at the Ludington Library.

The draft FS and the interim action Proposed Plan were available for public comment from August 8, 1988 to August 31, 1988. A public meeting was held on August 17, 1988 to present the interim action Proposed Plan and FS. Comments received during that Public comment period and the U.S. EPA's responses are included in the Responsiveness Summary of the interim ROD.

A fact sheet informing the community that the landfill cap construction was expected to begin and explaining the on-going monitoring program at the Site was distributed in December of 1990. The Proposed Plan for the final action at the Site was released to the public on August 6, 1993. The Technical Memorandums, 1 through 7 upon which this decision is based, were made available in both the Administrative Record and the information repository.

A public comment period was held from August 9 through September 7, 1993. A public meeting was held on August 25, 1993 to present the results of the technical memorandums and the preferred alternative as presented in the Proposed Plan for this final action. All significant comments which were received by EPA prior to the end of the public comment period, including those expressed verbally at the public meeting, are addressed in the Responsiveness Summary, which is attached to this Record of Decision. The provisions of Sections 113(k)(2)(i-v) and 117 of CERCLA have been satisfied.

IV. Scope of Response Action

The Mason County Landfill Site has been divided into two operable units: one to control the contaminant source areas, which was addressed in the September 1988 interim ROD which required construction of a RCRA compliant subtitle C clay cap, and the groundwater. The interim ROD also required continued monitoring and to evaluate the effect of the clay cap on the groundwater prior to and after construction. Residential and monitoring well results after construction of the clay cap for three rounds of sampling shows a decrease in the contamination observed from sampling prior to construction of the clay cap. This decision addresses the groundwater operable unit. The selection of No Action with long term monitoring will allow further evaluation the clay cap's effect on the groundwater and ensure risk to human health remains protective.

V. Summary of Site Characteristics

The 1988 ROD required further monitoring for the groundwater operable unit. EPA began semi-annual sampling in October 1989 and the last sampling round was completed May 1993 (Round 8). Round 7 results, conducted October 1992 are the most recent results available when the proposed plan was written. The nature and the extent of contamination for Sampling Rounds 1 through 7 are presented in Technical Memorandums, Phase III, Rounds 1 through 7 and summarized in the following sections.

A. Hydrogeologic Characteristics

Two aquifers have been identified at the Site. The potentiometric surfaces of the upper and lower aquifers were determined using water level measurements taken in December 1987 (Figures 6 and 7). The hydraulic gradients and hydraulic conductivities of each aquifer are summarized as follows:

	Hydraulic Conductivity (cm/s)		Hydraulic Gradient (ft/ft)
	Range	Logarithmic Average	Range
Upper Aquifer	5.0×10^{-4} to 8.7×10^{-3}	2.5×10^{-3}	0.040 to 0.064
lower Aquifer	6.1×10^{-3} to 2.4×10^{-3}	4.4×10^{-3}	0.018 to 0.310

The upper aquifer is unconfined and possibly perched above the subsurface till units as evidenced by large head differentials between the two aquifers. The till units are thin and possibly discontinuous on the north side of the landfill. The outwash deposits overlying the till units have interlayered seams of silt and/or clay. The tills and clay/silt seams retard groundwater flow from the upper aquifer to the lower aquifer. This subsurface condition combined with recharge (including potential recharge from the nearby pump-storage reservoir) could produce perched conditions.

Water from the upper aquifer percolates downward to recharge the lower aquifer. Downward percolation is controlled by the thickness and permeability of the intervening till units and clay/silt seams. There may be areas where the intervening layers are missing, which would allow a larger quantity of water to percolate downward to the lower aquifer. Groundwater in the upper aquifer flows generally to the northwest and discharges into the wetlands, Babbin Pond and Iris Creek (see Figure. 6). Water level measurements during Phase III, Rounds 3,4,5 and 6 had shown the upper aquifer to have a north to northeast component.

In the lower aquifer both confined and unconfined conditions exist. The potentiometric surface in the lower aquifer is higher than the till unit along Inman Road, indicating a confined condition. East and south of the landfill, a 20 to 40-foot thick unsaturated zone of sand lies between the water surface in the lower aquifer and the till unit, indicating an unconfined condition.

Groundwater flow in the lower aquifer trends toward the northwest (see Figure 7) and eventually discharges to the Pere Marquette Lake and River and Lake Michigan. According to well logs from local brine wells owned and operated by Dow Chemical, the aquifer is underlain by a

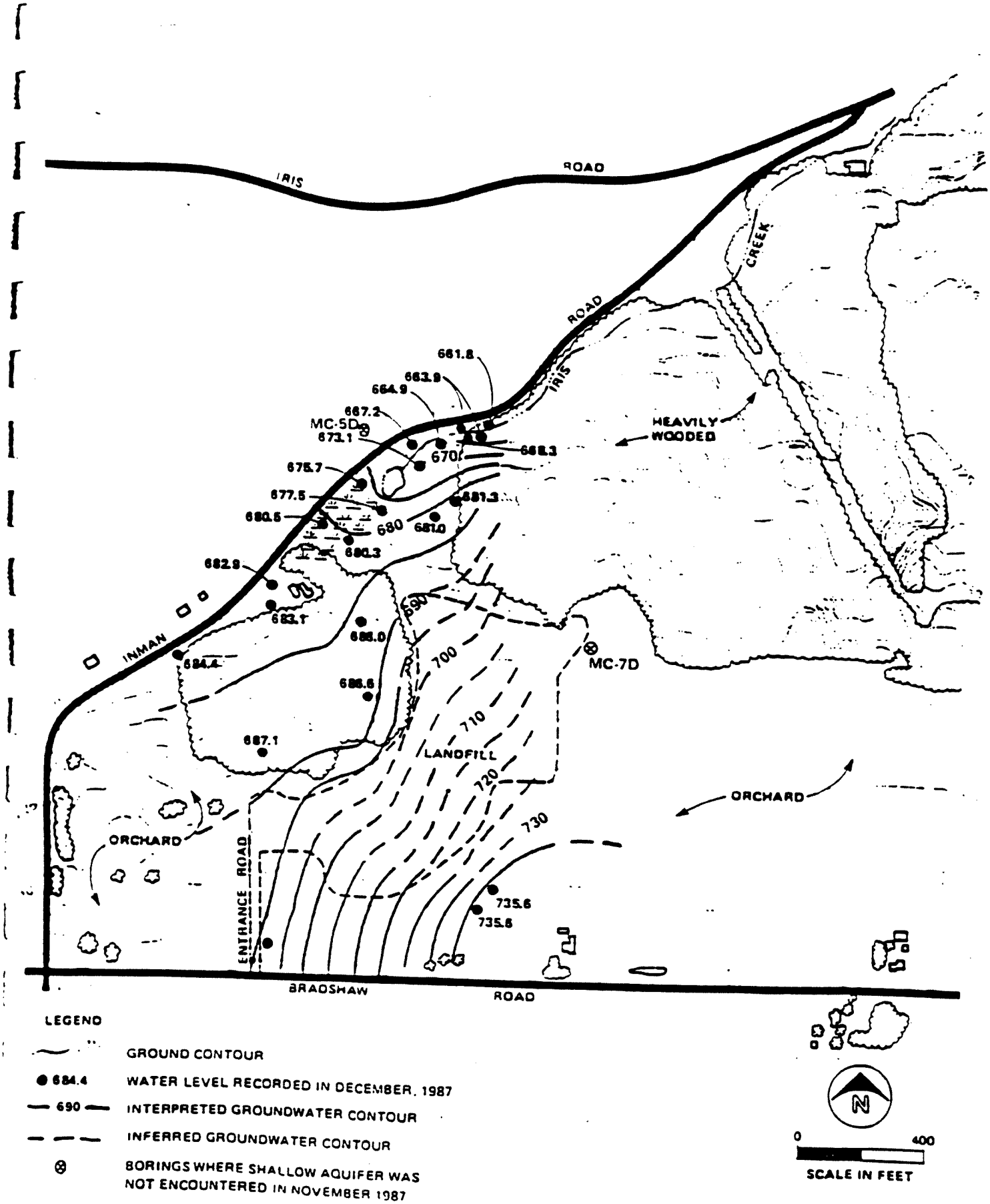


FIGURE 6
UPPER AQUIFER

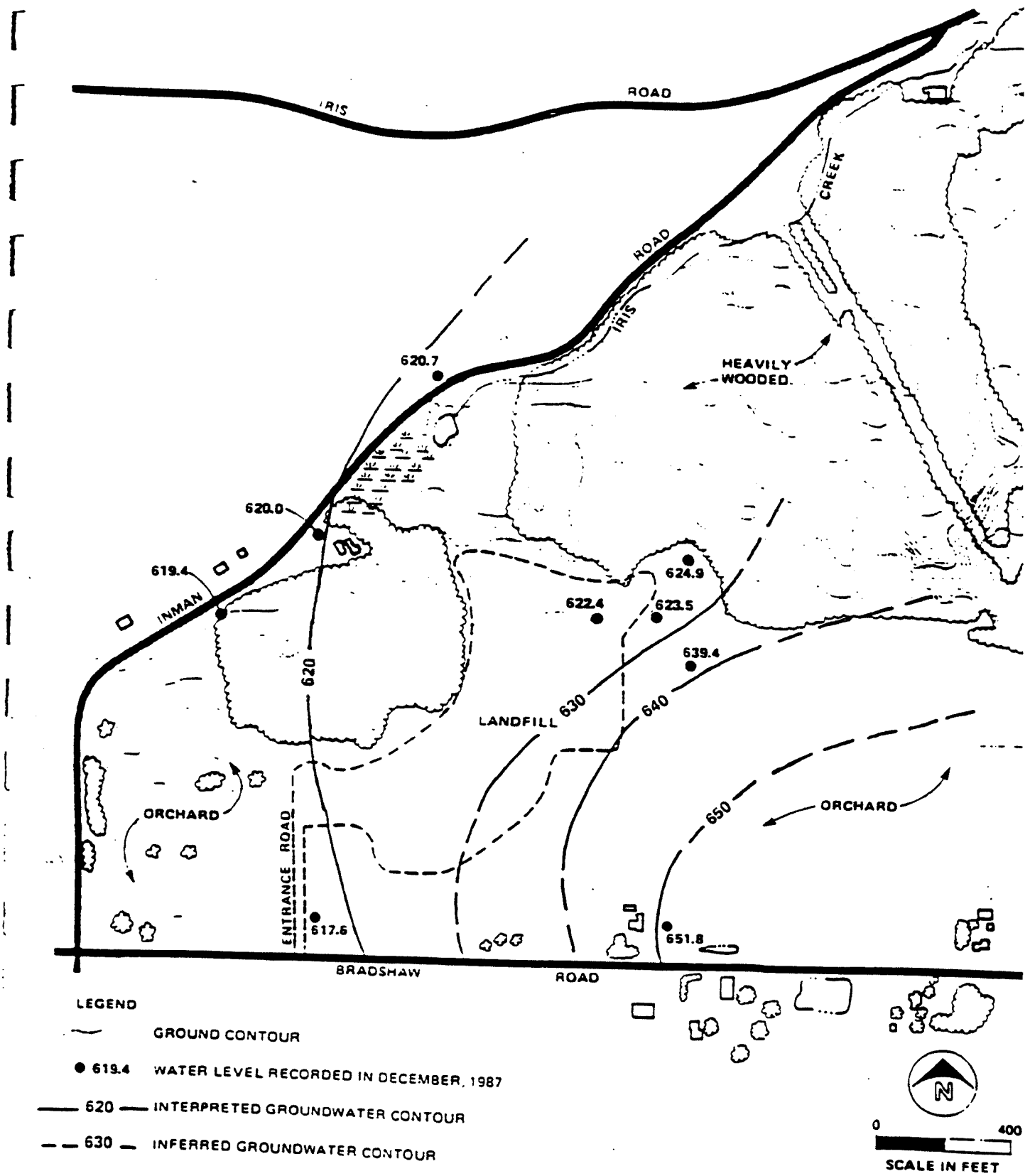
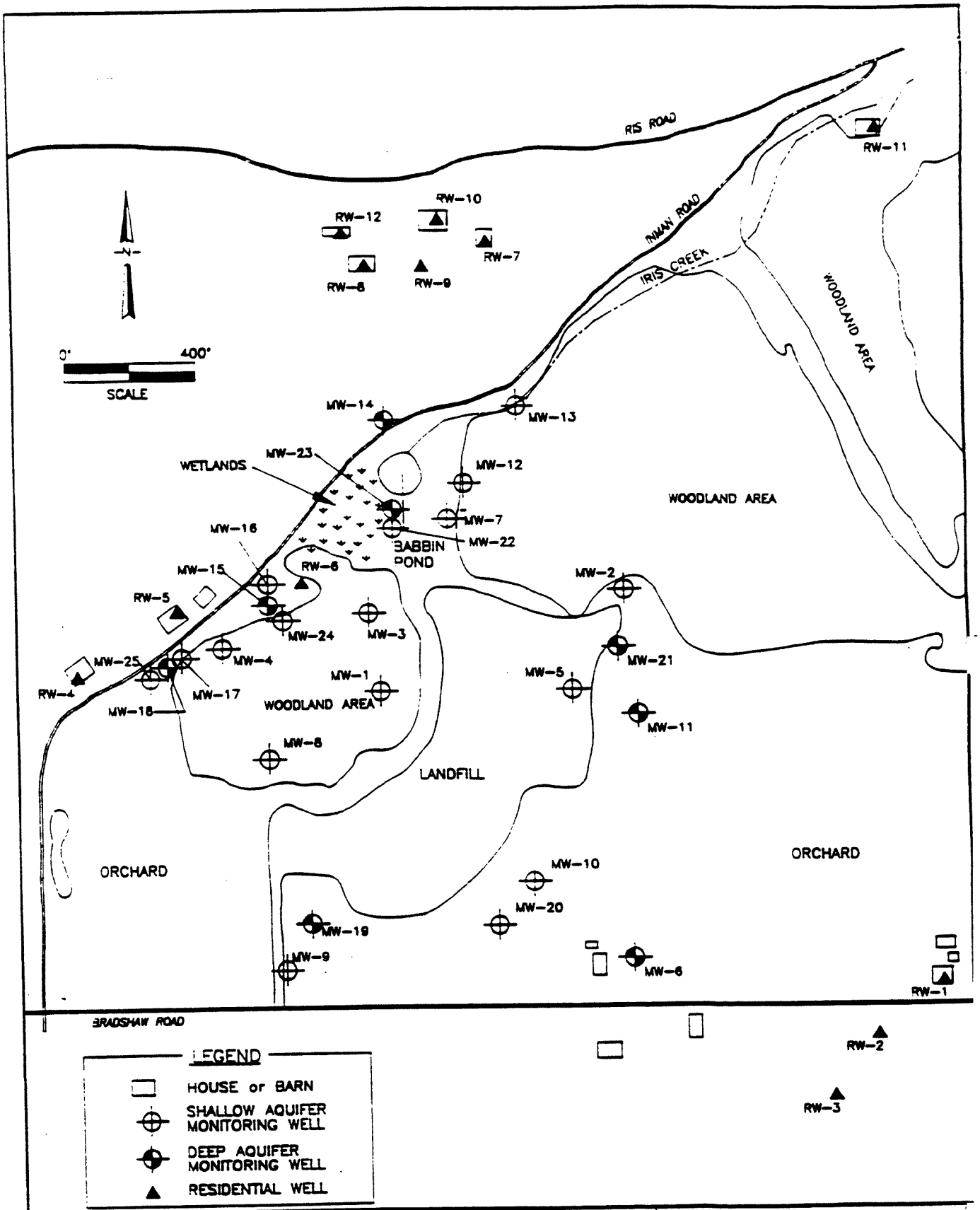


FIGURE 7
LOWER AQUIFER
POTENTIOMETRIC SURFACE



ALTERNATIVE REMEDIAL CONTRACTING STRATEGY
U.S. EPA CONTRACT No. 68-W8-0089
WORK ASSIGNMENT No. 044-5LE3
DOCUMENT CONTROL No. 4500-44-AGTA

FIGURE 8

LOCATIONS OF MONITORING & RESIDENTIAL WELLS
MASON COUNTY LANDFILL
Ludington, Michigan

1499

massive till unit (see Figure 4). The exact thickness of the lower aquifer at the Mason County Landfill Site is unknown.

Surface Water - The Site lies within the Pere Marquette River watershed. Surface water units near the Site include a wetland area at the base of the landfill that discharges to man-made Babbin Pond, which in turn discharges to Iris Creek. Since no upslope stream feeds the wetland area, the wetland area forms the headwaters of Iris Creek.

Iris Creek flows for about one mile through a series of small ponds and eventually discharges to the Pere Marquette River just west of Highway 31 (see Figure 2).

Surface runoff from the landfill cap discharges directly into Iris Creek. Other surface runoff from the landfill is channeled to the north through riprap lined ditches that lie on the side slopes of the landfill (see Figure 9).

The wetland area is a local discharge area for groundwater that covers approximately 0.8 acre. Babbin Pond covers approximately 0.1 acre and contains about 200,000 gallons of water.

B. Residential Wells

Prior to the installation of the upgraded clay cap, low levels (generally 1 to 2 ppb) of one or two organic chemicals were periodically detected in some of the residential wells, and lead was detected in two residential wells at concentrations from 2 to 5 ppb, with a maximum detection in one well of 23 ppb (Table 1). After the landfill cap was repaired and upgraded however, no organic contaminants were detected in any of the residential wells, and lead was only detected in the two residential wells in one of three sampling events (Round 6) at concentrations of 4 to 5 ppb. Lead had not been detected in either of these residential wells during the previous round of sampling, nor was lead detected in subsequent sampling. The levels of lead detected during this one sampling event are well below the level considered safe for humans to drink (the Action Level set by EPA under the Safe Drinking Water Act for lead is 15 ppb at the tap), and may be the result of lead in indoor plumbing rather than contamination from the landfill. In addition, lead was also detected in shallow and deep wells located upgradient of the landfill (MW-9 and MW-19) at maximum concentrations of 38 and 52 ppb, and may be the result of naturally occurring deposits of lead or some source other than the landfill.

C. Monitoring Wells

The results of on-site groundwater monitoring indicate that the landfill cap is effective in reducing the amount of contamination reaching the groundwater, resulting in a reduction of the number and levels of chemicals present in groundwater. As illustrated in Table 2, prior to the construction of the upgraded cap a variety of chemicals including volatile, semivolatile and inorganic compounds were detected in several site wells, some at levels exceeding the Maximum Contaminant Level (MCL) set by U.S. EPA under the Safe Drinking Water Act, (benzene, antimony, cadmium, chromium, lead and nickel). After the landfill cap was repaired and

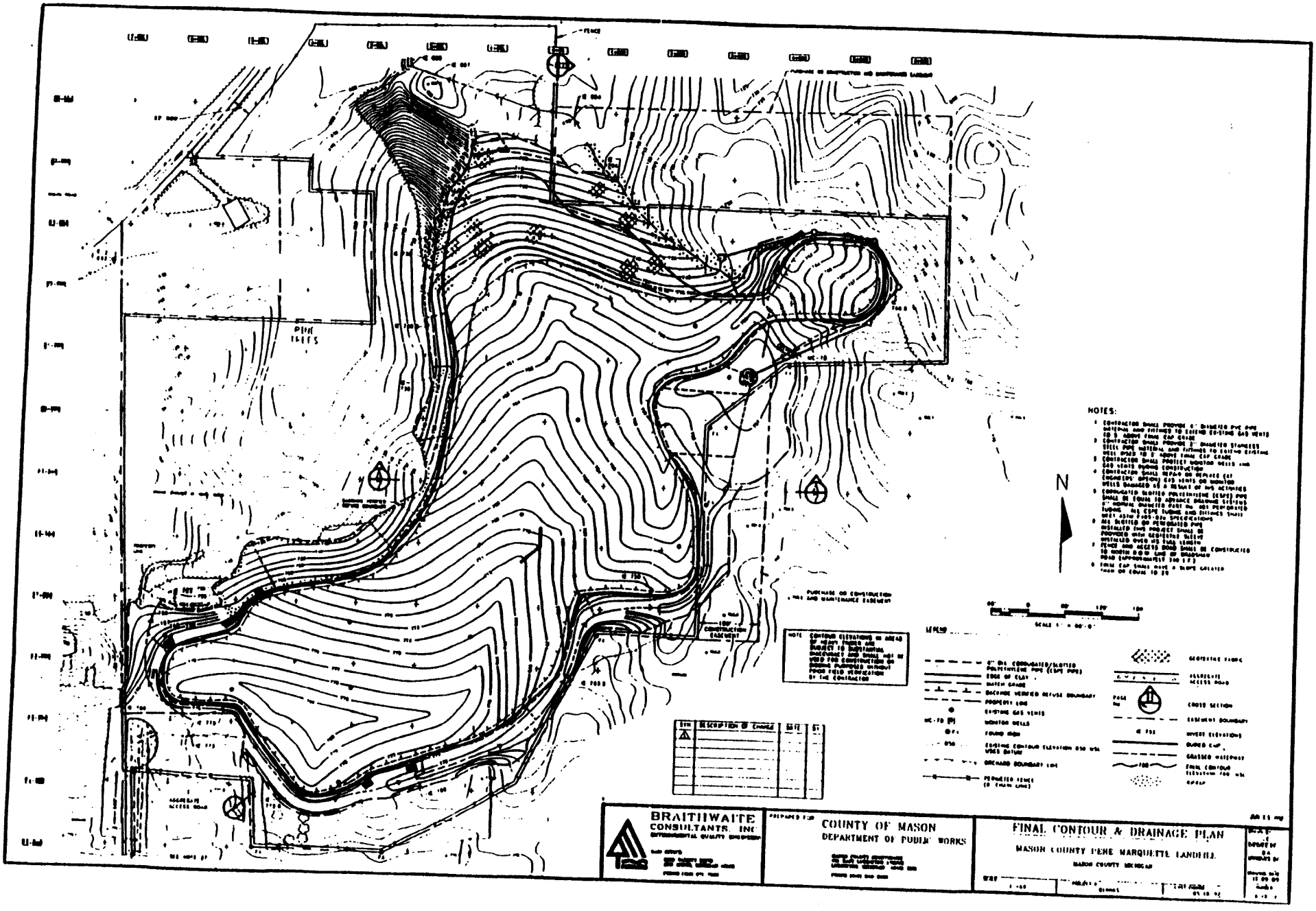

NOTES:
N
BRAITHWAITE
CONSULTANTS, INC
COUNTY OF MASON
DEPARTMENT OF PUBLIC WORKS
FINAL CONTOUR & DRAINAGE PLAN
MASON COUNTY PERE MARQUETTE LANDFILL
MASON COUNTY MICHIGAN

TABLE 1
CHEMICALS DETECTED IN RESIDENTIAL WELLS BEFORE AND AFTER NEW LANDFILL COVER

BEFORE NEW LANDFILL COVER					AFTER NEW LANDFILL COVER			
	DETECTED CONCENTRATIONS		SAMPLING		DETECTED CONCENTRATIONS		SAMPLING	
CHEMICAL	*(ppb)*	*WELLS*	*ROUND*		*(ppb)*	*WELLS*	*ROUND*	*MCL*
VOLATILES (VOCs)								
Acetone	1	RW-5	4		ND	-	-	*
2-Butanone	3-10	RW-5,6, 12	3		ND	-	-	*
Chloromethane	1-2	RW-4,7	2		ND	-	-	*
Methylene Chloride	1-2	RW-4,5, 8,9,10 12	4		ND	-	-	*
Toluene	1-2	all wells except RW-11	3,4		ND	-	-	1,000
INORGANICS								
Lead	2-26	RW-4,6, 7,8	1,2,3,4		4-5	RW-7,8	6	15

NOTES: Includes seven rounds of residential well sampling; Rounds 1-4 before new landfill cover, Rounds 5-7 after new cover.
MCL is Maximum Contaminant Level set by U.S. EPA under Safe Drinking Water Act.
* indicates MCL not available.
ND indicates "Not-Detected".

TABLE 2
CHEMICALS DETECTED IN SITE MONITORING WELLS
BEFORE AND AFTER NEW LANDFILL COVER

BEFORE NEW LANDFILL COVER			AFTER NEW LANDFILL COVER			
	DETECTED CONCENTRATIONS		DETECTED CONCENTRATIONS		MAXIMUM BACKGROUND CONCENTRATION	
CHEMICAL	*(ppb)*	*WELLS*	*(ppb)*	*WELLS*	*(ppb)*	*MCL*
VOLATILES (VOCs)						
Acetone	2	MW-16	ND-6	MW-15	10	*
Benzene	2-14	MW-1,3,7,8	2-12	MW-1,7	4	5
2-Butanone	21	MW-16	ND	-	ND	*
Carbon Disulfide	4-180	MW-1,3,4,7, 8,12,13,14, 15,17,20	ND	-	14	*
Chlorobenzene	ND	-	1	MW-7	ND	*
Chloroethane	2-5	MW-3,7	ND	-	ND	*
Chloroform	ND	-	10	MW-14	ND	100
Chloromethane	ND	-	2	MW-7	ND	*
1,1-Dichloroethane	1-3	MW-3,7,15	ND	-	1	*
1,1-Dichloroethene	0.6-2	MW-3,7,15	2	MW-7	1	7
1,2-Dichloroethane	ND	-	ND	-	9	5
1,2-Dichloropropane	2	MW-7	2	MW-7	ND	5
Ethylbenzene	4-120	MW-1,3,7	42-78	MW-7	ND	700
Methylene Chloride	ND	-	7	MW-15	2	*
Toluene	4	MW-8	ND	-	ND	1,000
Xylene	3-260	MW-3,4,7	39-120	MW-7	ND	10,000

TABLE 2 Con't
CHEMICALS DETECTED IN SITE MONITORING WELLS
BEFORE AND AFTER NEW LANDFILL COVER

BEFORE NEW LANDFILL COVER			AFTER NEW LANDFILL COVER			
	DETECTED CONCENTRATIONS		DETECTED CONCENTRATIONS	MAXIMUM BACKGROUND CONCENTRATION		
CHEMICAL	*(ppb)*	*WELLS*	*(ppb)*	*WELLS*	*(ppb)*	*MCL*
SEMIVOLATILES (SVOCs)						
Bis(2-ethylhexyl)phthalate	0.5-180	MW-1,3,4,7, 8,15,16,17,21	0.3-79	MW-1,3,15 17,21,25	3,700	*
Butylbenzlphthalate	ND	-	1-7	MW-17,25	ND	*
4-chloro-3-methylphenol	1	MW-7	1-8	MW-7	ND	*
1,4-Dichlorobenzene	1-2	MW-7	0.8-2	MW-7	ND	*
2,4-Dimethyphenol	3	MW-7	1-5	MW-7	ND	*
Diethylphthalate	0.8-12	MW-3,7	0.4-14	MW-1,3,7, 16,20	2	*
Di-N-Butylphthalate	2	MW-16	0.1-1	MW-1,4,7, 12,13,14 23,24	8	*
Din-octylphthalate	ND	-	0.6	MW-17	*	*
Napthalene	2-4	MW-1,7	0.5-4	MW-1,7	ND	*
Phenol	5	MW-1	ND	-	1	*
INORGANICS						
Aluminum	89.5-2,730	all wells	17.28	MW-1	486	*
Antimony	20-28.5	MW-3,4,7,14	ND	-	61.4	6
Arsenic	3.7-16	MW-3,7,15	17.1	MW-7	ND	50
Barium	6.3-290	all wells	269	MW-7	835	2,000

TABLE 2 Con't
CHEMICALS DETECTED IN SITE MONITORING WELLS BEFORE AND AFTER NEW LANDFILL COVER

BEFORE NEW LANDFILL COVER			AFTER NEW LANDFILL COVER			
	DETECTED CONCENTRATIONS		DETECTED CONCENTRATIONS		MAXIMUM BACKGROUND CONCENTRATION	
CHEMICAL	*(ppb)*	*WELLS*	*(ppb)*	*WELLS*	*(ppb)*	*MCL*
Cadmium	3.8-6.9	MW-8,12,17,21	7.2	MW-3	ND	5
Chromium	5.6-169	MW-17,20,21	10.5-56	MW-23	27.8	100
Cobalt	12	MW-3	ND	-	ND	*
Copper	2.1-26.1	MW-3,7,8, 16,17,20, 21	26.1	MW-21	31.7	1,300
Lead	2.1-83.3	MW-1,3,8, 17,21	3.8-13.2	MW-1,3,8 20	52.1	15
Manganese	1.7-2,670	MW-1,3,7,12 13,15,16,21	1.1-2,680	MW-1,3,7, 12,13,16	ND	*
Mercury	ND	-	0.24-2.5	MW-1,12, 13,15,20 21,24	ND	2
Nickel	17.9-129	MW-17,21	ND	-	ND	100
Silver	4.3	MW-3	12	MW-1	ND	*
Vanadium	ND	-	4-4.8	MW-1,16	ND	*
Zinc	20.1-6,110	all wells except MW-13,17	21.3-927	MW-1,3,4, 7,8,12,16, 17,20,21	5,030	*

NOTES: Does not include chemicals due to laboratory contamination.
Maximum background concentration from upgradient wells MW-9 and MW-19.
MCL is Maximum contaminant Level set by U.S. EPA under Safe Drinking Water Act.
* indicates MCL not available.
ND indicates "Not Detected".

upgraded however, many contaminants were no longer detected in the groundwater, or were only detected sporadically at limited well locations and at concentrations generally below those previously detected. Three chemicals, including benzene (MW-7, Round 7), cadmium (MW-3, Round 6) and mercury (MW-15, Round 7) were detected at concentrations above the MCL, however these chemicals were not detected consistently in these wells, and were only detected in one of the last three rounds of sampling.

D. Contaminant Migration

Population areas that could be affected if exposed to contamination migrating from the landfill in groundwater or from groundwater discharging to the wetland and Iris Creek include residents that reside north of the landfill. Environmental areas include the wetland area, Babbins Pond, and Iris Creek, north of the site. The RI modeled the contaminant load necessary for benzene and xylene to exceed MCLs at the site boundary. The results of the modeling concluded that extremely large volumes (in the range of millions of gallons) of pure product would be needed in the landfill to exceed MCLs at the site boundary for a one time release. The modeling suggests that a constant and continuous source of 7×10^{-4} gallons per day of benzene and 2×10^{-3} gallons per day of xylene added to the aquifer over a 6-year period would be required to exceed the MCL at the site boundary. These results indicate that a slug of contamination (e.g., a drum rupture) is unlikely to cause an exceedance of MCLs at the site boundary because of the large volume of contaminants needed.

VI. Summary of Site Risks

A. Human Health Risk

Within the RI, a Risk Assessment chapter detailed a baseline risk assessment that addressed the potential threats to public health and the environment from the Site associated with the no action-alternative for the Site.

The RI report further details the baseline assessment for the Site and the baseline indicated the following major area of concern:

> The use of groundwater from wells located between the landfill and Iman Road may result in adverse health effects. This concern comes from the detection of carcinogens in monitoring wells at concentrations greater than those associated with a 1 x 10-7 excess lifetime cancer risk, the presence of noncarcinogens at levels higher than those needed to exceed reference dose values, and the presence of two chemicals (benzene and 1,1-dichloroethene, 11 ppb and 59 ppb) at levels that exceed MCLs.

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 $(mg/kg\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in 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.

Reference doses (RfDs) have been developed by U.S. EPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of 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 chemical 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 assure that the RfDs will not underestimate the potential for adverse non carcinogenic effects to occur.

Excess lifetime cancer risks are determined by multiplying the intake level with the cancer potency factor. These risks are probabilities that are generally expressed in scientific notation (e.g., $1x10^{-6}$). An excess lifetime cancer risk of $1x10^{-6}$ indicates that, as a plausible upper bound, an individual has a one in a million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific conditions at a site.

The Phase III data was compared to the baseline risk assessment conducted for Phases I and II. After the landfill cap was repaired and upgraded many contaminants were not detected in the groundwater or at concentrations below those previously detected. For the two chemicals which resulted in an exceedance of the risk range of 10^{-4} and 10^{-6} during Phase I or Phase II sampling, 1,1-dichloroethene was observed only once in MW-07 at the concentration of 2 ppb (Round 7) and benzene was detected in MW-1 (2 ppb, Round 7), MW-07 (12 ppb, Round 7), and MW-09 (4 ppb, Round 7). The MCLs for these two contaminants are 7 and 5 ppb respectively. The MCL was exceeded only once, for benzene at MW-07, Round 7. The only other exceedance of an MCL occurred for cadmium. The MCL is 5 ppb and the highest concentration detected was 7.2 ppb.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the hazard quotient (HQ) (or the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminants reference dose). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably 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 or across media.

The combined noncancer HI using average concentrations during the Phase I investigation for lead, manganese, xylenes, and zinc for children drinking monitor well water was 3.5. The combined HI for Phase II was 0.5. Phase III monitor well data is not significantly different than Phase II data and the HI is likely to be less than 1.0.

As the groundwater beneath the site is not used as a drinking water supply, the risks due to on-site groundwater are considered potential future risks. Any future exposure to on-site groundwater is also unlikely, as deed restrictions prohibit the installation of drinking water wells on the property.

B. Ecological Risks

The RI concluded that environmental impacts were limited due to the low levels of contamination and the shallow creek depth. Chronic water quality criteria was exceeded for iron, lead, and copper during Phase III, Round 7 sampling in the creek, although due to the lack of fish in the creek and its shallow nature no ecological risk exists.

VII. Description of Alternatives

In addition to addressing landfill contents, the FS and interim action ROD also identified and evaluated alternatives to address threats and/or potential threats from contaminated groundwater. The alternatives that were evaluated to address contaminated groundwater include:

A. Alternative 1 - No Action, Continue Groundwater Monitoring.

Under this alternative approximately 8 residential wells, and 20 existing on-site groundwater monitoring wells, would continue to be sampled and analyzed on an annual basis for volatile, semivolatile and inorganic compounds. Groundwater monitoring would be conducted for up to 30 years to ensure the upgraded landfill cap continues to be effective in reducing the amount of contamination reaching the groundwater, thus eliminating or continuing to reduce chemical concentrations in groundwater to an acceptable level, and to monitor the water quality of nearby residential wells to ensure that residents are not exposed to unacceptable levels of contaminant concentrations. The estimated cost of this alternative is $0.5 million.

B. Alternative 2 - Groundwater Collection and Treatment

Under this alternative an on-site water treatment plant would be constructed and approximately 10 extraction wells would be constructed to collect the groundwater. Groundwater treatment would occur using precipitation and settling tanks, followed by granular activated carbon adsorption. Sludges that accumulate would be collected, solidified and disposed of at an appropriate off-site landfill. Treated groundwater would be discharged by pipeline to Iris Creek. The estimated capital cost for this alternative is $4,270,000 and the O&M cost is $416,000. The estimated total present worth cost of this alternative is $12,000,000.

VIII. Comparative Analysis of Alternatives

In order to determine the most appropriate alternative for the Mason County site, the alternatives were evaluated against each other. Comparisons were based on the nine evaluation criteria. The nine criteria are: 1) overall protection of human health and the environment, 2) compliance with applicable or relevant and appropriate requirements, 3) long-term effectiveness and permanence, 4) reduction of toxicity, mobility, and volume, through treatment, 5) short-term effectiveness, 6) implementability, 7) cost, 8) state acceptance, and 9) community acceptance.

A. Overall Protection of Human Health and the Environment

The long term monitoring described in Alternative 1 will provide information on whether contaminant concentrations in groundwater and surface water continue to be within acceptable

human health and environmental standards. The construction of the clay cap minimizes the amount of infiltration through the landfill contents which decreases contamination migrating into the shallow aquifer. Thus contamination is being reduced through natural attenuation. As a result of this natural attenuation, contaminates in the shallow aquifer will be reduced to levels required by MCLs in a time frame comparable to that which could be achieved through active remediation. Long term monitoring of the shallow aquifer will provide further information regarding the effectiveness of the clay cap.

Alternative 2 would remove contaminants, thereby reducing the risks from ingestion and further off-site migration.

B. Compliance With ARARs

Each alternative is evaluated for compliance with ARARS, including chemical specific, action specific, and location specific ARARS.

Because no remedial action will be performed for Alternative 1, no ARARS are applicable to the groundwater operable unit, although the following policy will be complied with:

It is the policy of EPA to evaluate the appropriate remediation of groundwater based upon EPA's Protecting the Nation's Groundwater, EPA's Strategy for the 1990's, July, 1991. Pursuant to the Groundwater Protection Strategy, the groundwater located in both the shallow and deep aquifer are classified as Class IIA groundwater. At this site, goals for Class IIA groundwater is set at the Maximum Contaminant Levels (MCLs) under the Federal Safe Drinking Water Act.

The following are ARARs that alternative 2 would comply with: the Clean Water Act for discharge to Iris Creek and the Clean Air Act and state code MAC R336.1701-.1702 for discharges to the air; spent treatment residuals if land disposed will comply with treatment standards of 40 CFR 268.41 and if regenerated, 40 CFR Part 264 Subpart X.

C. Long-Term Effectiveness and Permanence

This evaluation focuses on the results of a remedial action in terms of the risks remaining at the site after response objectives have been met. The following factors are addressed for each alternative: magnitude of remaining risk, adequacy and reliability of controls.

Alternative 1 complies with this criteria by controlling the remaining risk through monitoring to prevent residents from being exposed to unacceptable concentrations in groundwater.

Alternative 2 would slowly remove the contaminated groundwater onsite. Removing a bulk of the contamination will prevent migration towards the residential wells. It is projected that the groundwater extraction and treatment may attain the Ground-Water Cleanup Standards within 30 years or less. However, ground-water quality will need to be evaluated to determine if the remedial action objectives have been met.

D. Reduction of Toxicity, Mobility, or Volume (TMV) Through Treatment

This evaluation addresses the statutory preference for selecting remedial actions that employ treatment technologies which permanently and significantly reduce toxicity, mobility, or volume of the hazardous substances. This preference is satisfied when treatment is used to reduce the principal threats at a site through destruction of toxic contaminants, irreversible reduction of contaminant mobility, or reduction of total volume of contaminated media.

Alternative 1 will not reduce the toxicity, mobility, or volume through treatment although treatment will occur through natural attenuation. Alternative 2, by removing and treating the groundwater, will reduce the toxicity and the mobility of the groundwater plume as well as the volume of the plume.

E. Short-Term Effectiveness

This evaluation focuses on the effects to human health and the environment which may occur while the alternative is being implemented and until the remedial objectives are met. The following factors were used to evaluate the short term effectiveness of each alternative: protection of the community during remedial actions, protection of workers during remedial actions, environmental impacts from implementation of alternatives, and time until remedial objectives are met.

Alternative 1 is expected to protect the community until the goal is met, and is not expected to have any effects on workers performing monitoring. Monitoring is expected for 30 years or until the goals have been met.

Construction operations associated with Alternative 2 will produce minimal disturbance to the surrounding community.

With regard to the time until remedial objectives are met Alternative 2 could be operated for 30 years but will be operated until the remedial objectives are met, which could be substantially less.

With regard to environmental impacts, Alternative 2 may result in a change in groundwater flow and will have to be monitored so that no adverse impacts result in the wetland north of the landfill.

F. Implementablity

This evaluation addresses the technical and administrative feasibility of implementing the alternatives and the availability of the various services and materials required during its implementation.

Alternative 1, monitoring, is well demonstrated and commercially available. Alternative 2 is a proven technology and is commercially available.

Administratively, none of the alternatives should pose any problems with regard to implementation.

G. Cost

This evaluation examines the estimated costs for implementing the remedial alternatives. Capital and O&M cost are used to calculate estimated present worth costs for each alternative. Alternative 1 has a capital cost of $0 and an O&M cost of $500,000. Total present worth is $500,000. Alternative 2 has a capitol cost of $4,300,000 and an O&M cost of $8,000,000. Total present worth cost of $12,000,000.

H. State Acceptance

The State of Michigan does not concur with the selection of Alternative 1. The State's comments and EPA's responses are included in the responsiveness summary.

I. Community Acceptance

Community response to the alternatives is presented in the responsiveness summary, which addresses comments received during the public comment period.

IX. The Selected Remedy

After considering the requirements of CERCLA, the detailed analysis of alternatives, and public comments, EPA has selected Alternative 1 for the final action at the Mason County Landfill which consists of continued monitoring for up to 30 years for residential wells, appropriate groundwater monitoring wells, sediment and surface water.

X. Statutory Determinations

The selected remedy must satisfy the requirements of Section 121(a-e) of CERCLA to:

A. Protect human health and the environment;
B. Comply with ARARs;
C. Be cost-effective;
D. Utilize permanent solutions and alternate treatment technologies to the maximum extent practicable; and,
E. Satisfy a preference for treatment as a principle element of the remedy.

The implementation of Alternative 1 at the Mason County site satisfies the requirements of CERCLA as detailed below:

A. Protection of Human Health and the Environment

Implementation of the selected alternative will address potential risks to human health and the environment by continued monitoring water quality to ensure that residents are not exposed to contaminated groundwater.

B. Compliance With ARARS

Section 121(d)(2) of CERCLA requires all remedial actions to attain ARARS upon completion of the remedial action. Because no remedial action will be performed, no ARARS are applicable to the groundwater operable unit.

B.1 Chemical-specific ARARS

The interim ROD stated that after closure is completed, the substantive monitoring and maintenance post closure requirements contained in Section 264.117 through 264.120 of Subpart G will be conducted.

The above regulation for post-closure requirements is relevant but not appropriate because the amount of listed hazardous waste that was disposed of in the landfill is minor in comparison to the overall waste landfilled. Therefore post-closure requirements will be in accordance with EPA's Groundwater Protection Strategy.

B.2 Action-specific ARARS

RCRA closure requirements for landfills with hazardous wastes are outlined in 40 CFR Subpart G. The interim ROD included this provision as relevant and appropriate and the landfill cap was upgraded in compliance with RCRA subtitle C requirements.

C. Cost-Effectiveness.

The selected remedy provides overall cost-effectiveness. The alternative provides protection through the use of institutional controls and allows the aquifers to achieve MCLs through natural attenuation at a cost significantly less ($500,000 vs. $12,000,000) than the active groundwater collection and treatment.

D. Utilization of Permanent Solutions, Alternative Treatment Technologies to the Extent Practicable, and Preference for Treatment as a Principal Element.

The selected remedy provides the best balance with respect to the nine evaluation criteria as described in Section VIII. Treatment technologies are not being utilized in this alternative as treatment has not been delineated to not be appropriate at this site. This alternative provides protection while being cost-effective.

E. Preference for Treatment as a Principal Element

The selected remedy does not utilize treatment as a principal element, and, therefore, does not satisfy the statutory preference for treatment. Groundwater treatment is not, at this point, necessary to provide adequate protection of human health and the environment.