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Environmental Protection
Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R05-93/242
June 1993

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Superfund Record of Decision:

Dakhue Sanitary Landfill, MN

50272-101

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15. Supplementary Notes

PB94-964122

16. Abstract (Limit: 200 words)

The 80-acre Dakhue Sanitary Landfill site is an inactive sanitary waste municipal landfill located in Hampton Township, Dakota County, Minnesota. Land use in the area is predominantly agricultural and residential. A gravel surficial aquifer, that is not a drinking water source, extends downgradient of the site. Most residents obtain their drinking water supply from nearby wells and/or a municipal water supply well located over 3 miles south of the site, both of which extract ground water from a deeper aquifer. The surficial and deep aquifers underlying the Dakhue site are thought to be hydraulically connected. From 1971, Dakhue Sanitary Landfill, Inc. owned and operated the landfill, and accepted mixed municipal and commercial waste and small amounts of industrial waste. Site operations ceased in 1988, but the landfill never received a final cover as part of the closure activities. State investigations conducted between 1983 and 1989 identified a variety of contaminants onsite in soil and ground water. EPA investigations identified elevated levels of VOCs, other organics, and inorganics in the surficial onsite aquifer, and it has been determined that the source of contamination is related to the improper disposal of municipal, industrial, and commercial waste in the landfill. The site has been divided into two OUs for remediation. A 1991 ROD addressed the source of the contamination and provided for

(See Attached Page)

17. Document Analysis a. Descriptors

Record of Decision - Dakhue Sanitary Landfill, MN
Second Remedial Action - Final
Contaminated Medium: gw
Key Contaminants: VOCs (benzene, PCE, TCE, toluene), metals (lead)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 44
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(See ANSI-Z39.18) *See Instructions on Reverse* OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

Abstract (Continued)

capping of the landfill with a final cover, as OU1. This ROD provides a final remedy for the site and addresses onsite ground water contamination, as OU2. The primary contaminants of concern affecting the ground water are VOCs, including benzene, PCE, TCE, and toluene; and metals, including lead.

The selected remedial action for this site includes allowing ground water to naturally attenuate; providing for a contingent remedy to initiate a corrective action, if monitoring results indicate that ground water downgradient of the site exceeds the surface water standards set as "trigger levels" for certain contaminants; monitoring ground water; and implementing institutional controls, including ground water use restrictions. The estimated present worth cost for this remedial action is $360,000.

PERFORMANCE STANDARDS OR GOALS:

Chemical-specific ground water cleanup goals are based on SDWA MCLs, and include benzene 5 ug/l; bis(2-ethylhexyl)phthalate 6 ug/l; 1,2-DCA 5 ug/l; 1,2-DCE 70 ug/l; 1,2-dichloropropane 5 ug/l; methylene chloride 5 ug/l (proposed MCL); 1,1,2-TCA 5 ug/l; TCE 5 ug/l; and vinyl chloride 2 ug/l. Trigger levels for the ground water contingent remedy are based on surface water exceeding the following levels, and include aluminum 87 ug/l; chromium 11 ug/l; cyanide 5.2 ug/l; iron 221 ug/l; manganese 572 ug/l; silver 0.12 ug/l; and zinc 191 ug/l.

Declaration
Record of Decision
Dakhue Sanitary Landfill
Hampton Township, Dakota County, Minnesota

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Dakhue Sanitary Landfill in Cannon Falls, Minnesota, 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 Contingency Plan (NCP). The decision is based on the Administrative Record for the Dakhue Sanitary Landfill. The attached index identifies the items which comprise the administrative record upon which the selection of the remedial action is based.

The U.S. Environmental Protection Agency has been consulted and concurs with the selected remedial action.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the remedial action selected in this Record of Decision, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF SELECTED REMEDY

This operable unit is the second for the site. The first operable unit involved capping the landfill to mitigate leachate formation. This operable unit includes the following major components:

- Institutional Controls contained in Dakota County Ordinance No. 114 and Minnesota Rules 4725.2000 and 4725.4300 which restrict well development; and

- Long term groundwater monitoring program to: (1) determine the migration of contamination; (2) assess trends in water quality in the Sand and Gravel aquifer; (3) verify that the deep aquifer is not affected; and (4) monitor contaminant levels in Judicial Ditch no. 1.

STATUTORY DETERMINATIONS

Consistent with CERCLA and, to the extent practicable, the NCP, 40 C.F.R. Part 300, the selected remedial action is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. The remedy utilizes permanent solutions and alternative treatment

technologies to the maximum extent practicable. This remedy does not satisfy the statutory preference for treatment as a principle element of the remedy. Natural attenuation of groundwater contaminants will take only slightly longer than an active treatment system and will cost less. Because this remedy will result in hazardous substances remaining on-site above health based levels, the five year review provisions of CERCLA will apply to this action.

Valdas V. Adamkus
Regional Administrator

June 30, 1993
Date

Charles W. Williams
Commissioner
Minnesota Pollution Control
Agency

June 29, 1993
Date

Record of Decision
Dakhue Sanitary Landfill
Hampton Township, Dakota County, Minnesota

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SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

Dakhue Sanitary Landfill
Hampton Township, Dakota County, Minnesota

I. SITE NAME, LOCATION, AND DESCRIPTION

Location

The Dakhue Sanitary Landfill (DSLF) is located in Hampton Township, Dakota County, Minnesota (Figure 1), off Hogan Avenue as shown in Figure 2. The Dakhue Sanitary Landfill is approximately 30 miles south of St. Paul, the state capital.

Site Description

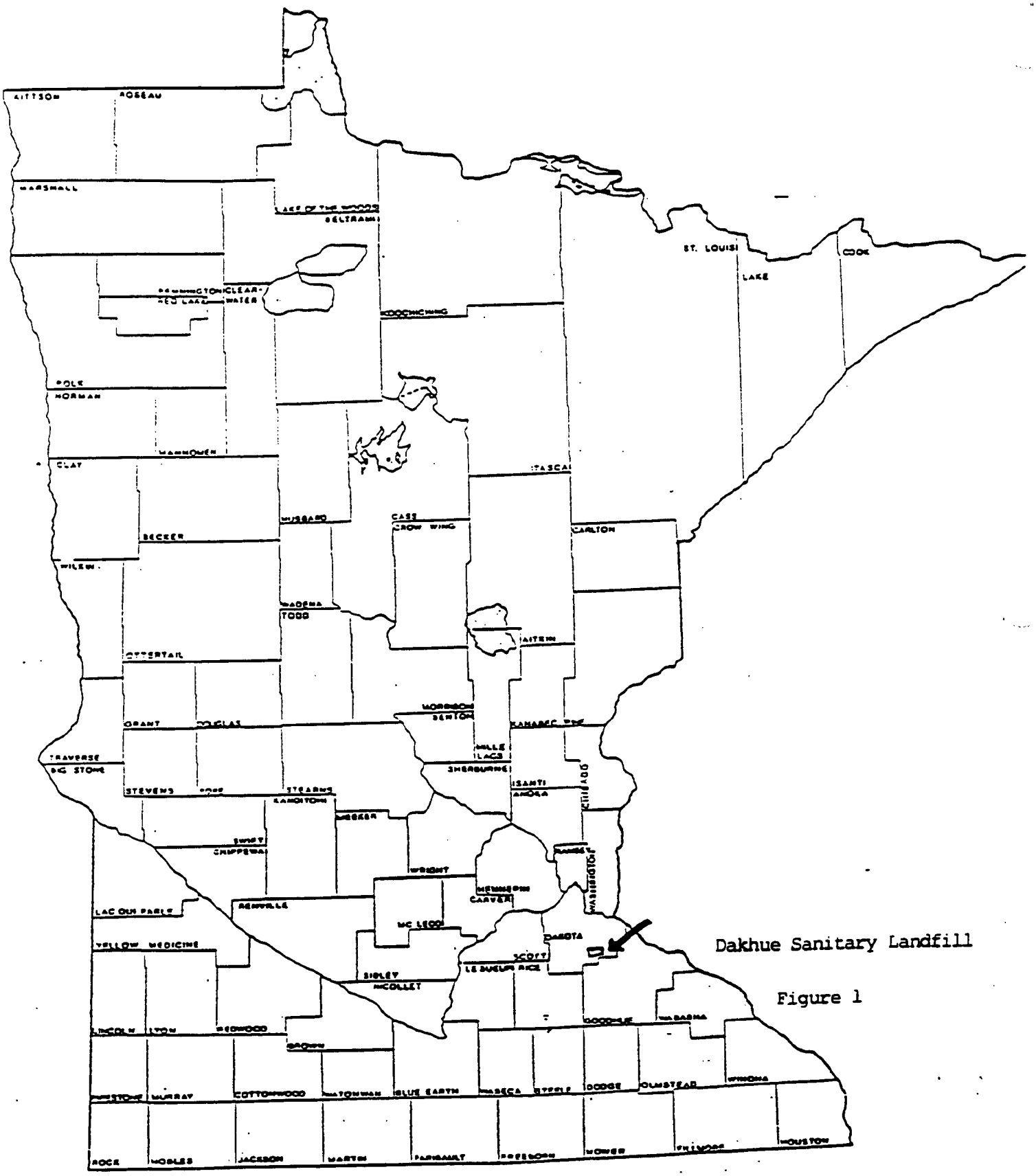
The DSLF is located in southeastern Dakota County, within the Rochester Till Plain Physiography region of Minnesota. The area of the landfill is associated with a topographic ridge trending northwest-southeast across the site. At the southern edge of the landfill the topographic ridge ends abruptly forming a series of gullies which drain into a dry creek bed. Farther to the east and south of the landfill the terrain is relatively flat, composed of open and cultivated fields.

The adjacent land is used primarily for agriculture with some residential plots intermixed.

The Dakhue Sanitary Landfill is developed over a sand and gravel water table aquifer which is present throughout the site and extends downgradient of the site. Only the bottom 20 to 30 feet of the glacial drift is saturated.

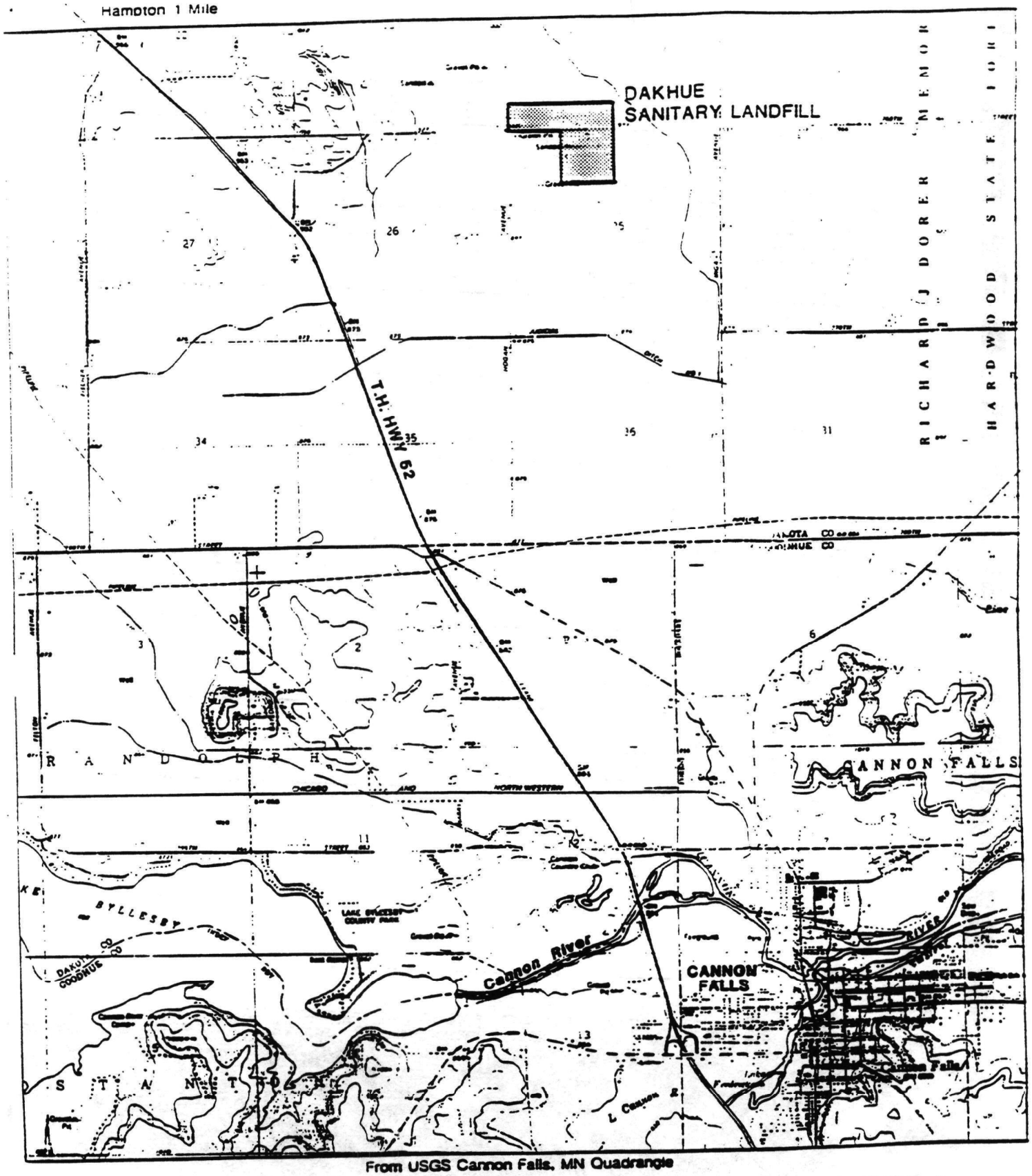
Based on well logs from residential and irrigation wells in the area, and on resistivity values from the 1985 hydrogeologic investigation, Bruce A. Liesch Associates (Liesch) (1985) concluded that there appears to be no hydraulic barrier between the drift aquifer and the underlying Prairie du Chien aquifer. This lack of hydraulic barrier is substantiated by the similar variations of groundwater elevations in wells MW-2 and BAL-1, both screened in the sand and gravel aquifer, and Well MW-1, open hole in the Prairie du Chien aquifer (Figure 3). Figure 3 was drawn using groundwater elevations published in the Evaluation Report (1987).

Based on groundwater elevations measured in Wells MW-1, MW-2 and BAL-1 Liesch (1987) concluded that groundwater flows in a southeasterly to southwesterly direction with a hydraulic gradient of 0.008 feet/foot.



Dakhue Sanitary Landfill

Figure 1



From USGS Cannon Falls, MN Quadrangle

FIGURE 2

0 1 mile
Scale

SITE LOCATION MAP
Dakhue Sanitary Landfill

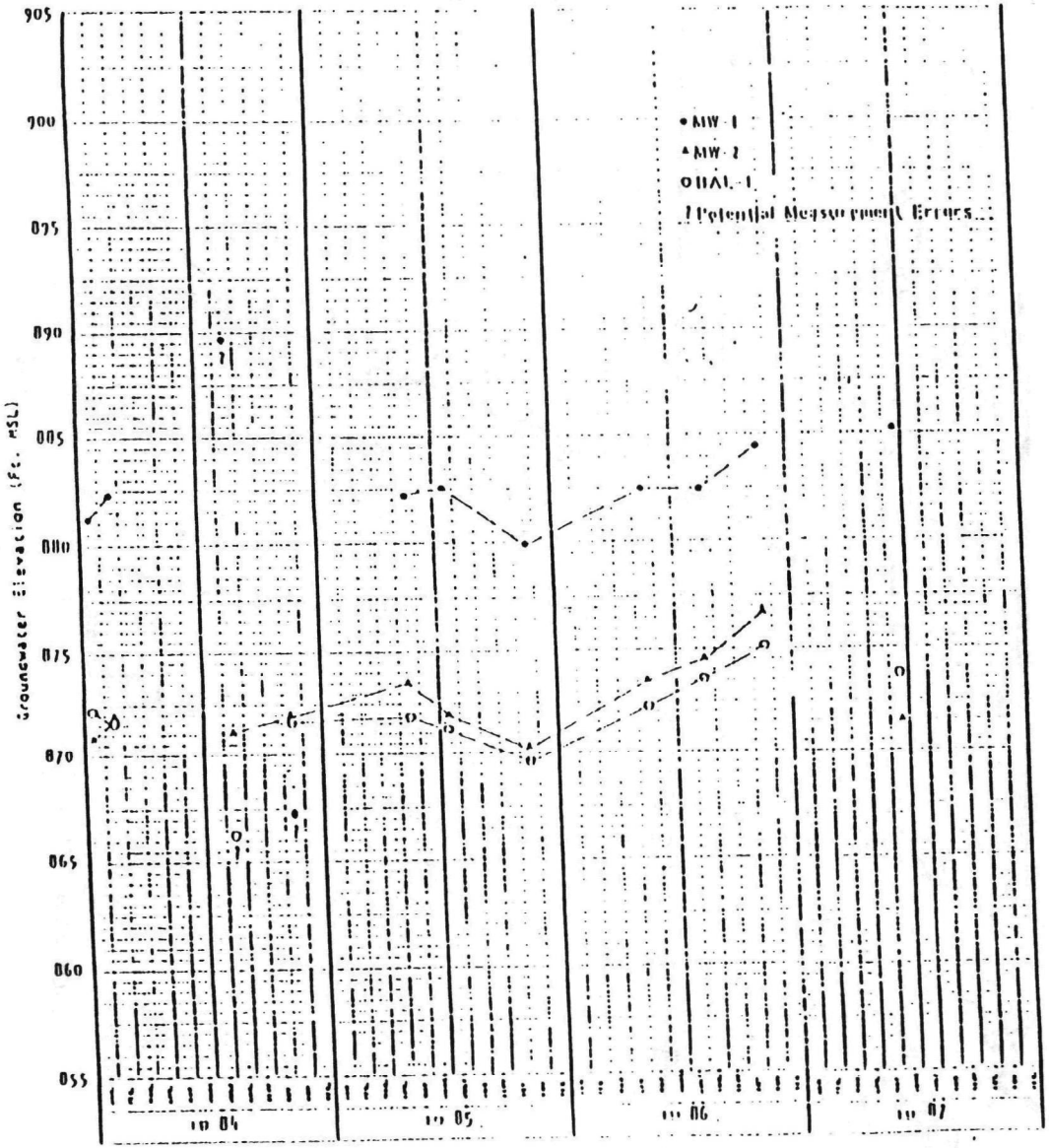


FIGURE 3

POOR QUALITY
ORIGINAL

II. SITE HISTORY

The DSLF is owned and was operated by Dakhue Sanitary Landfill, Inc., a Minnesota corporation. The DSLF is located in southern Dakota County approximately 3 miles north of Cannon Falls, Minnesota. The location of the landfill is shown on Figures 1 and 2. Dakhue Sanitary Landfill, Inc. purchased the property in 1971 for the purpose of developing a sanitary landfill.

Prior to 1971, the land within the site boundary was primarily undeveloped. On October 1, 1971, the Minnesota Pollution Control Agency (MPCA) issued a Solid Waste Disposal Facility Permit SW-50 (permit number) for an 80 acre operation at the Dakhue site to Dakhue Sanitary Landfill, Inc. As part of this permit requirement, Dakhue Sanitary Landfill, Inc. installed two on-site monitoring wells in October 1971. Monitoring Well MW-1 was installed upgradient, and Monitoring Well MW-2 was installed downgradient of the refuse area.

The landfill was initially open on a part-time basis (three days a week) until 1973, when the landfill extended its operation to six days a week. DSLF received an updated or amended permit from the MPCA on July 25, 1983.

DSLF operated until May 31, 1988, at which time waste disposal activities ceased. From October 1971 to May 1988, the landfill was utilized for the disposal of mixed municipal and commercial waste, and small amounts of industrial waste.

In a letter dated July 22, 1988, representatives of the landfill owners stated that Dakhue Sanitary Landfill, Inc. was financially unable to undertake closure and post closure activities necessary at the landfill. On October 11, 1988, Dakhue Sanitary Landfill, Inc. filed for Chapter 11 bankruptcy.

The facility was originally scored using the Hazardous Ranking System (HRS) on September 29, 1985. On June 23, 1987, the permittee, signed a Response Order by Consent with the MPCA. The HRS scoring package was amended on May 23, 1988, and in March 1989. The facility is currently on the State's Permanent List of Priorities and is on the U.S. Environmental Protection Agency's (U.S. EPA) National Priority List with a score of 42.

Additional information can be found in the Evaluation Report (Liesch, 1987).

A final cover consisting of a gas drainage layer, synthetic membranes, water drainage layer, and topsoil was installed during the 1992 construction season as part of the Source Control Operable Unit. The Remedial Investigation (RI) Report for the Groundwater Migration Operable Unit was completed in August 1992 and the Feasibility Study (FS) Report was completed in December 1992. Both contain additional information pertinent to this Record of Decision.

III. COMMUNITY RELATIONS HISTORY

Following completion of the RI/FS the State of Minnesota published a Proposed Plan for remedial action on January 28, 1993. The RI/FS Report and Proposed Plan for remedial action are located at the Cannon Falls Public Library and at MPCA, and in the Administrative Record located at the U.S. EPA in Region 5. Consistent with Section 113 of CERCLA, the Administrative Record includes all documents such as the work plan, data analyses, public comments, transcripts, and other relevant information used in developing remedial alternatives for the site. These documents were made available for public review and copying at the Cannon Falls Public Library and MPCA.

To encourage public participation in the remedy selection process consistent with Section 117 of CERCLA, the U.S. EPA initially set a 30 day public comment period from January 28, 1993 through March 1, 1993, for the Proposed Plan. A formal public hearing was held on February 11, 1993, to accept verbal public comment on the Proposed Plan. Interested parties provided comments on the alternatives presented in the Proposed Plan and elaborated upon in the FS. The remedy for the DSLF site described herein was selected after a detailed review of public comments received. The attached Responsiveness Summary addresses those public comments received.

IV. SCOPE AND ROLE OF REMEDIAL ACTIVITIES

The U.S. EPA and MPCA agreed to divide the project into two operable units in order to facilitate progress toward remedial action at this site. The two operable units are for source control and groundwater migration management.

Source Control Operable Unit

The DSLF never received final cover when the landfill closed. In October 1992, the installation of a final cover for the site was completed to prevent further infiltration of precipitation and subsequent leachate generation. Operable Unit One's Record of Decision was signed June 28, 1991.

Groundwater Migration Management Operable Unit

The FS identified two remedial objectives for the DSLF site based on the data obtained by the Remedial Investigation and the potential exposure ratio identified in the health and ecological risk assessments. The objectives of the Groundwater Migration Management FS are:

1. To eliminate or mitigate risks associated with human water supply use of groundwater from the sand and gravel or bedrock aquifer resulting in exposure to contaminants which exceed MCLs, have a total excess lifetime cancer risk greater than the range of protectiveness designated by U.S. EPA (10^{-6}-10^{-4}), or have a hazard index which exceeds one; and

2. To provide adequate protection to aquatic life in Judicial ditch No. 1 from adverse effects resulting from possible discharge of contaminated groundwater.

Ten actions were identified by the FS to satisfy the remedial action objectives. These potential actions were combined to formulate an array of remedial alternatives. These alternatives were screened and compared to each other and the remedial objectives to determine their ability to achieve the objectives.

Further evaluation of the FS array of remedial alternatives resulted in eight remedial alternatives that would satisfy the objective of the FS, meet health based cleanup levels and meet the statutory requirements of CERCLA. Table 1 lists the eight remedial alternatives that would satisfy the objectives of the FS.

The remedial action selected in this Record of Decision for the DSLF site will eliminate the threats associated with direct contact with contaminated media. It is anticipated that no further action will be necessary at the Site. The monitoring of groundwater will be conducted to assure that degradation of residual groundwater contamination is occurring. Since hazardous substances above health based levels will remain in fill material at the Site, five year reviews will be necessary.

V. SUMMARY OF SITE CHARACTERISTICS

A). Site Characteristics

There is no discrete source of contamination other than mixed municipal waste at the DSLF. Most of the waste disposed of at the landfill was household trash and garbage. A small quantity of industrial, commercial waste was

TABLE 1

Alternatives Summary
Groundwater Migration Control Operable Unit
Dakhue Sanitary Landfill Site

Alternative 1: No Action

Alternative 2: Monitoring, Water Supply Cost Participation

Alternative 3A: Monitoring, Extraction Wells to Contain Future Contaminant Migration from the Landfill, Air Stripping, Iron and Manganese Removal, Discharge to Stormwater Retention Basin

Alternative 3B: Monitoring, Extraction Wells to Remediate Entire Plume, Air Stripping, Discharge to Stormwater Retention Basin

Alternative 4A: Monitoring, Extraction Wells to Contain Future Contaminant Migration from the Landfill, Carbon Adsorption, Iron and Manganese Removal, Discharge to Stormwater Retention Basin

Alternative 4B: Monitoring, Extraction Wells to Remediate Entire Plume, Carbon Adsorption, Discharge to Stormwater Retention Basin

Alternative 5A: Monitoring, Extraction Wells to Contain Future Contaminant Migration from the Landfill, Photolysis/Chemical Oxidation, Iron and Manganese Removal, Discharge to Stormwater Retention Basin

Alternative 5B: Monitoring, Extraction Wells to Remediate Entire Plume, Photolysis/Chemical Oxidation, Discharge to Stormwater Retention Basin

disposed of at this site.

Twenty-two VOCs were detected in groundwater samples collected during the RI investigation. The RI discovered 1,2 Dichloropropane, 1,2 dichloroethylene, trichloroethylene, tetrachloroethylene, vinyl chloride and benzene on-site. These levels exceeded groundwater quality standards discussed below and more fully in the Feasibility Study Report (FS). In addition, groundwater quality standards for vinyl chloride, tetrachloroethylene and trichloroethylene were exceeded off-site. Table 2 summarizes the highest detected concentrations water quality data for the DSLF. Figure 4 depicts the present and potential future extent of impacted groundwater in the sand and gravel aquifer. No VOCs were found in groundwater samples from the Prairie du Chien aquifer.

Groundwater quality standards which were considered during the FS included U.S. EPA Maximum Contaminant Levels (MCLs) and Maximum Contaminant Level Goals (MCLGs) provided for under the Safe Drinking Water Act. Proposed MCLs and MCLGs, U.S. EPA Office of Drinking Water Health Advisories, and Minnesota Recommended Allowable Limits also were considered as potential groundwater quality standards.

The human health risk assessment (HHRA) for the Groundwater Migration Management O.U. characterized the potential human health risks posed by the Site if no additional remedial actions occurred. There are no known current exposures of people to chemicals associated with the site. The major risks for the site are associated with the future installation of residential water supply wells into areas of contaminated groundwater. The primary human health risk is cancer. The primary chemicals of concern are chlorinated ethenes and ethanes, especially vinyl chloride.

Potential exposure pathways were identified and evaluated (Table 3). The following potential future exposure pathways were identified by the HHRA:

- Exposure of people if a residential (potable water) well is installed in a contaminated portion of the Sand and Gravel aquifer;

- exposure of people if a residential well is installed in the bedrock aquifer and the pumping of the well draws in contaminated groundwater from the Sand and Gravel aquifer;

- exposure of people, directly or indirectly, if an agricultural water supply is installed in the bedrock aquifer and the pumping of the well draws in

TABLE 2

SUMMARY OF HIGHEST DETECTED CONCENTRATIONS
WATER QUALITY DATA
DAKHUE SANITARY LANDFILL

(Concentrations in µg/L)

Compound	Highest Detected Concentration	Monitoring Well with Highest Concentration
INORGANICS		
Aluminum	215	MW-8B
Arsenic	12.5	MW-10A(1)
Barium	182	MW-3A(1)
Beryllium	0.56	MW-12A(1)
Cadmium	2.1	MW-10A(2)
Calcium	219,000	MW-5A(1)
Chromium	15.3	MW-9A(1)
Cobalt	8.6	MW-5A(1)
Copper	9.2	MW-10A(1)
Iron	17,200	MW-5A(1)
Lead	7.5	MW-8A(1)
Magnesium	70,900	MW-5A(1)
Manganese	2,590	MW-10A(1)
Nickel	46	MW-5A(1)
Potassium	16,000	MW-11A(1)
Selenium	2.2	MW-11A(1)
Silver	9.2	MW-10A(1)
Sodium	62,500	MW-9A(1)
Zinc	829	MW-10B
Cyanide	28.8	MW-11A(1)
VOLATILE ORGANICS		
Chloromethane	1	MW-5A(1)
Vinyl Chloride	35	MW-5A(1)
Chloroethane	8	MW-5A(1)
Methylene Chloride	9	MW-5A(1)
Trichlorofluoromethane	13	MW-8A(1)
1,1-Dichloroethylene	2	MW-5A(1)

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TABLE 2 (CONT)

SUMMARY OF HIGHEST DETECTED CONCENTRATIONS
WATER QUALITY DATA
DAKHUE SANITARY LANDFILL

(Concentrations in µg/L)

Compound	Highest Detected Concentration	Monitoring Well with Highest Concentration
1,1-Dichloroethane	39	MW-5A(1)
1,2-Dichloroethylene	86	MW-5A(1)
Chloroform	1	MW-5A(1)
1,2-Dichloroethane	6	MW-9A(1)
Methyl Ethyl Ketone	190	MW-5A(1)
1,1,1-Trichloroethane	19	MW-5A(1)
1,2-Dichloropropane	8	MW-5A(1)
Trichloroethylene	62	MW-5A(1)
1,1,2-Trichloroethane	10	MW-9A(1)
Benzene	9	MW-5A(1)
Methyl Isobutyl Ketone	8	MW-5A(1)
Tetrachloroethylene	110	MW-5A(1)
Toluene	33	MW-10A(1)
Chlorobenzene	2	MW-9A(1)
Xylenes	14	MW-5A(1)
Tetrahydrofuran	49	MW-9A(1)
SEMIVOLATILES		
Phenol	3	MW-5A(1)
p-Cresol	12	MW-9A(1)
Benzoic Acid	28	MW-5A(1)
Diethyl phthalate	4	MW-5A(1)
Di-n-butyl phthalate	2	MW-8B
Bis(2-ethylhexyl)phthalate	8	MW-4A(1)
TENTATIVELY IDENTIFIED COMPOUNDS		
Dichlorofluoromethane	75	MW-5A(1)

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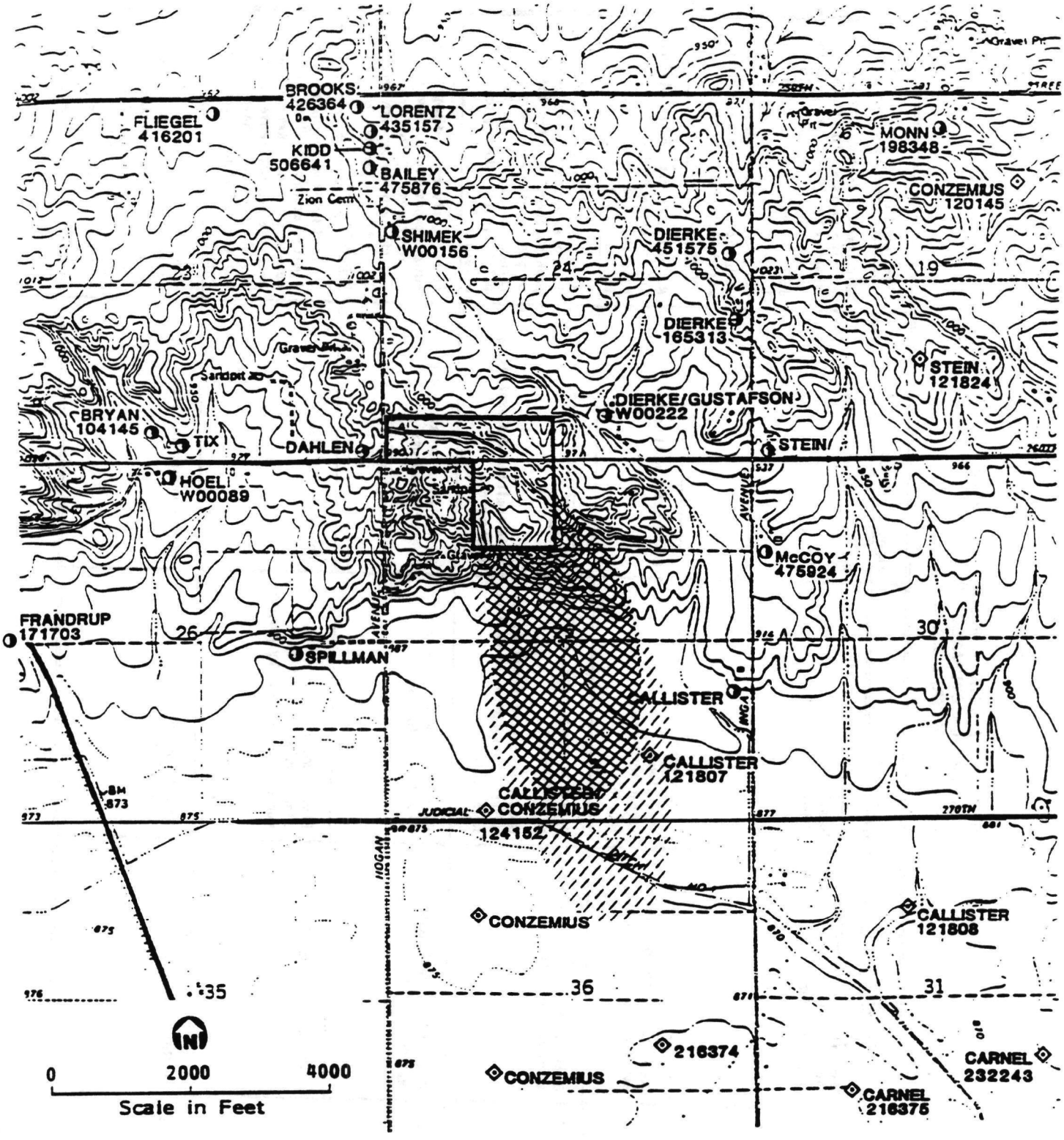

Residential Well Owner and MGS Unique Well Number if available

Irrigation Well Owner and MGS Unique Well Number

Present Extent of Impacted Groundwater in the Sand and Gravel Aquifer

Potential Future Extent of Impacted Groundwater in the Sand Aquifer

FIGURE 4

PRESENT AND POTENTIAL FUTURE EXTENT OF IMPACTED GROUNDWATER IN THE SAND AND GRAVEL AQUIFER
Dakhue Sanitary Landfill

TABLE 3

EVALUATION OF POTENTIAL EXPOSURE PATHWAYS
GROUNDWATER OPERABLE UNIT
DAKHUE SANITARY LANDFILL

Migration Pathway	Exposure Point	Exposure Route	Exposed Population	Likelihood of Exposure
Migration in sand and gravel aquifer	Downgradient residential wells screened in sand and gravel aquifer	Ingestion Dermal absorption Inhalation	Residential well users	No currently exposed population. Existing wells would not be impacted by contamination in the future. Exposure could only occur if new wells are installed in the contaminant plume. Land use practices and MDH prohibition on sand and gravel wells limit likelihood of exposure.
Migration from sand and gravel aquifer to bedrock aquifer as a result of pumping of bedrock well	Downgradient residential wells screened in bedrock	Ingestion Dermal absorption Inhalation	Residential well users	No currently exposed population. Future exposure limited by existing land uses (i.e., agricultural).
Migration in sand and gravel aquifer	Downgradient irrigation/ agricultural wells	Uptake by crops - consumption of food crops Uptake by cattle ingesting water - consumption of beef or dairy products	Farm families and crop consumers Farm families and beef/dairy consumers	No currently exposed population. Future exposure limited by well prohibitions. Limited ability of plants to take up chemicals. Chemicals likely to be lost by volatilization during use of water.
Migration in sand and gravel aquifer	Downgradient irrigation/ agricultural wells	Volatilization of chemicals from irrigation water	Agricultural workers and nearby residents	No currently exposed population. Future exposures limited by well prohibitions. Dilution of volatile compounds with ambient air reduces magnitude of exposure.
Discharge of groundwater to Judicial Ditch No. 1	Judicial Ditch No. 1	Bioconcentration/ bioaccumulation by fish - consumption of fish by people	Consumers of fish	Limited habitat for sport fish. Limited access to ditch by people to fish. Chemicals are volatile and may leave water phase. Chemicals have relatively low bioconcentration potential.
Discharge of groundwater to Judicial Ditch No. 1	Judicial Ditch No. 1	Dermal absorption Inhalation	People wading in ditch	Chemicals are volatile and may leave water phase. Ditch is shallow, limiting dermal exposure. Dilution of volatile compounds with ambient air reduces magnitude of exposure. Limited access to ditch.

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contaminated groundwater from the Sand and Gravel aquifer;

- exposure of people, directly or indirectly, if chemicals migrate to existing agricultural wells currently not contaminated;

- exposure of people, directly or indirectly, if contaminated groundwater discharges to Judicial Ditch No. 1.

Analysis and evaluation of the exposure pathways indicated that the primary exposure pathways of concern involve residential use of contaminated groundwater. The exposure routes associated with the groundwater use pathways are ingestion, dermal absorption during bathing, and inhalation of volatile compounds released to the household air. The other potential exposure pathways (e.g., agricultural water use) are not significant contributors of risk.

Minnesota Department of Health (MDH) rules currently prohibit the installation of a residential potable water well in the Sand and Gravel aquifer and Prairie du Chien aquifer. In addition, while the installation of a well in the Jordan Sandstone aquifer is not prohibited, a change in the current land use from agricultural to residential in the zone of potential groundwater impacts would be required.

The main potential risk to human health at the Dakhue Sanitary Landfill is through future use of the shallow sand and gravel aquifer. Installation of a residential well in the sand and gravel aquifer and within the contaminated plume would pose a greater than 10^{-4} risk to human health. As stated above, Minnesota Department of Health rules prohibit the development of such a well downgradient of a landfill.

A preliminary screening of ecological risks was conducted for the Groundwater Migration Management O.U. The primary objective of the ecological risk screening was to qualitatively assess the potential ecological impacts of groundwater contamination on aquatic habitats associated with discharge to Judicial Ditch No. 1 surface water. The results are summarized in Table 4.

The potential for future ecological impacts was assessed by estimating the future discharge concentrations of contaminants from the groundwater plume to Judicial Ditch No. 1. Discharge concentration estimates were made by utilizing the highest groundwater concentrations detected during the Remedial Investigation and factoring in concentration reductions through dispersion. A two-

TABLE 4

POTENTIAL FOR ECOLOGICAL EFFECTS
DAKHUE SANITARY LANDFILL SITE

CONTAMINANT OF CONCERN	POTENTIAL FOR ECOLOGICAL EFFECTS	EXPLANATION
INORGANICS		
Aluminum	Yes	Exceeds chronic standard
Arsenic	No	Below standards and criteria
Barium	No	Below NOEC
Beryllium	No	Below LREL
Cadmium	No	Below standards
Chromium	Yes	Exceeds chronic standard
Cobalt	Yes	Exceeds state chronic criterion
Copper	No	Below standards and criteria
Iron	Yes	Exceeds state criteria
Lead	No	Below standards and criteria
Manganese	Yes	Exceeds state chronic criterion
Nickel	No	Below standards and criteria
Selenium	No	Below standards and criteria
Silver	Yes	Exceeds chronic and maximum standards
Zinc	Yes	Exceeds standards and criteria
Cyanide	Yes	Exceeds chronic and maximum standards and federal criteria
VOLATILE ORGANICS		
Chloromethane	No	Below LREL
Vinyl Chloride	No	Below chronic standard
Methylene Chloride	No	Below standards and criterion
1,1-Dichloroethylene	No	Below LREL
1,2-Dichloroethylene	No	Below LREL
Chloroform	No	Below standards, criterion, and LREL
1,2-Dichloroethane	No	Below standards, criterion, and LREL
Methyl Ethyl Ketone	No	Below NOEC
1,1,1-Trichloroethane	No	Below standards and LREL
1,2-Dichloropropane	No	Below LREL
Trichloroethylene	No	Below standards, criterion, and LREL
1,1,2-Trichloroethane	No	Below LREL
Benzene	No	Below standards, criterion, and LREL
Methyl Isobutyl Ketone	No	Below NOEC

TABLE 4 (CONT.)

POTENTIAL FOR ECOLOGICAL EFFECTS
DAKHUE SANITARY LANDFILL SITE

CONTAMINANT OF CONCERN	POTENTIAL FOR ECOLOGICAL EFFECTS	EXPLANATION
Tetrachloroethylene	No	Exceeds chronic standard which is human health based, but is below chronic criterion which is aquatic life based, and is also below other standards and LREL
Toluene	No	Below standards and LREL
Chlorobenzene	No	Below standards and LREL
Xylenes	No	Below standards
Tetrahydrofuran	No	Below NOEC
SEMIVOLATILE ORGANICS		
Phenol	No	Below standards and LREL
p-Cresol	No	Below NOEC
Benzoic Acid	No	Below NOEC
Diethyl Phthalate	No	Below NOEC
Di-n-butyl phthalate	No	Below NOEC
Bis(2-ethylhexyl)phthalate	No	Below chronic standard

dimensional solute transport model (MYGAT Version 2) was employed for these calculations. This model is considered quite conservative because it does not take other reduction mechanisms into account such as retardation through reaction with aquifer components. Estimated future discharge concentrations were then compared with Federal and State surface water quality standards and criteria for the protection of aquatic life, lowest reported effect levels (LRELs), and no observable effect concentrations (NOECs). Contaminants of concern that were determined to have the potential for affecting the aquatic communities within Judicial Ditch No. 1 consist of the following inorganic compounds: aluminum, chromium, cobalt, iron, manganese, silver, zinc and cyanide. Concentrations of the other inorganic compounds, VOCs, and semivolatiles were below the standards, criteria, LRELs, and NOECs. At present, there are no contaminants being discharged to Judicial Ditch No.1.

B). Hydrogeology

The first aquifer beneath the refuse area is the Sand and Gravel aquifer (Figure 5). Groundwater in this aquifer occurs mostly under unconfined conditions and flows in a south to southeasterly direction (Figure 6). Downgradient of the landfill, the hydraulic gradient is estimated at 1.3 x 10^{-3} feet/foot. The geometric mean of all hydraulic conductivities measured in the Sand and Gravel monitoring wells is estimated at 15 feet/day. However, downgradient of the landfill where the VOC plumes are migrating, the geometric mean of the hydraulic conductivities is approximately 50 feet/year. Based on the hydraulic conductivity and hydraulic gradient measured downgradient of the landfill, the average groundwater flow velocity in that area is estimated to be 94 feet/year.

The Sand and Gravel aquifer is in direct hydraulic connection with Judicial Ditch No. 1. Only a small portion of the groundwater from the Sand and Gravel aquifer is expected to discharge to Judicial Ditch No. 1, because of the shallow depth of the ditch (1 to 3 feet) as compared to the saturated thickness of the aquifer at the location (approximately 36 feet). The majority of groundwater in the Sand and Gravel aquifer is expected to bypass the ditch and continue to flow to the south-southeast, discharging ultimately to the regional discharge zone, the Cannon river.

The Prairie du Chien/Jordan Aquifer lies directly beneath the Sand and Gravel aquifer. The Prairie du Chien/Jordan Aquifer is composed of two units: the Prairie du Chien Group, and the Jordan Sandstone. The Prairie du Chien group is a thin-to-thick bedded sandy dolomite in which flow occurs primarily in joint, fractures, and bedding planes.

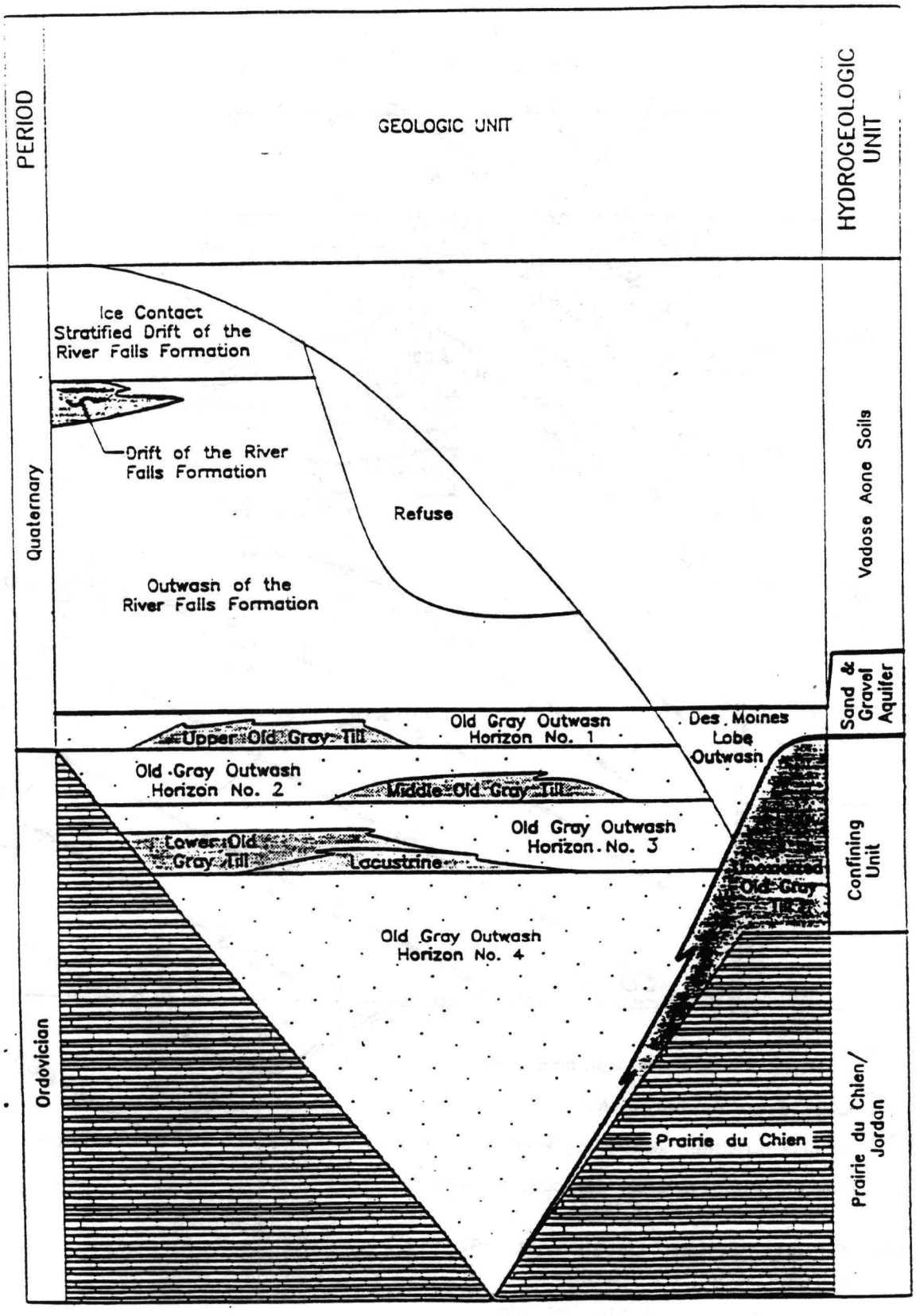

FIGURE 5

SAND

DISCONTINUOUS CONFINING LAYERS

TYPICAL STRATIGRAPHIC SECTION
Dakhue Sanitary Landfill Site

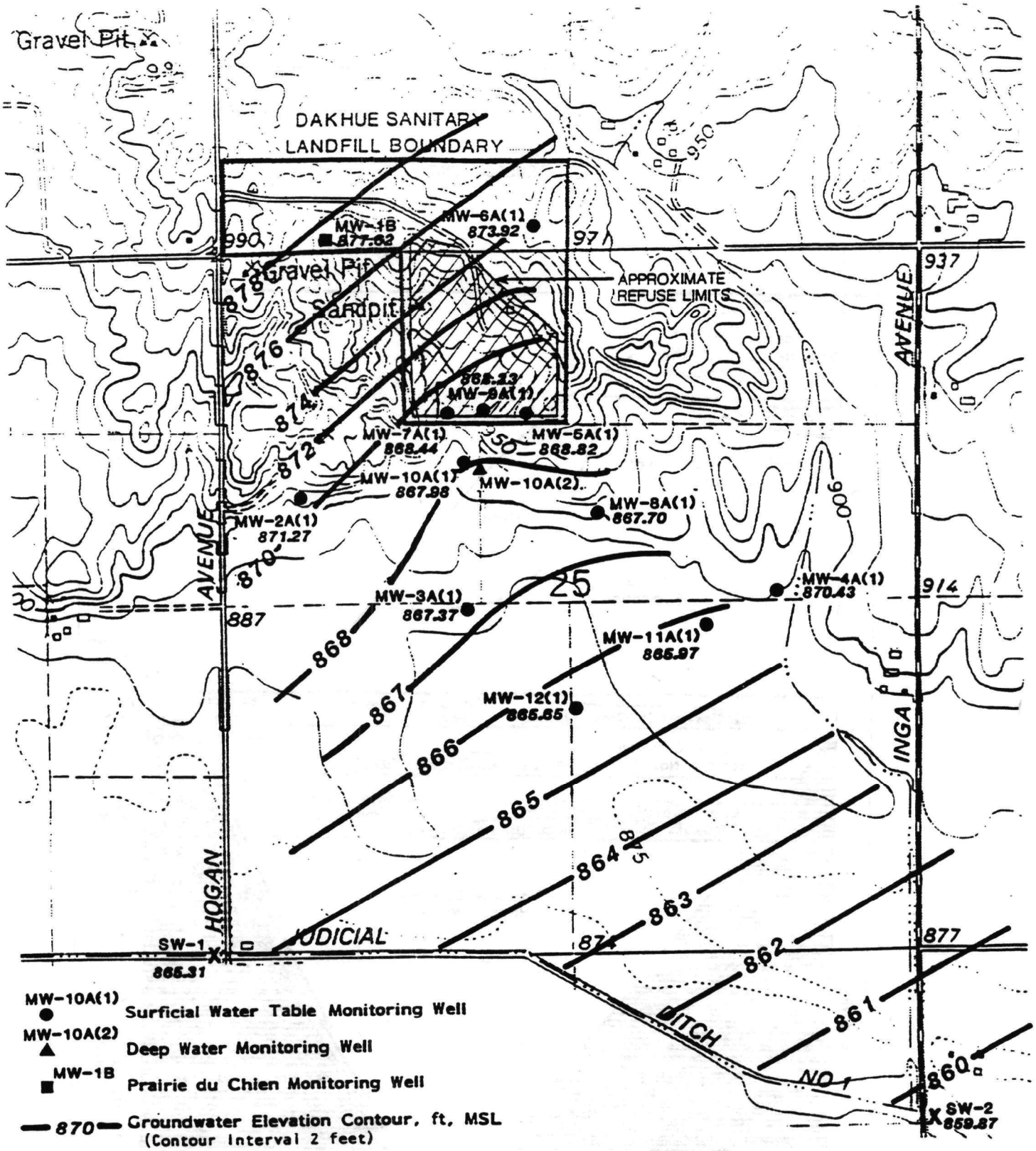

FIGURE 6

WATER TABLE ELEVATION CONTOUR MAP
(November 1991)
Dakhue Sanitary Landfill Site

The flow in the Jordan Sandstone is primarily intergranular. Although the nature of flow is fundamentally different in the two units, these two geologic units are considered to act as a single hydrogeologic unit as no confining bed separates them. It was determined during the Remedial Investigation that the irrigation wells screened in the Jordan aquifer would not result in vertical migration of the plume into the Jordan aquifer.

At the site, the Sand and Gravel aquifer is directly underlain by the Prairie du Chien (Figure 5). Groundwater in the Prairie du Chien aquifer flows in a south to southwesterly direction. Downgradient of the landfill, the average groundwater flow velocity in the Prairie du Chien aquifer is estimated to be 6 feet/year.

The Prairie du Chien aquifer is in direct hydraulic connection with the Sand and Gravel aquifer. Hydraulic gradients between these two aquifers are very small (in the 10^{-4} to 10^{-3} range). Some reversed gradients were even observed in two nests of wells. These low hydraulic gradients indicate that the flow in the Sand and Gavel aquifer is mainly horizontal, and that the Sand and Gravel and the Prairie du Chien aquifers act as a single aquifer near the site.

VI. DESCRIPTION OF ALTERNATIVES

The major objective of the FS and the Proposed Plan was to evaluate remedial alternatives using a cost-effective approach consistent with the goals and objectives of CERCLA, as amended by SARA.

Alternative 1: No further Action

As a basis for comparison to other alternatives, the National Contingency Plan (40 CFR 300.430 (e)(6)) requires full evaluation of the no action alternative. No action for the Groundwater Migration Management O.U. incorporates the construction of a cap to control the source of contamination. The cap is expected to reduce infiltration to less than 1.5 percent of the precipitation. For the purposes of this evaluation, no action would be taken to control the migration of contaminated groundwater toward Judicial Ditch No. 1. Long-term impacts of the no action alternative would be as identified in the risk assessment.

Alternative 2: Monitoring, Water Supply Cost Participation

This alternative incorporates groundwater monitoring, and provides cost participation for potable water source in the area affected by the Groundwater Migration Management O.U.

Cost participation refers to the difference in cost between a well developed in the Sand and Gravel aquifer and the Jordan aquifer. The plume is expected to attenuate naturally. MPCA will monitor the plume upgradient of the judicial ditch to insure that attenuation is occurring.

Water quality monitoring would consist of periodic sampling of selected existing and new monitoring wells and surface water. The samples would be analyzed for the appropriate parameters. The monitoring data would be used to: (1) determine the migration of contamination; (2) assess trends in water quality in the Sand and Gravel aquifer; (3) verify that the deep aquifer is not being affected; and (4) monitor contaminant levels in Judicial Ditch No. 1. Corrective action for surface water will be triggered if levels in the new wells installed downgradient exceed the surface water standards for iron (221 ug/l), manganese (572 ug/l), aluminum (87 ug/l), chromium (11 ug/l), silver (.12 ug/l), zinc (191 ug/l), and cyanide (5.2 ug/l).

The State will strictly enforce restrictions contained in Dakota County Ordinance No. 114 and MN. Rules 4725.2000 and 4725.4300. If potable water wells are constructed in the area affected by the Groundwater Migration Management O.U., they would be double cased at least 70 feet into the Prairie du Chien and screened at least 15 feet into the Jordan Sandstone aquifer.

Alternative 3A: Monitoring, Extraction Wells to Contain Future Contaminant Migration From the Landfill, Air Stripping, Iron and Manganese Removal, Discharge to Stormwater Retention Basin

This alternative combines groundwater monitoring, collection of contaminated groundwater, treatment to remove the contaminants and discharge of treated water. Monitoring activities are as described in Alternative 2.

The groundwater extraction system would be designed to capture groundwater that contains contaminant concentrations above drinking water or other health-risk based criteria at the landfill boundary. Treated water would be discharged to an on-site stormwater retention basin in accordance with a State Disposal System (SDS) discharge permit. The air stripping system would be designed and operated to meet the discharge limitation established in the discharge permit. Since the organic contaminants are emitted to the atmosphere, off-gas controls may be required for this alternative. The air system has the potential to remove manganese through oxidation, adsorption and sedimentation.

Alternative 3B: Monitoring Extraction Wells to Remediate Entire Plume, Air Stripping, Discharge to stormwater Retention Basin

This alternative incorporates the monitoring, discharge location and treatment system from Alternative 3A. The groundwater extraction system would be designed to capture the entire contaminant plume. The extraction system would be located at the landfill and between Judicial Ditch No. 1 and MW-12a(1). Although manganese removal is not required to meet the discharge standards, the air stripping system has the potential to remove manganese through oxidation, adsorption, and sedimentation.

Alternative 4A: Monitoring, Extraction Wells to Contain Future Contaminant Migration from the Landfill, Iron and Manganese Removal, Carbon Adsorption, Discharge to Stormwater Retention Basin

This alternative incorporates the monitoring, extraction system and discharge location from Alternative 3A. An iron and manganese removal system would be installed in series with a carbon adsorption system. The iron and manganese removal system would consist of chemical oxidation followed by filtration. The carbon adsorption system would remove the volatile organic compounds, except vinyl chloride. Vinyl chloride will rapidly volatilize to the atmosphere after discharge to the stormwater retention basin. Spent carbon would be regenerated under controlled conditions at a permitted facility.

Alternative 4B: Monitoring, Extraction Wells to Remediate Entire Plume, Carbon Adsorption, Discharge to Stormwater Retention Basin

Same as Alternative 4A, except the groundwater extraction system is designed to capture the entire contaminant plume. The influent manganese concentration is expected to be below the assumed discharge limitation. Therefore, iron and manganese removal is not required with this alternative.

Alternative 5A: Monitoring, Extraction Wells to Contain Future Contaminant Migration from the Landfill, Iron and Manganese Removal, Photolysis/Chemical Oxidation, Discharge to Stormwater Retention Basin

Same as Alternative 3A, except Photolysis/Chemical Oxidation replaces air stripping. Photolysis/Chemical Oxidation technology oxidizes the contaminants to CO_2, H_2O, and other oxidation products. This technology is especially effective for treating chlorinated organic compounds. Iron and manganese removal is required to limit scaling on the interior of the reaction vessel. Additional pretreatment may be required based on water chemistry which would

increase the cost for this alternative. The capital and maintenance costs for this alternative are higher than other alternatives.

Alternative 5B: Monitoring, Extraction Wells to Remediate Entire Plume, Iron and Manganese Removal, Photolysis/Chemical Oxidation, Discharge to Stormwater Retention Basin

Same as Alternative 5A, except groundwater extraction system is designed to capture the entire contaminant plume. Iron and Manganese removal is required to limit scaling on the interior of the reaction chamber. Additional pretreatment may be required based on water chemistry which would increase the cost for this alternative.

VII. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVE

The NCP and Section 121 of the Superfund Amendments and Reauthorization Act of 1986 (SARA) form the regulatory and statutory basis for the nine evaluation criteria utilized in determining the appropriate remedial action at a CERCLA site. Specifically, Section 121 of SARA requires that the selected remedy is to be protective of human health and the environment, cost-effective, and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

Alternatives were evaluated using current U.S. EPA guidance, including "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA", OSWER Directive 9355.3-01, October 1988; " A Guide to Selecting Superfund Remedial Action,"OSWER Directive 9355.)-27FS, April 1990; and " Streamlining the RI/FS for CERCLA Municipal Landfill Sites," OSWER Directive 9355.11-11FS, September 1990. The nine evaluation criteria, referenced in the first two guidance documents above, are as follows:

1) Long Term Effectiveness - The analysis under this criterion focuses on any residual risk remaining at the site after the completion of the remedial action. This analysis included consideration of the degree of threat posed by the hazardous substances remaining at the site, the adequacy of any controls (e.g., engineering or institutional control) used to manage the hazardous substances at the site, and the reliability of controls against possible failure.

2) Reduction of Toxicity, Mobility, and Volume - This evaluation criterion addresses the statutory preference for selecting remedial actions that employ treatment technologies that permanently and significantly reduce the toxicity, mobility, and volume of hazardous

substances as a principal element.

3) Short-Term Effectiveness - This evaluation criterion addresses the effects of the alternative during the construction and implementation phase until the remedial response objectives are met. Under this criterion alternatives are evaluated with respect to their effects on human health and the environment during the implementation of the remedial action.

4) Implementability - The implementability criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and material required during its implementation.

5) Cost- The estimated capital, annual maintenance and monitoring, and present worth value costs are evaluated under this criterion. Present worth costs are calculated using a ten percent discount rate over a 50 year period of operation.

6) Overall Protection of Human Health and the Environment. This evaluation criterion draws on the results of the above evaluation criteria to describe whether, and how, each alternative provides protection of human health and the environment.

7) Compliance with ARARs - This evaluation criterion is used to determine whether each alternative will meet all of its federal and State ARARs (as defined in CERCLA 121). The detailed analysis should summarize which requirements are applicable or relevant and appropriate to an alternative and describe how the alternative meets those requirements. When an ARAR is not met, the detailed analysis should discuss whether one of the six waivers allowed under CERCLA may be appropriate.

8) Community Acceptance - This criterion refers to the community's comments on the remedial alternatives under consideration. These comments are presented in the Responsiveness Summary which is included as an attachment to this Record of Decision.

9) State Acceptance - The State of Minnesota (MPCA) is the lead agency for this site.

COMPARATIVE ANALYSIS OF ALTERNATIVES

This section provides a summary of the relative performance of the alternatives with respect to each of the nine criteria. Table 5 present a comparison of the nine criteria for each alternative.

1. OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

All alternatives are considered protective of human health and the environment. All alternatives incorporate the access/use restrictions contained in Dakota County Ordinance No. 114 which prohibits the use of the contaminated aquifer for potable water and in MN Rules 4725.2000 and 4725.4300. If left unattended, future groundwater discharge to the judicial ditch might exceed surface water quality standards for some metals. MPCA will monitor groundwater levels upgradient of the judicial ditch, and take further action if necessary to meet water quality standards or to be protective of human health.

2. LONG-TERM EFFECTIVENESS AND PERMANENCE

All alternatives under consideration involve long term response actions. The active pump and treat system will restore the contaminated plume to potable quality in an estimated 45 years. The groundwater is expected to reach potable quality in 55 years after natural attenuation occurs. The residual risk following these time frames is expected to be well below the U.S. EPA's point of departure for groundwater ingestion, provided the landfill cap integrity is maintained. The landfill cap will be maintained under an operation and maintenance program administered by the MPCA. Institutional access/use restrictions of the site groundwater will be strictly enforced by MPCA. Long term monitoring will identify whether discharge standards are being exceeded.

Time to reach the MCLS for PCE is as follows:

ALTERNATIVES	PCE
1,2	55 Years
3A, 4A, 5A	45 Years
3B, 4B, 5B	45 Years

3. SHORT - TERM EFFECTIVENESS

Since there are no current complete exposure pathways, Alternative 1 and 2 are more effective. The other alternatives have the potential to expose people to

contaminants during remediation activities. In addition, the treatment alternatives do not substantially reduce the time required to clean-up the contaminated plume.

4. **COMPLIANCE WITH STATE AND FEDERAL REGULATIONS (ARARs)**

Alternatives 1, 2, 3a, 3b, 4a, 4b, 5a and 5b meet ARARs for groundwater, but vary in the amount of time within which they will meet revised Preliminary Remediation Goals (PRGs) for groundwater. The revised PRGs for groundwater are set forth in Table 7 and the method through which they were derived is set forth in the FS. Briefly, if an ARAR-based level for a contaminant was available, namely MCLs, it was selected to be the revised PRG for groundwater for that contaminant. If an ARAR-based PRG for groundwater was not available for a contaminant, a risk-based PRG served as the basis for the revised PRG. Alternatives 3b, 4b, and 5b comply with all ARARs. Currently, no contamination is discharging to surface water. Under Alternatives 1, 2, 3a, 4a, and 5a, some metals, most notably Iron, do have the potential to exceed at a future date surface water quality criteria and standards under the Federal Water Pollution Control Act and MN Rule 7050 for the protection of aquatic life. MPCA will monitor the groundwater plume upgradient of the ditch as stated above. This monitoring will include trigger levels for further action specified below (set at the surface water quality standards and criteria.)

Additional ARARs were presented in the FS for the Ground Water Migration Management Operable Unit.

5. **REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT**

Alternatives 1 and 2 do not reduce the toxicity, mobility, or volume of the contaminants beyond that due to natural degradation. Alternatives 4A, 4B, 5A, and 5B reduce the toxicity of organic compounds. Alternatives 3A, 3B, 4A, 4B, 5A, and 5B reduce the mobility of iron and manganese through treatment.

6. **IMPLEMENTABILITY**

The no action alternative requires no implementation. Alternative 2 is the easiest to implement of the remaining alternatives. Alternatives 3A and 3B are more easily implemented than the other alternatives that involve groundwater treatment. Alternatives 3B, 4B, and 5B require an easement for construction of extraction wells and pipelines on farm land south of the landfill. All the alternatives rely on future enforcement (long-term or short-term) of Dakota County water well restrictions and Minnesota Rules. Such enforcement is subject to funding levels and

priorities.

7. **COST**

Alternative 2 has an estimated cost of $360,000. Earlier cost estimates indicated the cost of Alternative 2 was higher. The Proposed Plan estimated its cost at $450,000. The difference in cost is based on elimination of the cost participation portion of the alternative. Alternative 2 has the lowest cost except for Alternative 1, the No Action Alternative, when compared to the remaining alternatives. See Table 5.

8. **STATE ACCEPTANCE**

MPCA and U.S. EPA concur on the remedy.

9. **COMMUNITY ACCEPTANCE**

Community acceptance has been assessed in the Responsiveness Summary following a review of the public comments received on the RI/FS Report and Proposed Plan. The selected remedy is a modification of the preferred alternative presented in the Proposed Plan and was modified to reflect comments received during the Public Comment Period. There does not appear to be any local opposition to the selected remedy.

VIII. DESCRIPTION OF THE REMEDY

The U.S. EPA and MPCA select a modification of Alternative 2 which constitutes a limited action involving continued water quality monitoring. Cost participation has been eliminated as a component of this alternative. This limited action alternative relies on the integrity of the composite cap which was installed on the landfill pursuant to the Source Control O.U. Record of Decision. The composite cap is expected to be 98.5 percent efficient in reducing infiltration through the waste material at the Site. In addition, current regulations restrict the use of the Sand and Gravel, and the Prairie du Chien aquifers in the area downgradient of the landfill. These aquifers are currently impacted or have the potential to be impacted in the future. MPCA and the County will enforce regulations, Dakota County Ordinance No. 114 and MN. Rules 4725.2000 and 4725.4300, restricting installation of wells in the future through well permit requirements.

It is anticipated that no further action will be required to mitigate the migration of contaminants already present in the aquifer. Since the leachate from the landfill is significantly reduced by the installation of the composite cap, the concentration in groundwater should decrease over

TABLE 5

COMPARATIVE ANALYSIS SUMMARY
MIGRATION CONTROL OPERABLE UNIT
DAKHUE SANITARY LANDFILL SITE

CRITERIA	ALTERNATIVE 1	2	3A	3B	4A	4B	5A	5B
Overall Protection of Human Health and the Environment	Protective of human health. Potential ecological impacts.	Same as 1.	Protective of human health. Potential ecological impacts.	Protective of human health and environment.	Same as 3A. Less protective if vinyl chloride is present.	Same as 3B. Less protective if vinyl chloride is present.	Same as 3A.	Same as 3B.
Long-term Effectiveness and Permanence								
Residual risk from untreated waste and treatment residuals	Restricted use of Sand and Gravel aquifer downgradient of landfill.	Same as 1.	Same as 1. Treatment residuals handled under SDS permit.	Treatment residuals handled under SDS permit. Larger volume treated.	Same as 3A and generation of spent carbon.	Same as 3B and generation of spent carbon.	Same as 3A.	Same as 3B
Adequacy and reliability of controls	Depends of enforcement.	Same as 1.	Same as 1.	No long-term controls.	Same as 1.	Same as 3B.	Same as 1.	Same as 3B
Short-term Effectiveness	No exposure to community or workers. Time to reach PRGs for PCE is 55 years. PRG for iron is not met with present cap design. Potential ecological impacts.	Same as 1.	VOC emissions are below SERs. Estimated 10 years operation. Time to reach PRGs for PCE and iron is 45 and 71 years, respectively.	VOC emissions are below SERs. Estimated >30 years operation. Time to reach PRGs for PCE and iron is 45 and 40 years, respectively.	Estimated 10 years operation. Time to reach PRGs for PCE and iron is 45 and 71 years, respectively. Vinyl chloride emissions are below SER.	Estimated >30 years operation. Time to reach PRGs for PCE and iron is 45 and 40 years, respectively. Vinyl chloride emissions are below SER.	Estimated 10 years operation. Time to reach PRGs for PCE and iron is 45 and 71 years, respectively.	Estimated >30 years operation Time to reach PRGs for PCE and iron is 45 and 40 years, respectively.
Compliance with: ARARs and TBCs	MCLs for drinking water are exceeded in the Sand and Gravel aquifer. Estimated to reach MCLs after 55 years. Potential to exceed surface water standards or criteria.	Same as 1.	Reach MCLs after 45 years. Air emissions are likely below SERs. Treated water discharged in accordance with SDS permit. Iron & manganese sludge management would comply with ARARs.	Reach MCLs after 45 years. Air emissions are likely below SERs. Treated water discharged in accordance with SDS permit. Iron & manganese sludge management would comply with ARARs.	Reach MCLs after 45 years. Treated water discharged in accordance with SDS permit. Spent carbon management would comply with ARARs. Iron & manganese sludge management would comply with ARARs.	Reach MCLs after 45 years. Treated water discharged in accordance with SDS permit. Spent carbon management would comply with ARARs. Iron & manganese sludge management would comply with ARARs.	Reach MCLs after 45 years. Treated water discharged in accordance with SDS permit. Iron & manganese sludge management would comply with ARARs.	Reach MCLs after 45 years Treated water discharged in accordance with SDS permit. Iron & manganese sludge management would comply with ARARs.

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TABLE 5 (CONT)

COMPARATIVE ANALYSIS SUMMARY
MIGRATION CONTROL OPERABLE UNIT
DAKHUE SANITARY LANDFILL SITE

CRITERIA	ALTERNATIVE 1	2	3A	3B	4A	4B	5A	5B
Reduction of Toxicity, Mobility, or Volume through Treatment	No reduction other than natural processes.	Same as 1.	Mobility of iron and manganese is reduced.	Mobility of iron and manganese is reduced.	Reduces toxicity through treatment. Mobility of iron and manganese is reduced.	Reduces toxicity through treatment.	Reduces toxicity through treatment Mobility of iron and manganese is reduced.	Reduces toxicity through treatment No atmospheric emissions. Mobility of iron and manganese is reduced.
Implementability	Readily implementable. Relies on future enforcement of MDE code.	Same as 1.	Readily implementable.	More impact on agricultural land downgradient of landfill than Alternative 3A.	Same as 3A. Difficult operation.	Same as 3B.	Same as 3A. Difficult operation. Additional pretreatment may be required.	Same as 3B. Difficult operation. additional pretreatment may be required.
Cost:								
Capital	$0	$0	$150,000	$280,000	$180,000	$270,000	$330,000	$460,000
Present Worth	$0	$570,000	$600,000	$910,000	$960,000	$1,550,000	$970,000	$1,670,000
Total	$0	$570,000	$750,000	$1,200,000	$1,100,000	$1,800,000	$1,300,000	$2,100,000
Support Agency Acceptance	NA	NA	NA	NA	NA	NA	NA	NA

NA - Not applicable to State-lead Dakhue site.

time due to dilution, biodegradation and other natural processes. Water quality monitoring will be conducted to monitor contaminant migration and to assess water quality in the Sand and Gravel aquifer, the deep aquifer and Judicial Ditch No. 1. Total cost for monitoring the site is estimated to be $360,000 with the installation of two additional monitoring wells. The preferred alternative provides the best balance of tradeoffs among alternatives with respect to the criteria used to evaluate the remedies.

Corrective action will be initiated if monitoring results indicate that the cover system is ineffective in reducing concentrations in the Sand and Gravel aquifer or that Judicial Ditch No. 1 will be negatively impacted. Corrective action for surface water will be triggered if levels in the new wells installed downgradient exceed the surface water standards for iron (221 ug/l), manganese (572 ug/l), aluminum (87 ug/l), chromium (11 ug/l), silver (.12 ug/l), zinc (191 ug/l), and cyanide (5.2 ug/l).

CERCLA provides for the establishment of Alternative Concentration Limits (ACLs) for groundwater pursuant to CERCLA Section 121 (d)(2)(B)(ii) under certain limited situations. The statutory prerequisites for the establishment of ACLs include 1) there are known and projected points of entry of groundwater into surface water, 2) on the basis of measurements or projections, there is or will be no statistically significant increase of such constituents from such groundwater in such surface water at the point of entry where there is reason to believe accumulation of constituents may occur downstream, and 3) the remedial action includes enforceable measures that preclude human exposure to contaminated groundwater at any point between the facility and all known or projected points of entry of groundwater into surface water then the assumed point of human exposure may be at such known and projected points of entry. Consideration may be given to setting ACLs if groundwater contamination is not attenuating as projected and the prerequisites are satisfied.

IX. STATUTORY DETERMINATION SUMMARY

The selected remedy must satisfy the requirements of Section 121 (a-e) of CERCLA, as amended by SARA, to:

a. Protect human health and the environment;
b. Comply with ARARs;
c. Be cost-effective;
d. Utilize permanent solutions and alternative treatment technologies to the maximum extent practicable; and,
e. Satisfy the preference for treatment as a

principal element or provide an explanation as to why this preference is not satisfied.

The implementation of modified Alternative 2 at the DSLF site satisfies the requirements of CERCLA, as amended by SARA, as detailed below:

a. Overall Protection of Human Health and the Environment

This alternative is considered protective of human health. There are no known complete exposure pathways under current site conditions (Barr, August 1992). The only possible mechanism for exposure to occur would be for someone to install a potable water well in a location where contaminated groundwater may be withdrawn. The installation of new surficial aquifer drinking water wells is legally prohibited and is, therefore, unlikely. The groundwater MCLs for TCE, PCE, vinyl chloride and benzene will be met after approximately 55 years due to natural attenuation.

Absent an active groundwater extraction and treatment system for the contaminated plume; Aluminum, Chromium, Cobalt, Silver, Zinc and Cyanide all have the potential to exceed their surface water quality standards as groundwater discharges to Judicial Ditch No. 1. Exposure point concentrations for the above metals were modelled using a two-dimensional solute transport mode (MYGAT Version 2.0) and the contaminant source was assumed to be equal to the highest concentrations observed. The model estimates reductions in concentration based only upon dispersion. Other chemical fate processes such as retardation through reaction with aquifer components were not evaluated. In addition, dilution effects due to mass flow in Judicial ditch No. 1 were not considered. Therefore the model is considered a very conservative worst case scenario, and the actual concentrations are likely to be significantly lower. Notwithstanding this, MPCA will monitor the groundwater plume upgradient of Judicial Ditch No. 1 and will implement measures to ensure that surface water quality standards and criteria are met.

b. Compliance With ARARs

This remedy will attain all applicable or relevant and appropriate Federal and/or State requirements which are more stringent.

Revised PRGs for groundwater will be met under this remedy. As stated earlier, the revised PRGs set forth

in Table 7 are either ARAR-based, MCLs, or risk-based levels. Now that the landfill cap has been installed, contaminant concentration in the Sand and Gravel aquifer is expected to slowly decrease over time due to natural attenuation processes. It is expected that the MCL for PCE, which has the longest half-life and highest concentration of the chemicals of concern, will be attained in approximately 55 years. The MCLs for other chemicals of concern will be met more quickly.

The State and the County will enforce well placement restrictions under MN Rules 4725.2000 and 4725.4300, and Dakota County Ordinance No. 114 to ensure that no residential wells are developed in the area downgradient of the landfill.

The selected remedy will attain ARARs for surface water as well. At the present time, surface water standards under Minnesota Rule 7050 and Federal Ambient Water Quality Criteria promulgated under the Federal Water Pollution Control Act are not exceeded. There, however, is a possibility that they may be exceeded in the future using extremely conservative groundwater models. Long term monitoring will be conducted on-site to ensure that inorganic concentrations in discharges to Judicial Ditch No. 1 do not exceed these surface water standards and criteria. Trigger levels have been specified above so that if groundwater monitoring indicates that the surface water standards and criteria are going to be exceeded, further action will be taken to address these discharges.

c. Cost - Effectiveness

The cost to install two additional monitoring wells and monitor the site over the next 30 years is estimated at $360,000. (Table 6) This is cost effective when compared to the cost of the treatment remedial alternatives which are significantly more expensive with only a marginal increase in their effectiveness in attaining the revised PRGs.

d. Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable.

U.S. EPA and the State of Minnesota believe the selected remedy meets the statutory requirement to utilize permanent solutions and treatment technologies to the maximum extent practicable. Of the alternatives that are protective of human health and the environment and comply with ARARs, U.S. EPA and the State have

TABLE 6

Preferred Alternative
Groundwater Migration Control Operable Unit
Dakhue Sanitary Landfill Site

	Quantity/ Unit	Unit Cost	Cost
I. SITE MONITORING			
Install Monitoring Wells	2 Each	3,300	6,600
Sample Collection	1 L.S.	2,200	2,200
Analysis:			
VOC	18 Each	300	5,400
Metals	18 Each	270	4,860
Cyanide	18 Each	42	756
Review and Reporting	1 L.S.	6,000	6,000
		SUSTOTAL:	$19,200
Contingencies (20%)			3,840
		Subtotal:	$23,040
PRESENT WORTH: Site Monitoring (30 yrs @ 5%)			$350,000
SUBTOTAL: Site Monitoring			$360,000

TABLE 7

REVISED PRELIMINARY REMEDIATION GOALS
GROUNDWATER-DRINKING WATER USE

DAKHUE SANITARY LANDFILL SITE
(concentration in µg/L)

CHEMICAL	PRG	BASIS
VOLATILE ORGANIC COMPOUNDS		
Benzene	5	MCL
Chlorobenzene	100	MCL
Chloroethane	29	Risk-based (10^{-6})
Chloroform	100	MCL
Chloromethane	1.4	Risk-based (10^{-6})
1,1-Dichloroethane	1,000	Risk-based (HQ)
1,2-Dichloroethane	5	MCL
1,1-Dichloroethylene	7	MCL
1,2-Dichloroethylene	70	MCL
1,2-Dichloropropane	5	MCL
Methylene Chloride	11 (5)[b]	Risk-based (10^{-6})
Methyl Ethyl Ketone	570	Risk-based (HQ)
Methyl Isobutyl Ketone	200	Risk-based (HQ)
Tetrachloroethylene	5	MCL
1,1,1-Trichloroethane	200	MCL
1,1,2-Trichloroethane	5	MCL
Trichloroethylene	5	MCL
Trichlorofluoromethane	1,700	Risk-based (HQ)
Vinyl Chloride	2	MCL
Xylenes	10,000	MCL
SEMIVOLATILES		
Benzoic Acid	150,000	Risk-based (HQ)
Bis(2-ethylhexyl)phthalate	6	MCL
Cresol	1,800	Risk-based (HQ)
Diethyl phthalate	29,000	Risk-based (HQ)
Phenol	22,000	Risk-based (HQ)
INORGANICS		
Aluminum	36,000	Risk-based (HQ)
Arsenic	50	MCL

TABLE 7 (CONT)

REVISED PRELIMINARY REMEDIATION GOALS
GROUNDWATER-DRINKING WATER USE

DAKHUE SANITARY LANDFILL SITE
(concentration in μg/L)

CHEMICAL	PRG	BASIS
Barium	2,000	MCL
Cadmium	5	MCL
Chromium	100	MCL
Copper	1,300	MCL
Cyanide	730 (200)[b]	Risk-based (HQ)
Manganese	3,600	Risk-based (HQ)
Nickel	100	MCL
Selenium	50	MCL
Zinc	7,300	Risk-based (HQ)

[a] Basis of Revised PRG:
MCL - maximum contaminant level
Risk-based (10^{-6}) - based on cancer risk at 10^{-6} risk level
Risk-based (HQ) - based on noncarcinogenic risk

[b] Proposed MCL in parenthesis.

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determined that the selected remedy provides the best balance of tradeoffs in terms of long-term effectiveness and permanence, reduction of toxicity, mobility or volume through treatment, short-term effectiveness, implementability, cost and State and community acceptance. The selected remedy can be implemented more quickly, with less difficulty, with no short-term exposure pathways, and at less cost than the active groundwater treatment alternatives.

The human health risk assessment indicates that the risks associated with the Groundwater Migration Management O.U. fall within acceptable guidelines as long as no potable water wells are screened in the Sand and Gravel aquifer downgradient of the landfill. Dakota County Ordinance No. 114 prohibits constructing a potable water well screened in the Sand and Gravel aquifer (Minn. Rules 4725.2000) and Prairie du Chien aquifer (Minn. Rules 4725.4300) in this area. In addition, the ordinance restricts the use of the Sand and Gravel aquifer due to elevated nitrate concentrations. These risks are controlled when these restrictions are enforced.

If a potable water well is required in the Groundwater Migration Management O.U. affected area, the well would be screened in the Jordan Sandstone aquifer. The human health-risk assessment indicates this aquifer would provide a safe potable water source (Barr, August 1992).

In addition, the Source Control O.U. is expected to significantly reduce migration of contaminants from the DSLF site.

The selected remedy represents the maximum extent to which permanent solutions and treatment can be practicably utilized for this action taking into account the site conditions, the Source Control O.U. and the comparative analysis of the alternatives considered.

e. Preference for Treatment as a Principal Element

Because treatment of the groundwater at the site was not found to be practicable, the remedy does not satisfy the statutory preference for treatment as a principle element of the remedy. As was stated above, it is expected that the Source Control O.U. is expected to significantly reduce groundwater contaminants travelling off-site. In addition, based on the comparative analysis of the alternatives, it has been

determined that active groundwater treatment does not provide a significant benefit proportional to its cost.

X. DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for the DSLF Groundwater Migration Management O.U. was released for public comment in January 1993. The Proposed Plan identified a modification of Alternative 1 with monitoring as the preferred alternative. After review of the public comments, the selected remedy has been changed to a modification of Alternative 2 which calls for groundwater monitoring with provision for additional action should trigger levels be met. In addition, cost participation for potable water sources in the area effected by the O.U. was eliminated from the selected remedy.