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Superfund Record of Decision:

Hastings Groundwater Contamination, NE

50272-101

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15. Supplementary Notes

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16. Abstract (Limit: 200 words)

The Hastings Ground Water Contamination site is an area of ground water contamination located east of Hastings, Nebraska. An estimated 23,000 people draw their public water supply from the High Plains Aquifer, which has been contaminated with industrial chemicals. Contamination of the ground water was first detected in 1983, when the State sampled the Hastings public water supply system in response to citizen complaints of foul taste and odor in the drinking water. Ongoing site investigations by the State and EPA, starting in 1983, have identified several sources of ground water contamination. The Hastings public water supply system is located onsite and consists of two VOC-contaminated ground water plumes that encompass the Well #3 subsite. A 1989 ROD identified and addressed the source area for Plume 1, as OU13. Since it was only detected recently, the source area for Plume 2 (OU18) has not been identified and the extent of Plume 2 has not been accurately defined. This ROD addresses an interim remedy for the Well #3 subsite. The primary contaminants of concern affecting the ground water are VOCs, including PCE and TCE.

The selected remedial action for this site includes pumping contaminated ground water from Plumes 1 and 2 to hydraulically contain the contamination; treating the extracted

(See Attached Page)

17. Document Analysis a. Descriptors

Record of Decision - Hastings Groundwater Contamination, NE
Eighth Remedial Action
Contaminated Medium: gw
Key Contaminants: VOCs (PCE, TCE)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

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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)

ground water onsite with granular activated carbon to remove VOCs and achieve MCLs, followed by reinjection, reuse, or onsite discharge; and monitoring ground water to determine the effectiveness of the selected remedy. The estimated present worth cost for this remedial action is $1,933,000, which includes an annual O&M cost of $141,000 for years 0-10 and $72,000 for years 11-12.

PERFORMANCE STANDARDS OR GOALS:

Ground water cleanup goals for the interim remedy are based on attaining risk levels equal to or below the 10^{-4} level. Chemical-specific goals that will be met through management of plume migration include PCE 150 ug/l and TCE 290 ug/l.

INTERIM ACTION RECORD OF DECISION

DECISION SUMMARY

HASTINGS GROUND WATER CONTAMINATION SITE

WELL #3 SUBSITE

GROUND WATER OPERABLE UNITS

PLUME 1 OPERABLE UNIT #13

PLUME 2 OPERABLE UNIT #18

HASTINGS, NEBRASKA

Prepared by:

U.S. Environmental Protection Agency

Region VII

Kansas City, Kansas

June 30, 1993

INTERIM ACTION RECORD OF DECISION DECLARATION

SITE NAME AND LOCATION

Well #3 Subsite, Ground Water Operable Units
Plume 1 - Operable Unit #13
Plume 2 - Operable Unit #18
Hastings Ground Water Contamination Site
Hastings, Nebraska

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected interim remedial actions for the Well #3 ground water operable units. The Well #3 Subsite is a subsite of the Hastings Ground Water Contamination Site, Hastings, Nebraska. These actions were chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Re-authorization 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 this subsite.

The State of Nebraska concurs with the selected remedies as interim actions for this subsite.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this subsite, if not addressed by implementing the response actions selected in this interim action Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE SELECTED INTERIM REMEDIES

The interim action ROD addresses two separate areas of ground water contamination. Plume 1 is characterized by carbon tetrachloride (CCl_4) and chloroform ($CHCl_3$) contamination. Plume 2 is characterized primarily by trichloroethene (TCE), 1,1,1-trichloroethane (TCA), tetrachloroethene (PCE) and dichloroethene (DCE) contamination.[1] These interim ground water remedies were developed to protect public health, welfare and the environment by controlling the migration and reducing the volume and mass of contaminants present in the ground water beneath and downgradient from each source area of the Well #3 Subsite. Operable unit interim actions will be consistent with all planned future remedial activities.

The major components of the selected interim remedies include:

Plume 1: EPA and the State of Nebraska will initiate extraction of ground water by the pumping of well CW-1. From the information gained on CCl_4 concentrations and the aquifer response, the full scale ground water extraction and treatment system will be designed. The system will be designed to actively control migration of ground water contaminated with CCl_4 and to rapidly remove contaminant mass from the aquifer. Contaminant mass removal will be monitored by using existing or newly installed monitoring wells, if needed. A schedule of sampling and analysis of the ground water will be initiated to observe the effectiveness and progress of the remediation system. Extracted contaminated ground water will be treated to meet Maximum Contaminant Levels (MCLs), as established under the Safe Drinking Water Act, 42 U.S.C. § 300g-1, with Granular Activated Carbon (GAC) prior to reinjection or reuse.

Plume 2: EPA will request the Potentially Responsible Parties (PRPs) to design a ground water extraction and treatment system. EPA will require that the extraction system be designed to actively control migration of ground water contaminated with TCE/TCA and other volatile organic compounds (VOCs) and to rapidly remove contaminant mass from the aquifer. EPA will also require that monitoring wells be installed and ground water sampling and analysis be conducted to observe the effectiveness and progress of the remediation system. Extracted contaminated ground water will be treated to meet MCLs with GAC prior to reinjection or reuse.

STATUTORY DETERMINATIONS

These interim actions are protective of public health, welfare and the environment. The actions comply with action-specific and some chemical-specific federal and state applicable or relevant and appropriate requirements and are cost-effective. Although these interim actions are not intended to fully address the statutory mandate for permanence and treatment to the maximum extent practicable, these interim actions utilize treatment and thus are in furtherance of that statutory mandate. Because these actions do not constitute a final remedy for the subsite, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal

[1] Plume 1 was identified in the Proposed Plan for the Well #3 Subsite as the CCl_4 contamination plume and Plume 2 was identified as the TCE/TCA contamination plume.

element, although partially addressed by these remedies, will be more fully addressed by the final response action.

Because these interim remedies will result in hazardous substances remaining on site above health-based levels, a review will be conducted to ensure that these remedies continue to provide adequate protection of human health and the environment within five (5) years after commencement of the remedial action. Review of these interim remedies will be ongoing as EPA continues to develop final remedial alternatives for the Well #3 Subsite.

Date 6/30/93

William W. Rice
Acting Regional Administrator
Region VII

Attachments: Decision Summary
Responsiveness Summary - Attachment A

Interim Record of Decision

Decision Summary
Contents

Decision Summary
Contents

List of Tables:

List of Figures:

DECISION SUMMARY
Well #3 SUBSITE
HASTINGS GROUND WATER CONTAMINATION SITE
GROUND WATER OPERABLE UNITS

PLUME 1, OPERABLE UNIT #13
PLUME 2, OPERABLE UNIT #18

I. SITE DESCRIPTION

The Hastings Ground Water Contamination Site is located in south central Nebraska, within and east of the city of Hastings, Nebraska. The location of Hastings is shown by Figure 1. Hastings has an estimated population of 23,000. This site consists of several source areas which are referred to as "subsites" and depicted in Figure 2.

The Hastings Ground Water Contamination Site consists of an aquifer contaminated with industrial chemicals, primarily chlorinated volatile organics. Contamination was discovered in 1983 when the Nebraska Department of Health (NDOH) sampled the Hastings public water supply system in response to citizen complaints of foul taste and odor in the drinking water. That same year, NDOH and the Nebraska Department of Environmental Control (NDEC), now known as the Nebraska Department of Environmental Quality (NDEQ), began investigating wide-spread ground water contamination in the Hastings area. The City obtains all of its drinking water supply from the public water supply system which taps the ground water aquifer, known as the High Plains Aquifer deposited during the Pleistocene period. The ground water contamination problems addressed by this interim Record of Decision (ROD) pertain to this aquifer.

The Well #3 Subsite is located in the Central Industrial Area of Hastings between B Street and Second Street in the north-south direction, and between Maple Avenue and Denver Avenue in the east-west direction. The subsite includes commercial and industrial properties situated along the Burlington Northern Railroad (BNRR) right-of-way. The Well #3 Subsite is characterized by Plume 1, which extends eastward from a former grain storage facility and Plume 2, which appears to extend eastward from an industrial area between wells CW-4 and CW-9 as depicted in Figure 3.

The source area for Plume 1 is located on property that was formerly used as a grain storage facility. The source area for Plume 2 has not currently been identified. EPA published a ROD on September 26, 1989 which selected a remedy for CCl_4 contamination in the source area. The source area is currently undergoing remediation.

Hastings Public Water Supply wells are located within the subsite and downgradient. Figure 3 shows the location of the City wells in relation to the subsite.

II. SITE HISTORY

In 1983, the city of Hastings attempted to put municipal well M-18 into service, 40 years after installation. However, following startup, complaints by citizens of Hastings of foul taste and odor prompted the City to remove the well from service permanently. NDEC analyzed samples collected from Well M-18 in 1983 and 1984 and detected elevated levels of compounds TCA, TCE, DCE and PCE. These compounds belong to a general class of compounds referred to as volatile organic compounds (VOCs). VOCs are those chemicals that tend to evaporate when exposed to air. The NDEC also detected elevated levels of these and other VOCs in three other municipal wells in Hastings, including Well M-3, which was contaminated with CCl_4.

In 1984, the state of Nebraska installed five pairs of monitoring wells in the city of Hastings to define the extent of the contamination. The EPA began to sample wells on a quarterly basis in 1985. Due to the presence of VOCs, the city of Hastings decommissioned several of its public water supply wells including Well M-3; the Community Municipal System (CMS) operating east of Hastings decommissioned two wells.

Through EPA's soil-gas investigations in 1986-1989, EPA found CCl_4 upgradient from M-3 in the soils on property currently owned by W.G. Pauley Lumber Co., which was previously owned by grain merchandisers. After further investigation, EPA concluded that the most likely cause of the CCl_4 contamination on the Pauley property and downgradient of it was a grain fumigant spill. EPA obtained information that during the 1950s and 1960s, when there were large grain crop surpluses, extensive amounts of grain were stored for long periods of time while waiting for market. Fumigants were used on the grain in an effort to keep the grain in good condition. A primary ingredient of the liquid grain fumigants that was used then was CCl_4. $CHCl_3$ is a breakdown product of CCl_4. EPA, with the state of Nebraska, is remediating the CCl_4 contamination in the soils. EPA has no information that CCl_4 was ever generated at the subsite. Therefore, no onsite burial of wastes is suspected.

Prior to 1990, EPA installed two ground water monitoring wells at the subsite, MW-23 and CW-1, to assist EPA in defining the extent of Plume 1. In 1991, EPA added six monitoring wells: CW-2, CW-3, CW-4, CW-5, CW-6 and CW-7. Locations of these monitoring wells are shown on Figure 3. EPA also collected "in-situ" water samples during the drilling of these wells.[1] In addition, quarterly ground water samples have been collected from completed subsite wells. The analytical results from monitoring well CW-7 indicated that the subsite was contaminated with TCE, TCA, PCE and DCE. The original intent of these sampling efforts was to characterize the CCl_4 and $CHCl_3$ plume that began at the source control area and contaminated municipal well M-3. An unexpected result was the discovery of high levels of TCE, TCA, PCE, and DCE in CW-

[1] In-situ samples are one time only water samples; sampling results are presented in Table 1.

7. A separate subsequent investigation was undertaken to characterize this plume. In 1992, EPA installed three additional monitoring wells (CW-8, CW-9, and CW-10) to determine the extent of the contaminant source for Plume 2.

From 1988 to the present, EPA has been collecting ground water samples at the subsite. See Table 2 summaries of the analytical results of the sampling efforts. As more fully set forth in the Remedial Investigation (RI) Report and the draft Feasibility Study (FS) Report, two separate areas of VOC contamination within the aquifer have been identified and are shown in Figures 4 and 5. Figure 4 shows the estimated plume boundaries based on a ground water contaminant concentration that is equal to a 1 in 10,000 ($1X10^{-4}$) excess lifetime cancer risk.[2] EPA has targeted contaminated ground water exceeding the 1 in 10,000 risk level as an appropriate cleanup goal for interim ground water actions in Hastings.

The contamination source for Plume 2 is presently unidentified but appears to be emanating from an area north of the BNRR tracks and in the vicinity of monitoring wells CW-4 and CW-9. EPA has issued Information Requests pursuant to its authority under Section 104(e) of CERCLA to property owners and business operators in that general location.[3] Based on information provided by Dutton-Lainson Co. (Dutton-Lainson) that it used and stored significant quantities of TCE and TCA at its plant site, which is located directly north of CW-4 and CW-9, EPA has requested that Dutton-Lainson undertake a focused site investigation to determine the amount of TCE/TCA contamination present within the vadose zone at this location. The results of this focused investigation will aid EPA in determining if additional remediation is needed for the TCE/TCA contamination.

EPA has determined that two separate interim actions are needed to address the contamination at the Well #3 Subsite where the contaminants exceed the 1 in 10,000 risk level. EPA has estimated that in Plume 1 there are approximately 27 million gallons of CCl_4 contaminated ground water containing 79 pounds of CCl_4. EPA has estimated that in Plume 2 there are approximately 97 million gallons of TCE contaminated ground water containing approximately 720 pounds of TCE. Subsite information used to calculate the amount of contamination present in the plume is presented in the draft FS.

The ground water data indicate that the subsite's surface contamination has migrated and may continue to migrate to the ground water beneath and downgradient of the subsite. All data results are presented in the RI Report which was released on

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[2] $1 X 10^{-4}$ refers to a contaminant concentration that would cause one additional cancer for every 10,000 individuals, assuming a lifetime of exposure at target concentrations. Target concentrations of the contaminants are set forth in Table 3.

[3] TCE and TCA were used as degreasing solvents by metal finishing industries, as well as other industries. Presently TCA continues to be used for degreasing. PCE has been used by several industries within Hastings. DCE is a breakdown product of PCE and TCE.

December 14, 1992. The draft FS, based on the RI Report, was released on January 15, 1993. A Proposed Plan explaining the preferred alternative to mitigate the contamination at the subsite was released January 25, 1993 with a public comment period held from January 25 to March 29, 1993 to receive comments from any interested party on the Proposed Plan and other subsite documents. The EPA has prepared a responsiveness summary which addresses the comments received (Attachment A).

III. ENFORCEMENT HISTORY

Potentially Responsible Parties (PRPs) are those individuals or corporations liable under CERCLA for the costs incurred by the EPA in responding to a release or threat of release of a hazardous substance from a facility.[4] EPA conducted a PRP search to identify parties liable for Plume 1. EPA found that a grain merchandising business known as Farmers Grain Storage operated at the subsite. EPA attributes the CCl_4 contamination to a spill of grain fumigant during its period of operation. Farmers Grain Storage is a dissolved corporation. No PRPs have been named for Plume 1.

EPA is actively conducting a PRP search to identify parties liable for Plume 2. EPA issued a notice letter to Dutton-Lainson Company on November 5, 1992, based on information that Dutton-Lainson has used TCE or TCA since 1948 and has stored up to 400 gallons of TCE or TCA at its facility. On September 23, 1985, EPA named Ingersoll-Rand as a PRP for the central industrial area which included the subsites within the city of Hastings, based on information that Ingersoll-Rand used PCE. On February 26, 1993, EPA issued a notice letter to Ingersoll-Rand specifically for the TCA/PCE contamination at the Well #3 Subsite. This notice, like the earlier one issued to Ingersoll-Rand, was based on information that Ingersoll-Rand has used and stored significant quantities of these solvents.

EPA is continuing to request information from other owners and operators of businesses located near the Plume 2. EPA will continue to evaluate the potential liability of parties and determine PRP status.

IV. COMMUNITY RELATIONS

Community relations activities for the Hastings Ground Water Contamination Site were initiated by EPA in 1984. Early community relations activities included meeting with City and state officials to discuss the Site (December 1984), conducting interviews with local officials and interested residents (February 1985), establishing an information repository (February 1985), and preparing a Community Relations Plan (October 1985). Since December 1984, EPA has conducted periodic meetings with Hastings city officials and concerned citizens to update them regarding site work and investigation findings.

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[4] The contaminants of concern, CCl_4, $CHCl_3$, TCE, TCA, PCE and DCE are hazardous substances within the meaning of CERCLA.

The Community Relations Plan was revised in January 1988 and again in January 1990 to reflect new community concerns and site activities.

Information on the Well #3 Subsite, in the form of fact sheets, has been mailed to public officials, Hastings' businesses, and numerous citizens. EPA held a public comment period from January 25 to March 29, 1993 following the release of the Proposed Plan (January 25, 1993). The Proposed Plan identified the preferred alternative to mitigate the two separate ground water contamination plumes at the Well #3 Subsite. On February 16, 1993, EPA held a public meeting to discuss the preferred alternative for the subsite and to receive citizens' comments and questions. Agency responses to these comments are included in the Responsiveness Summary attached to this Decision Summary.

V. SCOPE AND ROLE OF OPERABLE UNITS

This interim action ROD addresses activities which will mitigate two separate areas of contamination within the ground water operable unit in the vicinity of the Well #3 Subsite and will reduce contaminant mass in the ground water from both plumes. The purpose of the interim action for each ground water operable unit is to begin aquifer restoration and collect additional information on the aquifer's response to remediation.

This interim action ROD is consistent, to the extent practicable, with the NCP. According to the NCP, the EPA regulation which establishes procedures for the selection of response actions, an interim action is appropriate where a contamination problem will become worse if left unaddressed and where the interim action will not be inconsistent with a final remedial action. Consistent with the principles of the NCP, these interim remedial actions are designed to promptly initiate an interim remedial action response which should prevent further degradation of the aquifer and will rapidly reduce contaminant mass.

In accordance with the NCP, the interim actions for the Well #3 Subsite will complement and be consistent, to the extent possible, with a final remedy. The final remedy may include ground water monitoring, ground water extraction and treatment options, well head protection and treatment, and institutional controls. Any future actions will be considered and selected based on the requirements of the NCP.

As interim actions, these selected remedies need not meet all federal and state standards for clean-up of the aquifer, nor must they provide a permanent solution to the contamination problems. Prompt remedial response is necessitated because water supply wells in the proximity of the Well #3 Subsite that remain in use have been threatened, and will continue to be threatened, by the contaminated ground water emanating from the Well #3 Subsite, unless these actions are taken. If left unaddressed, significant concentrations of contaminants in the ground water could impact other City supply wells, thus limiting the supply of water available for public use. In addition, if left unaddressed, the plume will continue to increase in size and migrate, affecting areas not currently contaminated.

The interim actions to be conducted at all of the subsites which are part of the Hastings Ground Water Contamination Site will have a common interim goal: to achieve ground water containment, rapid reduction of contaminant mass in the ground water and a reduction of excess cancer risk levels to one case in an exposed population of 10,000 over a 30-year period in a seventy year lifetime. In addition, EPA's interim goal at the Well #3 Subsite is to rapidly reduce contaminant levels to their target concentrations within approximately 10 years.[5] EPA will ensure that any final remedial action will minimize the potential for human exposure to ground water exceeding health-based standards.

EPA has calculated the volume of ground water contaminated with CCl_4 above 31 micrograms per liter (ug/l) and the volume of ground water contaminated with TCE above 290 ug/l.[6] These calculations were made assuming an aquifer porosity of 24 percent. To calculate the CCl_4 contamination, the aquifer was estimated to be approximately 125 feet deep; it was assumed that the CCl_4 contamination was present at the source area in only the upper 9 feet of water. Based upon this information, EPA calculated that approximately 26.6 million gallons of water is contaminated with CCl_4 above 31 ug/l. To calculate the TCE contamination, the levels of contaminants were assumed to be present in a 50 foot thickness of the aquifer. Based upon this information, EPA calculated that approximately 97.1 million gallons of water is contaminated with TCE above 290 ug/l.

Steps have been taken to prevent human exposure to contaminated ground water. However, unrestricted water use, though it is not known to be occurring, would pose an immediate threat to human health. Analytical results from samples collected during EPA's ongoing investigations are supplied to the City and the NDOH. If future sampling indicates the chemicals have migrated to other public water supply wells, the NDOH, which has been delegated authority under the Safe Drinking Water Act (SDWA), 42 U.S.C. § 300f et. seq., can cause the public water supplier to provide water which meets the requirements of the SDWA.

VI. SITE CHARACTERISTICS

Ground Water Characteristics

The geologic profile in the Hastings area, from shallowest to deepest deposits of interest, are Quaternary fluvial deposits and Cretaceous marine deposits. Pleistocene

[5] The target concentration of a contaminant is the level of contamination that is equivalent to a 1 in 10,000 cancer risk level.

[6] 31 ug/l and 290 ug/l represent the target concentrations for CCl_4 and TCE respectively.

deposits make up the majority of the regional unconsolidated deposits and contain the aquifer that supplies the Hastings area. The upper geologic units of the Pleistocene deposits, the Peoria, Loveland and Sappa Formations, are finely grained loesses and sandy clays with some sandy lenses. The total thickness of the upper fine grained Pleistocene materials is approximately 50 to 100 feet. The lower Pleistocene deposits consist of fine to coarse sand and gravel with discontinuous layers of silts and clays. These water-bearing deposits are approximately 100 feet thick. The Cretaceous Niobrara Formation, a marine shale with frequent chalky zones, is considered to be bedrock in the Hastings area. The contact between the Pleistocene and Cretaceous formations is a weathered and eroded surface.

The Pleistocene age ground water aquifer is a prolific ground water resource capable of sustaining substantial pump rates of 1000 to 2000 gallons per minute. The regional potentiometric surface slopes toward the east-southeast with a gradient of approximately 0.001 foot per foot (ft/ft) to 0.002 ft/ft. Although there are some differences between the upper and lower portions of the aquifer, available information indicates that it behaves as a single unconfined aquifer. The transmissivity of the aquifer ranges from 90,000 gallons per day per foot (gpd/ft) to 225,000 gpd/ft. The hydraulic conductivity of the aquifer ranges from 989 gallons per day per square foot (gpd/ft^2) to 2184 gpd/ft^2. The aquifer is recharged by infiltration of precipitation, seepage from streams, and inflow from irrigation to the extent of approximately 1.6 inches per year.

The results of the RI have indicated there are sources of contamination in the vadose zone and in the ground water within the Well #3 Subsite and downgradient from both these source areas. The source area of the vadose zone CCl_4 contamination was described in the September 26, 1989 ROD for this subsite. The source area for the vadose zone contamination for Plume 2 has not yet been identified.

The ground water data gathered during the RI indicated that CCl_4, $CHCl_3$, TCE, TCA, DCE and PCE have migrated vertically into the deeper vadose zone and have entered the aquifer. The data further indicated that once these VOCs entered the aquifer, they migrated downgradient primarily in the dominant direction of flow.[7]

Precise ground water plume characterization is made difficult by the fact that the Pleistocene aquifer is highly transmissive and is heavily used. Seasonal stress on the aquifer alters the hydraulic flow patterns in the region substantially; consequently, contaminant concentrations vary seasonally. The present monitoring network is insufficient to fully characterize the extent of the plume but is adequate to establish primary contaminant plume features.

[7] Although the ground water flow is in the east-southeast direction, the nature of the soils and the thickness of the vadose zone at this particular subsite allow the contaminants to travel in all directions as they migrate to the aquifer.

Ground water data from all the monitoring and municipal wells depicted in Figure 3 were used to characterize and evaluate the contamination at the Well #3 Subsite.

Analyses of samples collected from the wells named CW-1 through CW-10 indicate elevated levels of CCl_4, $CHCl_3$, TCE, TCA, DCE and PCE in the ground water. Table 2 is a summary of the ground water data collected from all subsite wells. Figure 4 is a depiction of the area of the two separate ground water contamination plumes.

Pursuant to the authority of the SDWA, EPA has established maximum contaminant levels (MCLs) for CCl_4, $CHCl_3$, TCE, TCA, DCE and PCE. MCL refers to the maximum contaminant level or maximum permissible level of a contaminant in water which is delivered to any user of a public water system. MCLs are based on health risk, treatment technology, cost and analytical methods and are used in developing ground water cleanup levels. The MCL established for CCl_4, TCE and PCE is 5 parts per billion (ppb or ug/l); the MCL for TCA is 200 ppb; the MCL for $CHCl_3$ is 100 ppb; and the MCL for DCE is 7 ppb. Figure 5 shows the areas of contamination which exceed the MCLs for both CCl_4 and TCE where Plumes 1 and 2 intermingle.

As indicated by the data presented in this ROD, the MCLs for CCl_4, $CHCl_3$, TCE, TCA, DCE and PCE have been exceeded. All these compounds are VOCs which readily volatilize because they have high vapor pressures. In addition, these vapors have a tendency to move through soil pore spaces driven by diffusive and dispersive processes. Further, gravitational forces tend to drive vapors and liquids in a downward vertical direction until they meet ground water. VOCs may then become dissolved in ground water or may be transported separately, if concentrations are great enough.

The continuous movement of CCl_4 is indicated by the data. For example, prior to the decommissioning of public supply well M-3 in 1985, CCl_4 concentrations ranged from 27 to 46 ppb. Since M-3 was taken out of service and is no longer drawing CCl_4 from the source area, the presence of CCl_4 has been noted in MW-23, a downgradient monitoring well. Recent data from M-3 indicated that the CCl_4 contamination levels have remained steady as the contamination moves through the aquifer.

The extent of Plume 2 is not well defined since its recent discovery at the subsite in 1991. The field investigation conducted in 1992 focused on identifying the upgradient source of the TCE found within CW-7. Sufficient data has been gathered to determine that Plume 2 exists and requires remediation. Additional data regarding the extent of the VOC contamination will be gathered during remediation.

VII. SUMMARY OF SITE RISKS

CERCLA requires EPA to seek permanent solutions to protect human health and the environment from hazardous substances. These solutions provide for removal, treatment, or containment of dangerous chemicals so that any remaining contamination does not pose an unacceptable health risk to anyone who might come into contact with them. The risks associated with the subsite were based upon the presence of CCl_4,

$CHCl_3$, TCA, TCE, DCE and PCE that have been found in the ground water at the subsite.

EPA has evaluated potential risks to human health posed by ground water contamination if no remedial action were taken. The Baseline Risk Assessment, included as Section 5 of the RI Report, is based on the results of the contamination studies and evaluates potential carcinogenic and non-carcinogenic risks. The results presented here incorporate the 1992 RI Report, and prior studies conducted at the Well #3 Subsite and other Hastings subsites contaminated with TCE and PCE.[8]

In preparing the Baseline Risk Assessment, EPA first determined the most likely ways in which community members might come into contact with site-related chemicals. EPA determined that residents living near the Well #3 Subsite might be exposed to contaminants in ground water if they ingest ground water, use the ground water for bathing, or inhale ground water vapors while cooking, showering, washing dishes, etc.

Pursuant to Section 300.430(d)(4) and (e)(2) of the NCP, EPA determines whether or not Superfund remedial actions are required for a site based upon the human health risk for a reasonable maximum exposed individual (RME). RME exposures generally include not only current exposures given existing land uses, but also exposures which might reasonably be predicted based upon expected or logical future land uses.

The RME for this site assumes certain exposures which may not currently exist. EPA believes such exposures are reasonable and may occur unless preventive actions are taken.

A. Carcinogenic Risks

EPA considers the cumulative carcinogenic risk at a Superfund site to be unacceptable if an RME for the site results in an increase in cancer risk over background risk of one-in-ten thousand ($1X10^{-4}$). The term "cancer risk" sometimes is referred to as "excess cancer risk" because it is the number of additional cases above the average number of cases that are expected to occur in the general population if the chemicals are not present.

For the Well #3 Subsite, EPA calculated the increased cancer risk of the RME using exposure to drinking water from the following monitoring wells:

> Plume 1 - monitoring well CW-1. EPA averaged the concentrations of the CCl_4 present (240 ug/l) and calculated the RME's cumulative carcinogenic risk. This calculation indicated a carcinogenic risk of $3.7 X 10^{-4}$. This risk is sufficient to warrant remedial actions for Plume 1; or

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[8] Risk studies conducted at other Hastings subsites are contained in the Administrative Record which is available at the Hastings Public Library.

Plume 2 - monitoring well CW-9. EPA used the following data for calculation: TCE, concentration of 920 ug/l; PCE, concentration of 160 ug/l; and 1,1-DCE concentration of 86 ug/l. The cumulative cancer risk for the RME at Plume 2 was calculated to be 2.2×10^{-4}. This risk is sufficient to warrant remedial actions for Plume 2.

EPA believes that additional exposures to the water from Plume 1 or Plume 2, related to showering, bathing and household uses of water, may create additional cancer risk which has not been calculated because the oral risk alone was sufficient to warrant remedial action.

B. Non-carcinogenic Risks

Exposure to chemicals can cause adverse health effects which include birth defects, organ damage, central nervous system effects and many other non-carcinogenic health impacts. Non-carcinogenic health effects are based upon contaminant concentrations and are given a Hazard Index Rating (HI). Compounds with HI ratings greater than or equal to one would pose an unacceptable health risk whereas those having a rating of less than one would not pose an unacceptable health risk. Table 4 lists the HI equal to one for each contaminant at this subsite.

For the Well #3 Subsite, EPA evaluated the increased non-carcinogenic risk of ground water using exposure to drinking water from the following subsite wells:

Plume 1 - the HI is greater than one for Plume 1 where CCl_4 is greater than 14 ug/l. The following monitoring wells were found to be contaminated with CCl_4 at a level greater than 14 ug/l: CW-1, and CW-2. Ground water from former municipal supply well M-3 were also found to be greater than 14 ug/l. This risk is sufficient to warrant remedial actions for Plume 1; or

Plume 2 - the HI is greater than one for Plume 2 at locations where contaminants are present at concentrations greater than the following levels: PCE greater than 198 ug/l; TCE greater than 140 ug/l; and TCA greater than 2,516 ug/l. EPA found the HI greater than 1 in the following monitoring wells: CW-7 and CW-9 for TCE. This risk is sufficient to warrant remedial actions for Plume 2.

EPA believes that additional exposures to the water from Plume 1 or Plume 2, related to showering, bathing and household uses of water, may create additional non--carcinogenic risks which have not been calculated.

C. Classification and Associated Risks of Contaminants found in Plume 1 and Plume 2

- CCl_4 is classified by EPA as B2, a probable human carcinogen. CCl_4 is well absorbed by all dosage pathways: ingestion, inhalation and dermal. Many other toxic chemicals interact with CCl_4 to increase the toxicity of these toxicants. CCl_4 has been found at the subsite above the target concentration of 31 ug/l which is the 10^{-4} cancer risk level.

Non-carcinogenic effects of CCl_4 include central nervous system depression and gastrointestinal tract irritation. Repeated doses cause severe liver and kidney lesions, including liver tumors in many species of animals. The HI for CCl_4 equal to 1 is 14 ug/l; CCl_4 has been found at levels above 14 ug/l. Therefore, EPA has determined the presence of CCl_4 at the subsite may pose an unacceptable non-carcinogenic risk.

- $CHCl_3$ is classified by EPA as B2, a probable human carcinogen. $CHCl_3$ is well absorbed by all exposure pathways: ingestion, inhalation, and dermal contact. $CHCl_3$ has been found at the subsite in one sample above the target concentration of 94 ug/l which is the 10^{-4} cancer risk level.

  Non-carcinogenic effects of $CHCl_3$ include central nervous system depression. Repeated doses produce liver and kidney damage in animals based on animal tumor development. The HI for $CHCl_3$ equal to 1 is 190 ug/l; $CHCl_3$ has not been found at levels above 190 ug/l. Therefore, EPA has determined that the presence of $CHCl_3$ at the subsite does not pose a non-carcinogenic risk.

- TCE is classified by EPA as B2, a probable human carcinogen. TCE has been found at the subsite above the target concentration of 290 ug/l which is the 10^{-4} cancer risk level.

  Non-carcinogenic effects of TCE include headaches, vertigo, visual disturbance, tremors, nausea, vomiting, eye irritation, dermatitis, cardiac arrhythmias, and paresthesia. Chronic exposure may irreversibly damage the respiratory system, heart, liver, kidneys, and central nervous system. The HI for TCE equal to 1 is 140 ug/l; TCE has been found at levels above 140 ug/l. Therefore, EPA has determined that the presence of TCE at the subsite may pose an unacceptable non-carcinogenic risk.

- TCA is not classified by EPA as to human carcinogenicity due to the insufficient amount of data available.

  Non-carcinogenic effects of TCA include headaches, lassitude, central nervous system depression, poor equilibrium, eye irritation, dermatitis, and cardiac arrhythmias. Chronic exposure may cause irreversible damage to the central nervous system, cardiovascular system and eyes. The HI for TCA equal to 1 is 2,516 ug/l; TCA has not been found at levels above 2,516 ug/l. Therefore, EPA has determined that TCA does not pose a non-carcinogenic risk.

- The classification of PCE is under review by EPA. PCE has been found at the subsite above the target concentration of 150 ug/l which is the 10^{-4} cancer risk level.

  Non-carcinogenic effects of PCE include irritation to the eyes, nose, and throat; finger tremors; flushed face and neck; vertigo, dizziness; skin erythema; liver damage; and mental confusion. Chronic exposure may lead to irreversible damage of the liver, kidneys, eyes, upper respiratory system and central nervous system. The HI for PCE equal to 1 is 198 ug/l; PCE has not been found at levels above 198 ug/l. Therefore, EPA has determined that PCE does not pose a non-carcinogenic risk.

- DCE is classified by EPA as C, a possible human carcinogen. DCE has been found at the subsite above the target concentration of 5 ug/l which is the 10^{-4} cancer risk level.

  Non-carcinogenic effects of DCE include irritation to the skin and mucous membranes, headaches, and liver and kidney damage. Chronic exposure may lead to irreversible damage of the liver and kidneys. DCE is considered an experimental mutagen. The HI for DCE equal to 1 is 161 ug/l; DCE has not been found at levels above 161 ug/l. Therefore, EPA has determined that DCE does not pose an unacceptable non-carcinogenic risk.

VIII. DESCRIPTION OF ALTERNATIVES

EPA has evaluated ground water remediation alternatives at several other Hastings subsites. Alternatives evaluated at the Hastings East Industrial Park (HEIP) and at the Colorado Avenue Subsite were used to develop and consider the alternatives for the remediation of the ground water contamination at the Well #3 Subsite.

As presented in the draft FS, the retained remedial alternatives fall into three (3) general categories.[9] These are: No Action, Institutional Controls and Limited Action, and Ground Water Containment and Treatment. Figure 6 lists the technologies and process options evaluated for the Well #3 Subsite. Figure 7 lists the alternatives evaluated for treatment of each contaminated area. Estimated costs for the alternatives

[9] Two treatment alternatives not retained were treatment by air sparging and ultraviolet (UV) photooxidation. The cost and physical problems associated with air sparging and the need to expand or install new Soil Vapor Extraction facilities make this technology less implementable and more costly than extraction and treatment. UV photooxidation is a relatively new technology that combines a chemical oxidant such as ozone and/or hydrogen peroxide with ultraviolet light to oxidize VOCs to carbon dioxide and water. A pilot program would be needed to demonstrate the effectiveness of the technology.

are presented in the draft FS. These cost estimates were based on what the remedies would cost today to build (Capital Cost) and what they would cost to operate and maintain until the remedial actions are completed (Annual Operation and Maintenance). EPA has combined the capital and Operation and Maintenance (O&M) costs to obtain a single present worth value for purposes of comparing the various alternatives. Present worth is the amount of money that, if invested today at the present interest rate, would pay for the capital and operating and maintenance costs for the life of the project. These alternatives are briefly described below.

A. No Action

Under the no action alternative, the subsite ground water contamination would continue to expand into ground water presently free of contamination at the rate of approximately 300 feet per year. The potential for significant ground water contamination to reach City supply wells would exist. This could result in the curtailment of available drinking water as additional wells would have to be shut down. The potential for community exposure to contaminant levels exceeding health standards still would exist. EPA policy requires consideration of a no action alternative to serve as a basis against which the other remedial alternatives can be compared.

The cost for this alternative is zero; implementation time is zero.

Chemical-specific applicable or relevant and appropriate requirements (ARARs), discussed in Section IX. A.2. below, would not be met. Action-specific and location-specific ARARs do not apply to this No Action alternative at the Well #3 Subsite.

B. Institutional Controls and Limited Action

Institutional controls are actions which lower the risk of exposure to contamination through physical and/or legal means. Institutional controls would include deed restrictions to limit future development and domestic use of the ground water. Limited action includes ground water monitoring within the boundaries of the subsite.[10] Also included as part of a limited action is the installation of a public drinking water supply well outside the plume of contamination to replace decommissioned well M-3. This alternative does not attempt to clean up the contaminated ground water or restrict the flow of the contaminated ground water.

The estimated present worth for this action is $812,000 which includes $120,000 for the installation of a new public supply well and $45,000 annual costs for ground water monitoring for a period of 30 years.

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[10] Ground water monitoring, for purposes of this ROD, refers to the collecting and analyzing ground water samples to determine the effectiveness of the selected remedy and to determine whether the quality of the ground water poses a threat to human health and the environment.

Chemical-specific ARARs would not be met. Action-specific ARARs would be attained using this Institutional Control alternative at the Well #3 Subsite.

C. Action - Ground Water Containment and Treatment

1. Plume Management of Plume 1 to a $1X10^{-4}$ Risk Level

This plume management alternative involves pumping contaminated ground water at a rate sufficient to hydraulically contain the contaminated ground water with extraction wells, treating the water and reinjecting the water back into the aquifer (or beneficial use). Two treatment processes were retained for comparison, GAC adsorption and air stripping without air emission control. EPA's preliminary analyses indicated that pumping for 12 years at a flow rate of 25 gallons per minute would be sufficient to reach the target concentration for CCl_4 of 31 ug/l.[11] The final pumping rates would be determined as part of the Remedial Design. A higher pumping rate than considered for cost analysis would remove contaminants in a lesser amount of time, but could be more costly. See Figure 8 for conceptual extraction well locations.

The pumping rate selected would contain the contaminated ground water at health based target levels, identified in this ROD. A water monitoring program would be established to determine the effectiveness of the extraction and treatment system and to chart the progress made in achieving our remediation goals. In addition, all extracted water would be treated to a level meeting MCLs prior to reinjection, reuse or discharge.

Action-specific ARARs for the interim action, such as level of treatment for ground water to meet MCLs, would be achieved. Location-specific ARARs are not applicable. Chemical-specific ARARs (MCLs) would be met for treated ground water. This interim action would only provide for the cleanup of the ground water to the 10^{-4} risk level, not to MCLs.

a. GAC System

The GAC system would consist of a piping manifold and minimal instrumentation. The system would be enclosed in a building for weather protection and security. Contaminated water from extraction wells would be pumped to a surge tank and from there, pumped through the GAC system. Two modular GAC adsorbers would be used and would be arranged in series so that breakthrough, that is passage of the contaminants from the first adsorber to the second adsorber, would be prevented. Until breakthrough occurs, GAC would remove nearly 100% of the VOCs. The piping

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[11] Our current information indicates that the target concentration of $CHCl_3$ (94 ug/l) is at a higher level than that of CCl_4 (31 ug/l); therefore, when the target level for CCl_4 is attained, $CHCl_3$ contamination would be remediated to a protective level (at less than the $1X10^{-4}$ level).

manifold would allow either of the two adsorbers to be the first in series. Treated water would flow to one or more reinjection wells (or other beneficial use) via underground piping. See Figure 9 for a process flow diagram of this system.

b. Air Stripping System

The air stripping system would consist of piping, minimal instrumentation, and possibly a chemical feed system to prevent scale formation. The system would be enclosed in a building for weather protection and security. Contaminated ground water would flow to the top of a packed column stripper. The removal efficiency of such a stripper is estimated to be 99.8%. A blower would be used to force air through the tower, counter current to the flow of water. Treated water would collect in a sump at the base of the stripper and from there, pumped to one or more reinjection wells, or would be committed to beneficial use via underground piping. The air stripper would extend out of the top of the building because of its height. Contaminants removed from the water in the air stripper would be released to the atmosphere. NDEQ requires a permit for air toxic emissions above 74 pounds per day.[12] The air stripping system would emit air toxics at a rate of 0.03 pounds per day, based upon an extraction of 20 gpm and the average VOCs concentration of 132 ug/l. See Figure 10 for a process flow diagram of this system.

A pump test would be conducted at the subsite using the monitoring well CW-1 to determine the appropriate extraction rate of ground water for Plume 1 containment and mass removal system.

2. Plume Management of Plume 2 to a 1X10^{-4} Risk Level

This plume management alternative involves pumping contaminated ground water with one extraction well at a rate sufficient to hydraulically contain the contaminated ground water. Two treatment processes were retained for comparison, GAC adsorption and air stripping without air emission control. EPA's preliminary analyses indicate that pumping Plume 2 for 10 years at a flow rate of 40 gallons per minute would be sufficient to reach the target concentration for TCE of 290 ug/l.[13] The final pumping rates would be determined as part of the Remedial Design. A higher rate than considered for cost analysis would remove contaminants in a lesser amount of time, but could be more costly. See Figure 11 for a conceptual extraction well location.

The pumping rate selected would contain the contaminated ground water at

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[12] As set forth in Section 121 of CERCLA, no permit is required when a remedial action is performed under CERCLA.

[13] The target concentration of TCA is at a higher level than that of TCE, therefore when the target level for TCE is attained, TCA contamination will be remediated to a protective level (a HI less than 1 or 2,516 ug/l). PCE has a target level of 150 ug/l. DCE has a target level of 5 ug/l.

health based target levels, identified in this ROD. A water monitoring program would be established to determine the effectiveness of the extraction and treatment system and to chart the progress made in achieving our remediation goals. In addition, all extracted water would be treated to a level meeting MCLs prior to reinjection, reuse or discharge.

Action-specific ARARs for the interim action, such as level of treatment for ground water to meet MCLs, would be achieved. Location-specific ARARs are not applicable. Chemical-specific ARARs (MCLs) would be met for treated ground water. This interim action would only provide for the cleanup of the ground water to the 10^{-4} risk level, not to MCLs.

a. GAC System

The GAC system for Plume 2 would be very similar in design to the system designed for Plume 1. Refer to paragraph C. 1.a. in this section for a description of the GAC system to be implemented and see Figure 12 for a process flow diagram of this system.

b. Air Stripping System

The air stripping system for Plume 2 would be similar to the system designed for Plume 1. Refer to paragraph C. 1.b. in this Section for a description of the air stripping system to be implemented and see Figure 13 for a process flow diagram of this system. The air stripping system for Plume 2 would emit air toxics at a rate of 0.2 pounds per day, based upon the an extraction of 40 gpm and the average VOCs concentration 484 ug/l.

IX. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The NCP sets forth nine evaluation criteria which serve as a basis for comparing the remedial alternatives for final actions. Interim actions, such as those proposed here, may not achieve final cleanup levels for the ground water although they are effective in the short term in preventing further degradation of the ground water and initiating reduction in toxicity, mobility or volume. Nine evaluation criteria were developed by EPA to serve as a basis for comparing the remedial alternatives for final actions. Interim actions, such as those proposed, will fulfill some, but not all of the nine criteria.

The nine criteria are divided into three categories: Threshold Criteria, Primary Balancing Criteria, and Modifying Criteria. If any remedial alternatives identified during the Feasibility Study do not meet the Threshold Criteria (Criteria 1 and 2), EPA will not consider them as possible final remedies. If the alternatives satisfy the Threshold Criteria, they then are evaluated against the next five criteria, called the Primary Balancing Criteria. These criteria are used to compare the remedial alternatives against each other in terms of effectiveness, degree of difficulty involved, and cost. The final two criteria, state acceptance and community acceptance, are called Modifying Criteria. The alternatives are compared against the Modifying Criteria after the state and the community have reviewed and commented on the Proposed Plan and the other alternatives considered by EPA.

Tables 5, 6, 7, and 8 present the remedial alternatives and describe how each alternative satisfies the threshold and primary balancing criteria. Evaluation of compliance with the remaining Modifying criteria is included in the following discussion. The following is a discussion of the nine criteria used by EPA for remedy selection.

A. Threshold Criteria:

1. Overall Protection of Human Health and the Environment

EPA assesses the degree to which the alternatives would eliminate, reduce, or control threats to public health and the environment through removal, containment, and/or institutional controls. An alternative is normally considered to be protective of human health if the excess cancer risk is reduced to less than 1 in 1,000,000 (10^{-6}) and risks do not pose non-carcinogenic health risks (HI <1).[14]

Two alternatives presented for plume management and ground water treatment provide overall protection of human health and the environment. In contrast, the No Action would not be protective as it would not prevent further degradation of the ground water or reduce risks associated with exposure to contaminated ground water. Institutional Controls would provide marginal protection of human health and the environment by preventing exposure, controlling ground water use, and monitoring. However, Institutional Controls would not prevent further degradation of the ground water or reduce risks by removing contaminants from the ground water. Therefore, the No Action and Institutional Controls alternatives will not be discussed further in this ROD. Instead, the comparative analysis for discussion will focus on the other protective alternatives for plume management.

These are interim actions and would not restore the plumes at the subsite to drinking water standards. However, these interim actions would prevent the further degradation of the aquifer as high concentrations of the contaminants would be contained. As a result of these interim actions, the public water supply wells in Hastings would not become contaminated by the Well #3 Subsite plumes.

GAC would be more protective than air stripping as a treatment process

[14] The Hazardous Index rating, as discussed in Section VII. B., herein, does not exceed 1.

since no air emissions would be generated with GAC. Air stripping would allow the contaminants to be transferred from the ground water into the atmosphere.

2. Compliance with all Applicable or Relevant and Appropriate State and Federal Environmental Regulations

EPA assesses whether the remedial alternatives being evaluated would comply with all applicable or relevant and appropriate regulations, called ARARs, established by the state and federal government. As these are interim actions, full compliance with ARARs might be delayed until implementation of the final action. The ground water interim action would address plume control at a 10^{-4} risk-based level. To achieve that level, the ground water extraction system would be required to pump contaminated ground water at a rate which would stop the contaminant migration by hydraulic plume control and also provide rapid mass removal. The ground water interim action would provide for treatment of the extracted ground water to MCLs prior to release, reinjection or reuse.

There are three (3) types of ARARs to be addressed: chemical-specific, action-specific, and location-specific.[15]

- Chemical-specific ARARs are requirements that set final concentrations of chemicals of concern in the contaminated material (e.g., ground water) which must be achieved by the remedial action. Chemical-specific ARARs for this subsite are listed in Table 9. These interim actions would not attain chemical-specific ARARs set forth in the Nebraska Administrative Rules and Regulations (Neb. Adm. Rules and Regs.), Title 118 - Ground Water Quality Standards and Use Classification, and the Safe Drinking Water Act (SDWA), 42 U.S.C. § 300 et. seq. However, all extracted ground water, prior to discharge, would meet the requirements of Title 118 and the SDWA as the extracted water would be treated to a level that would achieve MCLs. If the treated ground water is discharged into surface water, the requirements of the Clean Water Act, 33 U.S.C. § 1251 et. seq. and the Nebraska Environmental Protection Act would have to be met. In summary, this interim action is required to meet the ARARs set forth in Table 10 for the extracted ground water.

- Action-specific ARARs are those requirements that set standards on the treatment and discharge components of the remedial action.

[15] The state of Nebraska has identified the state ARARs, listed in Table 12, for the remedial action alternatives.

Action-specific ARARs for this subsite are listed in Table 11. Occupational Safety & Health Act (OSHA) 42 U.S.C. §§ 651-678 and SDWA apply to the GAC alternative and the air stripping alternative. Specifically, all remediation would be performed by workers acting in compliance with OSHA regulations. Additionally, if the treated ground water is provided as a beneficial use to the public drinking water supply, with the State's permission, the MCLs would have to be met, in compliance with SDWA. Also, treated ground water would have to comply with SDWA prior to reinjection. The GAC adsorption alternative would meet action-specific ARARs in that hazardous waste generated through the GAC adsorption would be disposed in compliance with RCRA and the Neb. Adm. Rules and Regs., Title 128 - Rules and Regulations Governing Hazardous Waste Management in Nebraska. The use of air stripping with no emission controls would also meet action-specific ARARs even though this alternative would result in the discharge of very low levels of VOCs into the atmosphere. The limitation on discharge of VOCs without a permit, set by Neb. Adm. Rules and Regs., Title 129 - Air Pollution Control Rules and Regulations, would not be exceeded. Air emissions would comply with the Clean Air Act, 33 U.S.C. § 1251 et. seq., as well as Title 129 - Air Pollution Control Rules and Regulations.

- Location-specific ARARs are requirements that might apply to a remedial action due to the site's unique cultural, archaeological, historical, or physical setting (e.g., wetlands). There are no location-specific ARARs for the Well #3 Subsite because there are no such features in the subsite area.

B. Primary Balancing Criteria:

1. Long-Term Effectiveness and Permanence

The alternatives are evaluated based on their ability to maintain reliable protection of human health and the environment after the remedial action is completed. This criterion also focuses on the magnitude of health and environmental risks remaining after the remedial action is completed.

Because this ROD selects interim action remedies, EPA will evaluate the long term effect and permanence by comparing the residuals which remain after achievement of the target concentrations. Extraction of contaminated ground water would reduce contaminant mass and prevent the further migration of contaminants in significant concentrations. These interim actions will not achieve final cleanup levels for the ground water at the subsite, although they are effective in the short-term in preventing further degradation of the ground water and initiating reduction in toxicity, mobility or volume. Also, as mandated by Section 121(c) of CERCLA, EPA will conduct 5-year reviews at the subsite as long as hazardous substances remain above health based criteria.

2. Reduction of Toxicity, Mobility, or Volume Through Treatment

This criterion focuses on the amount and types of hazardous substances that will be destroyed or treated, whether the results of the remedial action are reversible, and whether the alternative includes a treatment process. Remedial actions which include treatment are favored by the NCP. EPA evaluates each alternative based on how its treatment methods reduce the harmful nature of the contaminants, limit the ability of the contaminants to migrate, and minimize the amount of contamination remaining after the remedial action is completed.

Both of the plume management alternatives would employ treatment to reduce the toxicity, mobility or volume of the contaminated ground water plume. GAC treatment removes the contaminants from the ground water and regeneration of the GAC for reuse will ultimately result in the destruction of the contaminants. Air stripping removes the contaminants from the ground water and releases them into the atmosphere. Though any release to the atmosphere would be in compliance with state and federal standards.

3. Short-Term Effectiveness

The length of time needed to implement each segment of the alternatives is considered. Both alternatives would meet the short-term effectiveness criteria as each could be implemented within 6 to 8 months. EPA considers the risks that conducting a particular activity may pose to site workers, nearby residents, or the local environment.

A Health and Safety Plan will be prepared for the implementation of the response actions which will be conducted. This plan will provide the procedures for all site workers to follow during the field testing, installation of the extraction wells and all associated equipment needed for the ground water treatment system. Health and safety issues will be addressed at each phase of these interim response actions.

Implementation of either GAC or Air Stripping would present a minimal risk to workers, the community and the environment. The potential worker exposure during construction and operations would be minimized by following a site Health and Safety Plan addressing issues such as air monitoring and personnel protective equipment. The release of contaminants to the atmosphere is expected to be minimal during construction. Contaminated soils or fluids would be properly handled and disposed.

4. Implementability

EPA considers how difficult the alternative is to construct and operate, how other government agencies and EPA will coordinate monitoring programs and the availability of goods and services and personnel needed to implement and manage the alternative.

Ground water extraction and treatment is a well established technology for ground water containment and contaminant mass removal. In addition, it would be easily implemented at Well #3 Subsite. It has been implemented at numerous Superfund sites and has proven effective in removing significant levels of contaminants.

Both GAC and Air Stripping are conventional, well established technologies, and therefore should be simple to implement. There are no expected technical or administrative difficulties in implementing either alternative.

5. Cost

EPA considers capital costs, operation and maintenance costs, and Present Worth, which is the cost of the activities that will take place until the remedial action is completed. Capital costs apply to activities such as construction, land and site development, and disposal of waste materials. Annual operation and maintenance costs are spent on activities such as on-going operation of equipment, insurance and periodic site reviews.

a. Plume 1

	GAC	Air Stripping
Capital	$ 469,000	$ 492,000
Annual O&M	$ 72,000	$ 62,000
Present Worth	$ 1,104,000	$ 1,042,000

Capital costs include $135,000 for design and treatability study costs.

b. Plume 2

	GAC	Air Stripping
Capital	$ 294,000	$ 323,000
Annual O&M	$ 69,000	$ 58,000
Present Worth	$ 829,000	$ 768,000

Capital costs include $95,000 for the cost of design.

C. Modifying Criteria:

1. State Acceptance

The state concurs with the selected remedies as interim remedial actions for these operable units.

2. Community Acceptance

EPA held a public comment period to allow the community to comment on the preferred alternative as set forth in the Proposed Plan and the other alternatives considered. No one commented that EPA's preferred alternative was inadequate to protect public health and the environment. However, many community members questioned the benefits and cost of remediation efforts at the Well #3 Subsite. EPA's responses to these comments are included in the Responsiveness Summary section of this document.

X. SELECTED REMEDY FOR EACH PLUME

EPA selects the following interim actions to address the ground water operable units at the Well #3 Subsite.

A. PLUME 1

- Extraction of contaminated ground water, (extraction rate, number and location of wells to be based on subsite pump test);
- Treatment of contaminated ground water with liquid phase GAC; and
- Ground water monitoring to determine effectiveness of the selected interim action remedy.

B. PLUME 2

- Extraction of contaminated ground water, (extraction rate and well location to be based on information contained within the draft FS and other Well #3 Subsite documents);
- Treatment of contaminated ground water with liquid phase GAC; and
- Ground water monitoring to determine effectiveness of the selected interim action remedy.

C. BASES FOR EPA's SELECTION

EPA has identified these interim actions as its selected alternatives because they provide the best balance among other alternatives with respect to the evaluation criteria based on the information available. Each of these actions, explained below, shows a preference for treatment. EPA believes that these interim actions are protective, implementable, and effective in reducing the toxicity, mobility and volume of contamination present at the subsite. EPA selects GAC treatment of ground water over air stripping treatment without air emission controls because GAC treatment does not result in the release of contaminants to the atmosphere. In addition, air stripping with air emission controls would be more costly than EPA's selected remedy.

In order to implement the selected remedies, ground water extraction wells will be installed at locations within the 10^{-4} plume area to be determined as part of the remedial design. The ground water will then be pumped to the surface at a rate that will prevent further migration of contaminants and rapidly reduce the contaminant mass in the aquifer. The treated ground water will either be reinjected, reused, or released to promote conservation of ground water. The ground water will be treated with liquid phase GAC prior to release. GAC does not create air emissions.

EPA's selected interim response actions for both plumes would contain and remove contaminant mass from the ground water plumes. Significant levels of CCl_4 and TCE contamination at the Well #3 Subsite are within the bounds of the municipal water supply system. The interim response actions would rapidly reduce contaminant concentrations and would be consistent with the expected final remedy. These interim response actions would achieve long-term effectiveness as contaminated ground water would be pumped via extraction wells, whose locations would be determined as part of the design of the system. The pumped ground water would be treated with GAC and then reinjected into the aquifer or reused. The extraction of contaminated ground water would generally remove contaminant mass and contain each contaminant plume within the areas as shown on Figure 4. These interim actions would be monitored to determine their effectiveness in producing a hydraulic control of the contaminated plume. EPA's interim response actions would meet the criteria for long-term effectiveness and permanence. All extracted ground water would be treated to drinking water quality prior to reinjection or reuse or to the appropriate level to assure that all action specific ARARs would be met.

GAC treatment has several distinct advantages over air stripping without emission controls: there are no air emissions associated with the process; it is effective in removing a wide range of VOCs and other organics; and it is also effective over a wide range of influent concentrations. All of these factors reduce the risk of human exposure during operation. Additionally, GAC is a relatively low maintenance process compared to UV photooxidation and air sparging. The system requires frequent monitoring, but little in the way of maintenance. Monitoring and carbon change outs would become less frequent with time as experience is gained in the operation and maintenance of the system and influent concentrations decrease.

Operationally, the GAC treatment plant would consist of an influent tank to provide surge capacity and equalization of flow into the carbon columns. Contaminant removal should be nearly 100 percent. Series operation, that is, the water flowing through the two carbon beds in sequence, gives GAC the additional advantage over the other processes of having a reserve treatment capacity at all times. By monitoring the effluent from the first carbon bed in the series, contaminant breakthrough would be detected well before the contaminants enter the second carbon bed in the series.

Carbon consumption is directly proportional to the amount of contamination removed from the ground water. This process is sensitive to influent contaminant concentrations. Costs can increase if the actual contaminant loading rate is higher than estimated. EPA believes that the advantages of GAC outweigh any risk of a higher than anticipated cost.

EPA prefers ground water reinjection as the preferred method of water discharge because of its ability to return treated ground water to the aquifer. Reinjection was considered preferable to surface water discharge because the latter would not result in beneficial use of the pumped ground water. Reinjection and other beneficial use of the treated ground water (industrial, irrigation, etc.) will be evaluated during the design.

EPA estimates that the interim action for remediation of Plume 1 will cost $1,104,000 in capital and operation and maintenance cost for the 12-year period that is described in the draft FS.

EPA estimates that the interim action for remediation of Plume 2 will cost $829,000 in capital and operation and maintenance cost for the 10-year period that is described in the draft FS.

These costs are explained in Tables 13 and 14. Based upon the cost of the alternatives and the degree of protectiveness that one alternative affords as compared to the other alternative, EPA has selected the most cost effective alternatives which meet interim remedial action guidelines.

XI STATUTORY DETERMINATIONS

The selected interim action remedies will achieve substantial reduction in risks by initiating the reduction of the toxicity, mobility and volume of ground water contaminants, by containment and removal of ground water contamination to the target concentration associated with a 10^{-4} cancer risk level, and by reducing environmental risks associated with the contaminated ground water.

The selected interim action remedies meet those ARARs appropriate to this action, based on the following federal and state standards identified in Tables 9, 10, 11 and 12 herein.

The selected interim action remedies will protect human health and the environment because the interim actions will reduce contaminant concentrations in the aquifer to a level that poses significantly reduced risk. This level will be at or below a 10^{-4} cancer risk level, or a risk of less than one cancer case in 10,000 due to exposure to contamination. This will provide a significant level of protectiveness to human health. In addition to risk reduction, the interim actions will stop the ground water contaminant migration at the target level and prevent further degradation of the ground water within the area of containment through rapid mass removal and hydraulic plume control. These interim actions represent the best balance of trade-offs among alternatives with regard to implementability, effectiveness and cost.

Because these interim action remedies will result in hazardous substances remaining on-site above health-based levels, a review will be conducted to ensure that the remedies continue to provide adequate protection of human health and the environment within five (5) years after commencement of the interim actions. Review of this subsite and of these interim remedies will be ongoing as EPA continues to develop site-wide final remedies.

WELL #3 SUBSITE

TABLES, FIGURES AND GLOSSARY OF TERMS

TABLE 1

Summary of In-Situ Ground Water Quality Data

1991 DATA

Parameter (ug/l)	Sample Identification:	CSLS2002	CSMS2001	CSMS2002(a)	CSNS2001	CSNS2002	CSOS2001
	Sample Location:	CW-2	CW-3	CW-3	CW-4	CW-4	CW-5
	Sample Depth (Feet):	130	130	162	130	148	135
Bromochloromethane		NA	NA	NA	NA	NA	NA
Benzene		NA	NA	NA	NA	NA	NA
Carbon Tetrachloride		1.4	0.1U	172	2.1	14	28
Chloroethane		NA	NA	NA	NA	NA	NA
Chloroform		0.1U	0.1U	3.3	0.4	1	0.4
1,1-Dichloroethene		NA	NA	NA	2.1	0.4	NA
1,2-Dichloroethane		NA	NA	NA	NA	NA	NA
Ethylene Dibromide		0.05U	0.05U	0.05U	0.05U	0.05U	0.05U
Tetrachloroethene		0.3	0.06U	1.1	1.4	0.2	0.1
Toluene		NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane		NA	NA	NA	3.1	0.3	NA
Trichloroethene		0.01U	0.01U	0.1	18	5.6	0.01U
Xylenes (total)		NA	NA	NA	NA	NA	NA

Parameter (ug/l)	Sample Identification:	CSOS2002	CSOS2003	CSPS2001	CSPS2002	CSOS2001(b)
	Sample Location:	CW-5	CW-5	CW-6	CW-6	CW-7
	Sample Depth (Feet):	157	178	132	162	162
Bromochloromethane		NA	NA	NA	NA	0.1U
Benzene		NA	NA	NA	NA	0.1
Carbon Tetrachloride		25	0.10U	31	0.1U	7
Chloroethane		NA	NA	0.2U	1	0.2U
Chloroform		2.5	0.1U	0.7	0.01U	0.3
1,1-Dichloroethene		NA	NA	NA	NA	11
1,2-Dichloroethane		NA	NA	0.1U	0.2	0.1U
Ethylene Dibromide		0.05U	0.05U	0.08U	0.28U	0.5U
Tetrachloroethene		0.3	0.06U	NA	NA	11
Toluene		NA	NA	0.6	0.6	0.03U
1,1,1-Trichloroethane		NA	NA	NA	NA	25
Trichloroethene		0.01U	0.01U	0.01U	0.01U	18
Xylenes (total)		NA	NA	NA	NA	0.04U

1989 DATA

Parameter (ug/l)	Sample Identification:	NE7S2066	NE7S2082	NE7S2112	NE7S2120	NE7S2001	NE7S2003	NE7S2004	NE7S2005	NE7S2007	NE7S2008	NE7S2009
	Sample Location:	C9A	C10	C11	C11	CW1	CW1	CW1	CW1	CW1	CW1	CW1
	Sample Depth (Feet):	128-130	128-130	128	128-130	121-123	125-127	129-131	133-135	141-143	146-148	151-153
Benzene		5.0U	5.0U	5	5.0U	5.0U	5.0U	5.0U	5.0U	5.0U	5.0U	5.0U
Carbon Tetrachloride		63	100	700	60	8	45	15	5	5.0U	5.0U	5.0U
Chloroform		35	42	120	16	32	18	12	12	5.0U	5.0U	5.0U
1,1-Dichloroethene		5.0U	5.0U	5.0U	5.0U	5.0U	5.0U	5.0U	5.0U	5.0U	5.0U	5.0U
Ethylene Dibromide		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.0U
Tetrachloroethene		5.0U	5.0U	5.0U	12	5.0U	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane		5.0U	5.0U	6	12	5.0U	5.0U	5.0U	5.0U	5.0U	5.0U	5.0U
Trichloroethene		5.0U	5.0U	5	330	5.0U	5.0U	5.0U	5.0U	5.0U	5.0U	5.0U
Vinyl Chloride		14U	14U	14U	14U	14U	14U	14U	14U	14U	14U	5.0U
												14U

Notes: NA denotes given parameter not analyzed.
Data collected in 1989 and 1991 obtained by PRC and MK, respectively.
U: Reported value is less than specified detection limit.
(a): Analysis revised 10-13-92; results reported are 10-13-92 results.
(b): Duplicate sample at 162 feet reported non-detectable carbon tetrachloride at 0.1ug/l(U)

TABLE 2

Summary of Ground Water Quality Target Compounds, page 1 of 8

Well M-3

	Sample ID #:	NDOH	NDOH	NDEC	NR	AKCS2003	CKCS221	DKIS2018	N17S2004	N17S2003	N17S2002
	Date Sampled:	4/18/83	5/11/83	5/24/83	10/25/84	4/9/85	9/18/85	12/18/85	6/9/88	6/9/88	6/9/88
	Sample Depth:	122-196	122-196	122-196	122-196	122-126	122-196	122-196	126-131	160-165	170-175
Target Parameters (ug/L)											
Chloroform		NA	NA	NA	1 0 U	1 0U	5 0 U	1 0U	5 0U	5 0U	5 0U
Carbon Tetrachloride		27.1	46.4	31.3	NA	22	26	32 J	6	12	13
Ethylene Dibromide		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene		NA	NA	NA	1 0 U	1 0 U	5 0 U	1.0 U	5.0 U	5.0 U	5.0 U
1,1,1-Trichloroethane		NA	NA	NA	1 0 U	1 0 U	5 0 U	1 0 U	5 0 U	5 0 U	5 0 U
Trichloroethene		NA	NA	NA	1 0 U	1 0 U	5 0 U	1 0 U	5 0 U	5 0 U	5 0 U

Well M-3 (continued)

	Sample ID #:	N17S2001	N17S2017	N17S2016	N17S2015	N17S2014	N17S2013	N17S2012	N17S2011	N17S2010	N17S2009	N17S2008
	Date Sampled:	6/9/88	6/13/88	6/13/88	6/13/88	6/13/88	6/13/88	6/13/88	6/13/88	6/13/88	6/13/88	6/13/88
	Sample Depth:	175:180	125:130	130 135	135-140	140 145	145 150	150 155	150 155	155-160	160 165	165-170
Target Parameters (ug/L)												
Chloroform		5.0U	5.0U	5 0U	5 0U	5 0U	5 0U	5 0U	5 0U	5 0U	5 0U	5 0U
Carbon Tetrachloride		14	4.0 M	4.0 M	4 0 M	5	7	5	3 0M	8	6	11
Ethylene Dibromide		NA	0 02 U	NA	NA	0 02 U	NA	NA	NA	NA	0 02 U	NA
Tetrachloroethene		5.0 U	5.0 U	5.0 U	5 0 U	5 0 U	5 0 U	5 0 U	5 0U	5 0 U	5 0 U	5 0 U
1,1,1-Trichloroethane		5.0 U	5.0 U	5 0 U	5 0 U	5 0 U	5 0 U	5 0 U	5 0U	5 0 U	5 0 U	5 0 U
Trichloroethene		5.0 U	15	5.0 U	5 0 U	5 0 U	5 0 U	3 0M	3 0M	5 0 U	5 0 U	5 0 U

Well M-3 (continued)

	Sample ID #:	N17S2007	N17S2006	N17S2018	CSSS2010	CSSS2011	CSSS2012	CS6S2009	CSCS2006	CSKS2017	CSRS2015
	Date Sampled:	6/13/88	6/13/88	6/13/88	9/30/91	9/30/91	9/30/91	12/10/91	3/18/92	6/10/92	9/17/92
	Sample Depth:	170-175	175-180	180-185	135:136	165:166	190-191	135:136	135:138	135:138	135:138
Target Parameters (ug/L)											
Chloroform		NA	NA	5.0U	5 0 U	5 0 U	5 0 U	10 U	1	1 0U	1 0K
Carbon Tetrachloride		13	7	15	21	22	23	21	35	27	29
Ethylene Dibromide		NA	NA	0 02 U	0 027 U	0 027 U	0 027 U	NA	NA	NA	NA
Tetrachloroethene		5.0 U	4.0M	5.0 U	5 0 U	5 0 U	5 0 U	10 U	1	1 0U	1 0K
1,1,1-Trichloroethane		5 0 U	8	5 0 U	5 0 U	5 0 U	5 0 U	10 U	1 0 U	1 0U	1 0K
Trichloroethene		3 0M	65	13	5 0 U	5 0 U	5 0 U	10 U	1 0 U	1 0U	1 0K

Notes:

U: Less than specified detection limit.
I: Invalid - no reported value.
J: Data reported but not valid by approved QC procedures.
M: Detected but below level for accurate quantification.
NA: Parameter not analyzed.
NDOH: Analyses completed by the Nebraska Department of Health.
NDEC: Analyses completed by the Nebraska Department of Environmental Control

TABLE 2

Summary of Ground Water Quality Target Compounds, page 2 of 8

Well M-6

Sample ID #:	NDEC	AKCS2006	CKCS2217	IKLS2024	QKLS2002	I19S2011	I19S2001	I19S2012	I47S2026	HSXS2030	MSIS2026	CSSS2015	CSKS2011	CSRS2012
Date Sampled:	3/30/83	4/9/85	9/18/85	6/9/86	9/2/86	7/8/87	9/21/87	6/27/88	9/14/88	6/13/89	9/12/89	9/30/91	6/10/92	9/11/92
Sample Depth:	134-186	134-186	134-186	134-186	134-186	134-186	134-186	134-186	134-186	134-186	134-186	134-186	134-186	134-186
Target Parameters (ug/L)														
Chloroform	0.77	1.0 U	5.0 U	1.0 U	0.1 U	1.0 U	1.0 U	5.0 U	5.0 U	5.0 U	1.0 U	5.0 U	1.0 U	1.0 K
Carbon Tetrachloride	NA	1.0 U	5.0 U	1.0 U	0.1 U	1.0 U	1.0 U	5.0 U	5.0 U	5.0 U	1.0 U	5.0 U	1.0 U	1.0 K
Ethylene Dibromide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.02 U	NA	NA
Tetrachloroethene	NA	1.0 U	5.0 U	1.0 U	0.1 U	1.0 U	1.0 U	5.0 U	5.0 U	5.0 U	1.0 U	5.0 U	1.0 U	1.0 K
1,1,1-Trichloroethane	NA	1.0 U	5.0 U	1.0 U	0.1 U	1.0 U	1.0 U	5.0 U	5.0 U	5.0 U	1.0 U	5.0 U	1.0 U	1.0 K
Trichloroethene	NA	1.0 U	5.0 U	1.0 U	0.1 U	1.0 U	1.0 U	5.0 U	5.0 U	5.0 U	1.0 U	5.0 U	1.0 U	1.0 K

Well M-9

Sample ID #:	AKCS2009	CKCS2219	R69S2004	NM7S2048	HSXS2032	MSIS2027	CS5S2007	CSSS2014	CSCS2007	CSKS2012	CSRS2013
Date Sampled:	4/9/85	4/10/85	3/28/88	3/21/89	6/13/89	9/12/89	3/15/90	9/30/91	3/18/92	6/10/92	9/17/92
Sample Depth:	140-190	140-190	140-190	140-190	140-190	140-190	140-190	140-190	140-190	140-190	140-190
Target Parameters (ug/L)											
Chloroform	1.0 U	5.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 K
Carbon Tetrachloride	1.0 U	5.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 K
Ethylene Dibromide	NA	NA	0.01 U	NA	NA	NA	NA	0.02 U	NA	NA	NA
Tetrachloroethene	1.0 U	5.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 K
1,1,1-Trichloroethane	1.0 U	5.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 K
Trichloroethene	1.0 U	5.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 K

Well M-11

Sample ID #:	NDEC	NR	AKCS2011	CKCS2218	IKLS2019	QKLS2003	I19S2014	I29S2014	I19S2014
Date Sampled:	8/30/83	10/25/84	4/9/85	9/18/85	6/19/86	9/2/86	12/8/86	4/3/87	7/8/87
Sample Depth:	141-193	141-193	141-193	141-193	141-193	141-193	141-193	141-193	141-193
Target Parameters (ug/L)									
Chloroform	0.15	1.0 U	1.0 U	5.0 U	1.0 U	0.1 U	0.1 U	0.2 U	1.0 U
Carbon Tetrachloride	NA	NA	1.0 U	5.0 U	1.0 U	0.1 U	0.1 U	0.2 U	1.0 U
Ethylene Dibromide	NA	NA	NA	NA	NA	NA	NA	0.2 U	NA
Tetrachloroethene	NA	1.0 U	1.0 U	5.0 U	1.0 U	0.1 U	0.1 U	0.2 U	1.0 U
1,1,1-Trichloroethane	NA	1.0 U	1.0 U	5.0 U	1.0 U	0.1 U	0.1 U	0.2 U	1.0 U
Trichloroethene	0.42	1.0 U	1.0 U	5.0 U	1.0 U	1.1 U	0.1 U	1.1	1.0 U

Well M-11 (continued)

Sample ID #:	J59S2004	R69S2005	NM7S2050	HSXS2034	MSIS2028	CS5S2011	CSSS2016	CSRS2011
Date Sampled:	9/21/87	3/28/88	3/21/89	6/13/89	9/12/89	3/15/90	9/30/91	9/17/92
Sample Depth:	141-193	141-193	141-193	141-193	141-193	141-193	141-193	141-193
Target Parameters (ug/L)								
Chloroform	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	5.0 U	1.0 K
Carbon Tetrachloride	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	5.0 U	1.0 K
Ethylene Dibromide	NA	NA	NA	NA	NA	NA	0.02 U	NA
Tetrachloroethene	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	5.0 U	1.0 K
1,1,1-Trichloroethane	1.0 U	1.0 U	5.0 U	5.0 U	1.0 U	1.0 U	5.0 U	1.0 K
Trichloroethene	1.0 U	2.0 J	5.0 U	5.0 U	3.0 J	5	5.0 U	2

Notes:
U: Less than specified detection limit.
I: Invalid - no reported value.
J: Data reported but not valid by approved QC procedures.
M: Detected but below level for accurate quantification.
NA: Parameter not analyzed.
NDEC: Analysis completed by the Nebraska Department of Environmental Control.
NR: Data not reported.
K: Analyte not detected at value reported.

TABLE 2

Summary of Ground Water Quality Target Compounds, page 3 of 8

Well M-20

Sample ID #:	R59S2027	N37S2001	N97S2025	HSXS2036	MSIS2101	CSSS2013	CSRS2014
Date Sampled:	5/3/88	6/27/88	9/14/88	6/13/89	9/12/89	9/30/91	9/17/92
Sample Depth:	172-232	172-232	172-232	172-232	172-232	172-232	172-232
Target Parameters (ug/L)							
Chloroform	5 0 U	5 0 U	5 0 U	5 0 U	1 0 U	5 0 U	1 0 K
Carbon Tetrachloride	5 0 U	5 0 U	5 0 U	5 0 U	1 0 U	5 0 U	1 0 K
Ethylene Dibromide	1 0 U	0.02 U	0.02 U	NA	NA	0 027 U	NA
Tetrachloroethene	5 0 U	5 0 U	5 0 U	5 0 U	1 0 U	5 0 U	1 0 K
1,1,1-Trichloroethane	5 0 U	5 0 U	5 0 U	5 0 U	1 0 U	5 0 U	1 0 K
Trichloroethene	5.0 J	5 0 U	5 0 U	5 0 U	1 0 U	5 0 U	1 0 K

Well IN-10A

Sample ID #:	DKJS2025	DKJS2026	PKJS2025	PKJS2026
Date Sampled:	12/18/85	12/18/85	3/13/86	3/13/86
Sample Depth:	NR	NR	NR	NR
Target Parameters (ug/L)				
Chloroform	1 0 U	4 0 J	4.1	4 1
Carbon Tetrachloride	1.0 U	1.0 U	1.0 U	1 0 U
Ethylene Dibromide	NA	NA	NA	NA
Tetrachloroethene	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	1 0 U	1 0 U	1 0 U	1 0 U
Trichloroethene	1.0 U	2.0 J	0 9 M	0 5 M

Well CW-1

Sample ID #:	NB7S2010	NB7S2012	HSXS2019	MSIS2047	CS2S2012	CS6S2008	CSAS2007	CSBS2042	CSDS2002
Date Sampled:	3/23/89	3/23/89	6/13/89	9/12/89	12/11/89	3/14/90	6/14/90	9/27/90	12/11/90
Sample Depth:	129-134	124-129	135	135	135	125-134	124-134	126 134	126 135
Target Parameters (ug/L)									
Chloroform	25	68	13 U	5 0 U	11	21	17 J	6 7 J	5 5
Carbon Tetrachloride	180	110	270	110	1400	280	310	170 J	150
Ethylene Dibromide	0 03	0.088	0.01 U	0 02 U	NA	NA	NA	NA	NA
Tetrachloroethene	5.0 U	5 0 U	8 0 U	5.0 U	2 0 J	13 U	5 0 U	5.0 U	5 0 U
1,1,1-Trichloroethane	5.0 U	5.0 U	8 0 U	5 0 U	5 0 U	13 U	5 0 U	5 0 U	5 0 U
Trichloroethene	5.0 U	5 0 U	8 0 U	9	5 0 U	13 U	5 0 U	5 0 U	5 0 U

Well CW-1 (continued)

Sample ID #:	CSHS2008	CSSS2001	CS6S2001	CSCS2002	CSKS2001	CSRS2002
Date Sampled:	3/22/91	10/2/91	12/11/91	3/17/92	6/11/92	9/15/92
Sample Depth:	124-134	128-134	128-134	122-134	122-134	122-134
Target Parameters (ug/L)						
Chloroform	7.2	5 0 U	10 U	6	4	7
Carbon Tetrachloride	130	43	110	74	110	110
Ethylene Dibromide	NA	0.027 U	NA	NA	NA	NA
Tetrachloroethene	5.0 U	5.0 U	10 U	3	3	4
1,1,1-Trichloroethane	5.0 U	5.0 U	10 U	1 0 U	1 0 U	1 0 K
Trichloroethene	5.0 U	5.0 U	10 U	1.0 U	1.0 U	1 0 K

Notes:

U: Less than specified detection limit.
I: Invalid - no reported value.
J: Data reported but not valid by approved QC procedures.
M: Detected but below level [illegible]

NR: Data not reported.
K: Analyte not detected at value reported.

TABLE 2

Summary of Ground Water Quality Target Compounds, page 4 of 8

Well CW-2

Sample ID #:	CSSS2002	CS6S2002	CSCS2003	CSKS2002	CSRS2013
Date Sampled:	10/2/91	12/14/91	3/17/92	6/11/92	9/15/92
Sample Depth:	128-133	128-133	126-133	126-133	127-133
Target Parameters (ug/L)					
Chloroform	5 0 U	10 U	1 0 U	2 0 U	1 0 K
Carbon Tetrachloride	17	18	22	23	18
Ethylene Dibromide	0.027 U	NA	NA	NA	NA
Tetrachloroethene	5 0 U	10 U	1	2 0 U	1 0 K
1,1,1-Trichloroethane	5 0 U	10 U	1 0 U	2 0 U	1 0 K
Trichloroethene	5 0 U	10 U	1 0 U	2 0 U	1 0 K

Well CW-3

Sample ID #:	CSSS2003	CS6S2003
Date Sampled:	10/3/91	12/13/91
Sample Depth:	131-137	131-137
Target Parameters (ug/L)		
Chloroform	5 0 U	10 U
Carbon Tetrachloride	6	10 U
Ethylene Dibromide	0.027 U	NA
Tetrachloroethene	5 0 U	10 U
1,1,1-Trichloroethane	5 0 U	10 U
Trichloroethene	5 0 U	10 U

Well CW-3R

Sample ID #:	CSBS2004	CSBS2005	CSCS2010	CSKS2003	CSRS2016
Date Sampled:	2/12/92	2/12/92	3/18/92	6/10/92	9/15/92
Sample Depth:	130-133	153-155	129-155	130-155	130-155
Target Parameters (ug/L)					
Chloroform	5 0 U	5 0 U	1 0 U	1 0 U	1 0 K
Carbon Tetrachloride	5 0 U	5 0 U	1.0 U	1 0 U	1 0 K
Ethylene Dibromide	NA	NA	NA	NA	NA
Tetrachloroethene	NA	NA	1.0 U	1.0 U	1 0 K
1,1,1-Trichloroethane	NA	NA	1 0 U	1 0 U	1 0 K
Trichloroethene	NA	NA	1 0 U	1 0 U	1 0 K

Well CW-4

Sample ID #:	CSSS2004	CS6S2004	CSCS2005	CSKS2004	CSRS2001
Date Sampled:	10/3/91	12/13/91	3/17/92	6/14/92	9/15/92
Sample Depth:	130-148	132-148	128-148	128-148	132-148
Target Parameters (ug/L)					
Chloroform	5 0 U	10 U	1 0 U	1 0 U	1 0 K
Carbon Tetrachloride	7.5	10 U	2	3.0 J	3
Ethylene Dibromide	0.027 U	NA	NA	NA	NA
Tetrachloroethene	5.0 U	10 U	1.0 U	4	3
1,1,1-Trichloroethane	5 0 U	10 U	1.0 U	5	3
Trichloroethene	35	18	3	52	27

Notes:

U: Less than specified detection limit.
I: Invalid - no reported value.
J: Data reported but not valid by approved QC procedures.
M: Detected but below level for [illegible]

TABLE 2

Well CW-5

Target Parameters (ug/L)					
Sample ID #:	CSSS2005	CS6S2005	CSCS2009	CSKS2005	CSRS2009
Date Sampled:	10/3/91	12/12/91	3/17/92	6/9/92	9/16/92
Sample Depth:	136-165	136-165	136-165	136-165	136-165
Chloroform	5.0 U	10 U	2	1.0 U	1.0 K
Carbon Tetrachloride	19	22	27	19	21
Ethylene Dibromide	0.027 U	NA	NA	NA	NA
Tetrachloroethene	5.0 U	1.0 U	1.0 U	1.0 U	1.0 K
1,1,1-Trichloroethane	5.0 U	1.0 U	1.0 U	1.0 U	1.0 K
Trichloroethene	5.0 U	1.0 U	1.0 U	1.0 U	1.0 K

Well CW-6

Target Parameters (ug/L)					
Sample ID #:	CSSS2006	CS6S2006	CSCS2004	CSKS2006	CSRS2010
Date Sampled:	10/3/91	12/11/91	3/17/92	6/9/92	9/16/92
Sample Depth:	160-180	160-180	160-180	160-180	160-180
Chloroform	5.0 U	1.0 U	1.0 U	1.0 U	1.0 K
Carbon Tetrachloride	5.0 U	2.0 U	1.0 U	1.0 U	1.0 K
Ethylene Dibromide	0.027 U	NA	NA	NA	NA
Tetrachloroethene	5.0 U	1.0 U	1.0 U	1.0 U	1.0 K
1,1,1-Trichloroethane	5.0 U	1.0 U	1.0 U	1.0 U	1.0 K
Trichloroethene	5.0 U	1.0 U	1.0 U	1.0 U	1.0 K

Well CW-7

Target Parameters (ug/L)					
Sample ID #:	CSSS2007	CS6S2007	CSCS2015	CSKS2016	CSRS2008
Date Sampled:	10/4/91	12/14/91	3/18/92	6/12/92	9/15/92
Sample Depth:	156-175	156-175	156-175	156-175	156-175
Chloroform	5.0 U	1.0 U	1.0 U	1.0 U	1.0 K
Carbon Tetrachloride	5.0 U	3	2	4.0 J	2
Ethylene Dibromide	0.027 U	NA	NA	NA	NA
Tetrachloroethene	19	23	19	16	11
1,1,1-Trichloroethane	89	68	24	43	24
Trichloroethene	700	740	492	450	210

Notes:

U: Less than specified detection limit.
I: Invalid - no reported value.
J: Data reported but not valid by approved QC procedures

TABLE 2

Well CW-8

Sample ID #:	CSRS2018
Date Sampled:	9/17/92
Sample Depth:	133-153

Target Parameters (ug/L)	
Chloroform	1.0 K
Carbon Tetrachloride	1.0 K
Ethylene Dibromide	NA
Tetrachloroethene	1.0 K
1,1,1-Trichloroethane	2
Trichloroethene	150

Well CW-9

Sample ID #:	CSRS2019
Date Sampled:	9/17/92
Sample Depth:	132-142

Target Parameters (ug/L)	
Chloroform	1
Carbon Tetrachloride	2
Ethylene Dibromide	NA
Tetrachloroethene	160
1,1,1-Trichloroethane	170
Trichloroethene	920

Well CW-10

Sample ID #:	CSRS2017
Date Sampled:	9/16/92
Sample Depth:	154-174

Target Parameters (ug/L)	
Chloroform	1.0 K
Carbon Tetrachloride	2
Ethylene Dibromide	NA
Tetrachloroethene	1.0 K
1,1,1-Trichloroethane	1.0 K
Trichloroethene	10

Notes: NA: Parameter not analyzed.
[illegible]

TABLE 2

Summary of Ground Water Quality Target Compounds, page 7 of 8

Well MW-23

Sample ID #:	NA7S2035	NA7S2034	NA7S2033	NA7S2032	MSIS2071	MSIS2070	MSIS2069	MSIS2068	MSIS2067	CS2S2012
Date Sampled:	12/8/88	12/8/88	12/8/88	12/8/88	9/13/89	9/13/89	9/13/89	9/13/89	9/13/89	12/12/89
Sample Depth:	155-160	175-180	195-200	215-220	135-140	155-160	175-180	195-200	215-220	135-140
Target Parameters (ug/L)										
Chloroform	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Carbon Tetrachloride	3.0 M	8	6	6	5.0 U	5.0 U	5.0 U	5.0 U	4.0 J	3.0 J
Ethylene Dibromide	1.0 U	1.0 U	1.0 U	1.0 U	NA	NA	NA	NA	NA	0.02 U
Tetrachloroethene	5.0 U	5.0 U	5.0 U	3.0 M	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
1,1,1-Trichloroethane	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
Trichloroethene	6	33	37	70	5.0 U	5.0 U	2.0 J	5.0 U	5.0 U	2.0 J

Well MW-23 (continued)

Sample ID #:	CS2S2031	CS2S2030	CS2S2029	CSDS2019	CSDS2020	CSDS2021	CSDS2022	CSDS2023	CSDS2024	CSHS2001
Date Sampled:	12/12/89	12/12/89	12/12/89	12/11/90	12/11/90	12/11/90	12/11/90	12/11/90	12/11/90	3/21/91
Sample Depth:	155-160	175-180	195-200	135-140	150-155	160-165	180-185	190-195	210-215	135-140
Target Parameters (ug/L)										
Chloroform	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	1.0 U
Carbon Tetrachloride	2.0 J	5	1.0 J	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	1
Ethylene Dibromide	0.02 U	0.02 U	0.02 U	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	1.0 U
1,1,1-Trichloroethane	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	1.0 U
Trichloroethene	5.0 U	5.0 U	7.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	1.0 U

Well MW-23 (continued)

Sample ID #:	CSHS2002	CSHS2003	CSHS2004	CSHS2005	CSHS2006	CSSS2017	CSSS2008	CSSS2018	CSSS2019	CS6S2008
Date Sampled:	3/21/91	3/21/91	3/21/91	3/21/91	3/21/91	10/2/91	10/2/91	10/2/91	10/2/91	12/10/91
Sample Depth:	150-155	160-165	180-185	190-195	204-209	135-140	160-165	185-190	215-220	140-145
Target Parameters (ug/L)										
Chloroform	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	5.0 U	5.0 U	1.0 U
Carbon Tetrachloride	2.9	4.8	1	1.0 U	1.0 U	5.0 U	5.0 U	5.0 U	5.0 U	1.0 U
Ethylene Dibromide	NA	NA	NA	NA	NA	0.027 U	0.027 U	0.027 U	0.027 U	NA
Tetrachloroethene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	5.0 U	5.0 U	1.0 U
1,1,1-Trichloroethane	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	5.0 U	5.0 U	5.0 U	1.0 U
Trichloroethene	1.0 U	1.0 U	1.0 U	1.0 U	1	5.0 U	19	5.0 U	5.0 U	1.0 U

Well MW-23 (continued)

	CS6S2015	CS6S2016	CS6S2017	CSCS2001	CSCS2011	CSCS2012	CSCS2013
Date Sampled:	12/10/91	12/10/91	12/10/91	3/16/92	3/24/92	3/24/92	3/24/92
Sample Depth:	160-165	190-195	205-210	135-140	160-161	185-186	205-206
Target Parameters (ug/L)							
Chloroform	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Carbon Tetrachloride	2.2	2.0 U	2.0 U	1	1.0 U	1.0 U	1.0 U
Ethylene Dibromide	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
1,1,1-Trichloroethane	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

Notes:
- U: Less than specified detection limit.
- I: Invalid - no reported value.
- M: Detected but below level for accurate quantification.
- NA: [illegible]

Summary of Ground Water Quality Target Compounds, page 8 of 8

Well MW-23 (continued)

Target Parameters (ug/L)		CSKS2007	CSKS2008	CSKS2009	CSKS2010	CSRS2007	CSRS2006	CSRS2005	CSRS2004
	Date Sampled:	6/14/92	6/14/92	6/14/92	6/14/92	9/16/92	9/16/92	9/16/92	9/16/92
	Sample Depth:	135-140	160-165	185-190	195-200	135-140	160-165	185-190	195-200
Chloroform		1.0 U	2.0 U	1.0 U	1.0 U	1.0 K	1.0 K	1.0 K	1.0 K
Carbon Tetrachloride		2	16	1.0 U	1.0 U	2	5	2	2
Ethylene Dibromide		NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene		1.0 U	2.0 U	1.0 U	1.0 U	1.0 K	1.0 K	1.0 K	1.0 K
1,1,1-Trichloroethane		1.0 U	2.0 U	1.0 U	1.0 U	1.0 K	1.0 K	1.0 K	1.0 K
Trichloroethene		1.0 U	2.0 U	1.0 U	1.0 U	1.0 K	1.0 K	1.0 K	1.0 K

Notes:

U: Less than specified detection limit.
NA: Parameter not analyzed.
K: Analyte not detected at value reported.

TABLE 2

TARGET CONCENTRATIONS FOR CARCINOGENIC CHEMICALS DETECTED IN GROUND WATER AT THE HASTINGS SITE

Chemical (a)	Weight of Evidence (b)	Slope Factor (mg/kg-day)-1 [Source] (c): Oral	Inhalation	Target Concentrations for Cancer Risk Range (ug/liter): 1X10-4	1X10-5	1X10-6
Benzene	(A)	0.029 [IRIS]	0.029 [HEAST]	140	14	1.4
Bromodichloromethane	(B2)	0.13 [IRIS]	-- (e)	31	3.1	0.31
Carbon Tetrachloride	(B2)	0.13 [IRIS]	0.13 [HEAST]	31	3.1	0.31
Chloroform	(B2)	0.0061 [IRIS]	0.081 [HEAST]	94	9.4	0.94
1,2-Dichloroethane	(B2)	0.091 [IRIS]	0.091 [HEAST]	45	4.5	0.45
1,1-Dichloroethene	(C)	0.60 [IRIS]	1.20 [HEAST]	5	0.5	0.05
Methylene Chloride	(B2)	0.0075 [IRIS]	0.0016 [IRIS] (d)	900	90	9.0
Styrene	(B2)	0.030 [HEAST]	0.0020 [HEAST]	260	26	2.6
Tetrachloroethene	(B2)	0.051 [HEAST]	0.0018 [HEAST] (d)	150	15	1.5
Trichloroethene	(B2)	0.011 [HEAST]	0.017 [HEAST]	290	29	2.9

(a) No toxicity criteria were available for chloroethane.

(b) EPA weight of evidence classification scheme for carcinogens: A--Human Carcinogen, sufficient evidence from human epidemiological studies; B1--Probable Human Carcinogen, limited evidence from epidemiological studies and adequate evidence from animal studies; B2--Probably Human Carcinogen, inadequate evidence from epidemiological studies and adequat evidence from animal studies; C--Possible Human Carcinogen, limited evidence in animals in the absence of human data; D--Not classified as to human carcinogenicity; and E--Evidence of noncarcinogenicity.

(c) Source: IRIS = the chemical files of EPA's Integrated Risk Information System (as of 4/1/91); HEAST = Health Effects Assessment Summary Tables (as of January, 1991); HA = Health Advisory (Office of Drinking Water).

(d) The inhalation slope factors were estimated from the following unit risk values: 4.7E-4 per mg/m3, methylene chloride; and 5.2E-4 per mg/m3 for tetrachloroethene. An inhalation rate of 20 m3/day was assumed for a 70-kg adult. Example calculation: (4.7x10-4/mg-m3) * (70kg/20m3-day) = 1.6x10-3 per mg/kg-day

(e) No inhalation toxicity criteria were available; therefore, it was assumed that the inhalation toxicity criterion is equal to the oral toxicity value.

TABLE 3

TARGET CONCENTRATIONS FOR NONCANCER RISKS FOR CHEMICALS DETECTED IN THE GROUND WATER AT THE HASTINGS SITE (a)

Chemical (e)	K (c)	Inhalation RfC (mg/m3)	Inhalation RfD (mg/kg-day)	Oral RfD (mg/kg-day)	Target Concentration Based on Hazard Index of One (ug/L)
Acetone	0.20	NA	0.10 (b)	0.10 IRIS	2,918
Bromodichloromethane	0.78	NA	0.020 (b)	0.020 IRIS	393
Carbon Tetrachloride	0.79	NA	0.00070 (b)	0.00070 IRIS	14
Chloroform	0.84	NA	0.010 (b)	0.010 IRIS	190
1,1-Dichloroethane	0.92	0.50 HEAST	0.20 HEAST	0.10 HEAST	2,400
1,1-Dichloroethene	0.95	NA	0.0090 (b)	0.0090 IRIS	161
1,2-Dichloroethene (total)	0.94	NA	0.010 (b)	0.010 HEAST (f)	180
Ethyl Benzene	0.90	1.00 IRIS	0.29 (d)	0.10 IRIS	2,663
Methylene Chloride	0.93	3.00 HEAST	0.86 (d)	0.060 IRIS	1,971
Styrene	0.88	NA	0.20 (b)	0.20 IRIS	3,714
Tetrachloroethene	0.77	NA	0.010 (b)	0.010 IRIS	198
Toluene	0.94	2.00 HEAST	0.57 (d)	0.20 IRIS	5,261
1,1,1-Trichloroethane	0.84	1.00 HEAST	0.30 HEAST	0.090 IRIS	2,516
Trichloroethene	0.83	NA	0.0074 (b)	0.0074 HA	140
Xylenes (total)	0.90	0.30 HEAST	0.086 (d)	2.0 IRIS	3,198

(a) Source of toxicity information: IRIS = the chemical files of EPA's Integrated Risk Information System (as of 4/1/91); HEAST = Health Effects Summary Table (as of January, 1991); HA = Health Advisory (Office of Drinking Water).
(b) In the absence of an inhalation RfD, the oral RfD is used for both oral and inhalation exposures.
(c) K is the constant ratio between the inhalation and the oral dose (see text).
(d) Inhalation RfD estimated from inhalation RfC. Assuming a 70 kg adult inhales 20 m3 of air per day.
Example calculation (xylenes): (0.3 mg/m3 * 20 m3)/70 kg = 8.57x10-2 mg/kg-day
(e) No toxicity criteria were available for chloroethane.
(f) Chronic RfD for cis-1,2-dichloroethene was used for 1,2-dichloroethene (total).
NA - not available

TABLE 4

Detailed Analysis Summary of Alternative - Plume Management of the CCl_4 Plume to a $1X10^{-4}$ Risk Level with GAC Adsorption

---

Protection of Human Health and the Environment

Would prevent further degradation of ground water downgradient of the $1X10^{-4}$ plume area and would reduce risks associated with exposure to ground water.

Compliance with ARARs

Chemical-specific ARARs (MCLs) would not be attained.

Action-specific ARARs would be attained.

Long-Term Effectiveness and Permanence

Would permanently reduce contaminant concentrations to below a $1X10^{-4}$ risk level.

Final action or institutional controls would be necessary to manage residual risk because contaminant concentrations above MCLs would continue to exist.

Reduction of Toxicity, Mobility, or Volume

Contaminants would be removed from the aquifer and treated, thus reducing the toxicity, mobility and volume of ground water contaminants.

GAC treatment would result in the destruction of contaminants since they would be removed from the ground water, adsorbed onto GAC, and ultimately incinerated at a regeneration facility.

Short-Term Effectiveness

Implementation would present a low-level, controllable risk to workers, the community and the environment.

Implementability

All of the individual technologies and process options for this alternative are readily implementable.

State Acceptance

Determined by State comments after its review of the Proposed Plan and ROD.

Community Acceptance

Determined by comments received during the public comment period on EPA's Proposed Plan.

Costs

Capital Costs	$ 469,000
O&M Costs	$ 72,000/yr.
Present Worth (12 years, 5%)	$1,104,000

TABLE 5

Detailed Analysis Summary of Alternative - Plume Management of the CCl_4 Plume to a $1X10^{-4}$ Risk Level with Air Stripping

---

Protection of Human Health and the Environment

Would prevent further degradation of ground water downgradient of the $1X10^{-4}$ plume area and would reduce risks associated with exposure to ground water.

Air stripping would transfer contaminants from the ground water to the atmosphere creating potential for impact to human health and the environment.

Compliance with ARARs

Chemical-specific ARARs (MCLs) would not be attained.

Action-specific ARARs would be attained.

Long-Term Effectiveness and Permanence

Would permanently reduce contaminant concentrations to below a $1X10^{-4}$ risk level.

Final action or institutional controls would be necessary to manage residual risk because contaminant concentrations above MCLs would continue to exist.

Reduction of Toxicity, Mobility, or Volume

Contaminants would be removed from the aquifer and treated, thus reducing the toxicity, mobility and volume of ground water contaminants.

Air stripping would result in the release of contaminants to the atmosphere and therefore would be less desirable than GAC adsorption in addressing the intent of this criteria.

Short-Term Effectiveness

Implementation would present a low-level, controllable risk to workers, the community and the environment.

Implementability

All of the individual technologies and process options for this alternative are readily implementable.

State Acceptance

Determined by State comments after its review of the Proposed Plan and ROD.

Community Acceptance

Determined by comments received during the public comment period on EPA's Proposed Plan.

Costs

Capital Costs	$ 492,000
O&M Costs	$ 62,000/year
Present Worth (12 years, 5%)	$1,042,000

TABLE 6

Detailed Analysis Summary of Alternative - Plume Management of the TCE Plume to a $1X10^{-4}$ Risk Level with GAC Adsorption

---

Protection of Human Health and the Environment

Would prevent further degradation of ground water downgradient of the $1X10^{-4}$ plume area and would reduce risks associated with exposure to ground water.

Compliance with ARARs

Chemical-specific ARARs (MCLs) would not be attained.

Action-specific ARARs would be attained.

Long-Term Effectiveness and Permanence

Would permanently reduce contaminant concentrations to below a $1X10^{-4}$ risk level.

Final action or institutional controls would be necessary to manage residual risk because contaminant concentrations above MCLs would continue to exist.

Reduction of Toxicity, Mobility, or Volume

Contaminants would be removed from the aquifer and treated, thus reducing the toxicity, mobility and volume of ground water contaminants.

GAC treatment would result in the destruction of contaminants since they would be removed from the ground water, adsorbed onto GAC, and ultimately incinerated at a regeneration facility.

Short-Term Effectiveness

Implementation would present a low-level, controllable risk to workers, the community and the environment.

Implementability

All of the individual technologies and process options for this alternative are readily implementable.

State Acceptance

Determined by State comments after its review of the Proposed Plan and ROD.

Community Acceptance

Determined by comments received during the public comment period on EPA's Proposed Plan.

Costs

Capital Costs	$294,000
O&M Costs	$ 69,000
Present Worth (10 years, 5%)	$829,000

TABLE 7

Detailed Analysis Summary of Alternative - Plume Management of the TCE Plume to a $1X10^{-4}$ Risk Level with Air Stripping

---

Protection of Human Health and the Environment

Would prevent further degradation of ground water downgradient of the $1X10^{-4}$ plume area and would reduce risks associated with exposure to ground water.

Air stripping would transfer contaminants from the ground water to the atmosphere creating potential for impact to human health and the environment.

Compliance with ARARs

Chemical-specific ARARs (MCLs) would not be attained.

Action-specific ARARs would be attained.

Long-Term Effectiveness and Permanence

Would permanently reduce contaminant concentrations to below a $1X10^{-4}$ risk level.

Final action or institutional controls would be necessary to manage residual risk because contaminant concentrations above MCLs would continue to exist.

Reduction of Toxicity, Mobility, or Volume

Contaminants would be removed from the aquifer and treated, thus reducing the toxicity, mobility and volume of ground water contaminants.

Air stripping would result in the release of contaminants to the atmosphere and therefore would be less desirable than GAC adsorption in addressing the intent of this criteria.

Short-Term Effectiveness

Implementation would present a low-level, controllable risk to workers, the community and the environment.

Implementability

All of the individual technologies and process options for this alternative are readily implementable.

State Acceptance

Determined by State comments after its review of the Proposed Plan and ROD.

Community Acceptance

Determined by comments received during the public comment period on EPA's Proposed Plan.

Costs

Capital Costs	$323,000
O&M Costs	$ 58,000/yr.
Present Worth (10 years, 5%)	$768,000

TABLE 8

TABLE 9

Chemical-Specific ARARs[1]

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Comment
Federal				
Safe Drinking Water Act	40 USC Sect. 300			
National Primary Drinking Water Standards	40 CFR Part 141	Establishes maximum contaminant levels (MCLs) which are health-based standards for public water systems.	Yes/Yes	The MCLs for organic and inorganic contaminants are relevant and appropriate to the ground water contamination in potential drinking water sources, including MCLs for volatile organics and metals.
National Secondary Drinking Water Standards	40 CFR Part 143	Establishes secondary maximum contaminant levels (SMCLs) which are non-enforceable guidelines for public water systems to protect the aesthetic quality of the water.	No/Yes	SMCLs may be relevant and appropriate if treated ground water is used as a source of drinking water.
Maximum Contaminant Level Goals (MCLGs)	PL No. 99-339, 100 Stat. 642 (1986)	Establishes drinking water quality goals set at levels of no known or anticipated adverse health effects with an adequate margin of safety.	No/Yes	MCLGs for organic and inorganic contaminants may be relevant and appropriate if a more stringent standard is required to protect human health or the environment. When available, non-zero MCLGs are relevant and appropriate to potential drinking water sources in lieu of MCLs.

TABLE 9

Chemical-Specific ARARs

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Comment
Clean Water Act	33 USC Sect. 1251-1376			
Ambient Water Quality Criteria	40 CFR Part 131 Quality Criteria for Water, 1976, 1980, 1986	Requires the states to set ambient water quality criteria (AWQC) based on water use classifications and the criteria developed under Section 304(a) of the Clean Water Act.	No/Yes	May be relevant and appropriate if contaminated or treated ground water is discharged to surface water during a remedial action.
Clean Air Act	42 USC Sect. 7401-7642			
National Primary and Secondary Ambient Air Quality Standards	40 CFR Part 50	Establishes standards for ambient air quality to protect public health and welfare.	Yes/No	The subsite is not considered to be a source of air pollution. However, may be applicable if contaminants are discharged to the air during a treatment process.
State				
Nebraska Environmental Protection Act	Chapter 81	Establishes state's policy on environmental control.		
Water Quality Standards for Surface Water of the State	Title 117	Establishes environmental quality standards for the surface waters of the state.	Yes/No	Surface water is not present at the site. May be applicable if contaminated ground water is discharged into a surface water body.

TABLE 9

Chemical-Specific ARARs

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Comment
Ground Water Quality Standards and Use Classification	Title 118	Establishes standards and use classifications for ground water sources of drinking water. Determines priorities for ground water remedial actions.	Yes/No	Nebraska MCLs are applicable to the ground water at the subsite if they are more stringent than any of the federal ARARs. Nebraska MCLs have been established for inorganic and organic compounds detected in the ground water
Nebraska Air Pollution Control Rules and Regulations	Title 129	Establishes Primary and Secondary Ambient Air Quality Standards and requires operating permits for various operations emitting contaminants into the air.	Yes/No	The subsite is not considered to be a source of air pollution. However, may be applicable if contaminants are discharged to the air during a treatment process. If treatment units are located onsite, no permits are required. However, the substantive requirements must be met.

TABLE 10

Potential Chemical-Specific ARARs for Selected Compounds Detected in Ground Water

Contaminant	SDWA MCL mg/l	Nebraska MCL mg/l	SDWA MCLG mg/l	Federal Water Quality Criteria, Protection for Ingestion of Water Only[a] mg/l	Ambient Water Quality Criteria for Protection of Freshwater Aquatic Life	
					Acute mg/l	Chronic mg/l
Carbon Tetrachloride	0.005	0.005	0	0.00042	35	---
Chloroform	0.1[d]	0.1	---	0.00019	28[b]	1.2[b]
1,1-Dichloroethene	0.007	0.007	0.007	0.000033	11.6	0.005
Tetrachloroethene	0.005	0.005	0	0.0008	5.28[b]	0.84[b]
1,1,1-Trichloroethane	0.200	0.200	0.200	NA	---[c]	---[c]
Trichloroethene	0.005	0.005	0	0.00028	45[b]	21.9

[a] The criterion corresponds to an excess carcinogenic risk of $1X10^{-6}$.

[b] Insufficient data to develop criteria. Value listed is the Lowest Observed Effect Level (L.O.E.L.).

[c] Criteria have not been developed.

[d] Based on criteria for total trihalomethanes.

TABLE 11

Action-Specific ARARs

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Comment
Federal				
Solid Waste Disposal Act (SWDA), Subtitle C as amended by Resource Conservation and Recovery Act of 1976 (RCRA)	41 USC Section 6901-6987			
Criteria for Classification of Solid Waste Disposal Facilities and Practices	40 CFR Part 257	Establishes criteria for use in determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on health, and thereby constitute prohibited open dumps.	Yes/Yes	If an alternative developed would involve the land disposal of solid waste, this part would be applicable or relevant and appropriate.
Hazardous Waste Management Systems General	40 CFR Part 260	Establishes procedure and criteria for modification or revocation of any provisions in 40 CFR Parts 260-265.	Yes/Yes	May be applicable or relevant and appropriate if a substance at the site was to be excluded from the list of hazardous wastes.
Identification and Listing of Hazardous Wastes	40 CFR Part 261	Defines those solid wastes which are subject to regulation as hazardous wastes under 40 CFR Parts 262-265 and Parts 124, 270, and 271.	Yes/Yes	Identifies those wastes considered to be hazardous wastes at the site. Any wastes considered as hazardous would be required to be handled as such.
Standards Applicable to Generators of Hazardous Waste	40 CFR Part 262	Establishes standards for generators of hazardous waste.	Yes/Yes	If an alternative developed would involve offsite disposal or treatment of hazardous materials, these standards would be applicable or relevant and appropriate.

TABLE 11

Action-Specific ARARs

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Comment
Standards Applicable to Transporters of Hazardous Waste	40 CFR Part 263	Establishes standards which apply to persons transporting hazardous waste within the U.S. if the transportation requires a manifest under 40 CFR Part 262.	Yes/Yes	If an alternative developed would involve offsite transportation of hazardous materials, these standards would be applicable or relevant and appropriate.
Standards for Owners and Operators of hazardous Waste Treatment, Storage, and Disposal Facilities	40 CFR Part 264	Establishes minimum national standards which define the acceptable management of hazardous waste for owners and operators of facilities which treat, store, or dispose hazardous waste.	Yes/Yes	Subparts B through O may be applicable or relevant and appropriate to onsite and offsite remedial actions.
Interim Standards for Owners and Operators of hazardous Waste Treatment, Storage, and Disposal Facilities	40 CFR Part 265	Establishes minimum national standards that define the acceptable management of hazardous waste during the period of interim status and until certification of final closure or if the facility is subject to post-closure requirements, until post-closure responsibilities are fulfilled.	Yes/Yes	Remedies should be consistent with the more stringent Part 264 standards as these represent the ultimate RCRA compliance standards and are consistent with CERCLA's goal of long-term protection of public health and welfare and the environment.
Land Disposal	40 CFR Part 268	Establishes a timetable for restriction of burial of wastes and other hazardous materials.	Yes/Yes	If an alternative involves land disposal of any restricted wastes, this part may be applicable or relevant and appropriate.
Hazardous Waste Permit Program	40 CFR Part 270	Establishes provisions covering basic EPA permitting requirements.	Yes/No	A permit is not required for onsite CERCLA response actions; however, a permit is required for offsite actions. Substantive requirements are addressed in 40 CFR Part 264.

TABLE 11

Action-Specific ARARs

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Comment
Occupational Safety and Health Act	29 USC Section 651-678	Regulates worker health and safety.	Yes/Yes	Under 40 CFR Section 300.38, requirements of the Act apply to all response activities under the NCP.
Safe Drinking Water Act	29 USC Section 300(f)			
Standards for Owners and Operators of Public Water Supply System	40 CFR 141	Provides treatment (water quality) requirements for public water supply systems.	Yes/Yes	MCLs may be applicable or relevant and appropriate to the establishment of cleanup goals for ground water contamination.
Underground Injection Control Regulations	40 CFR Parts 144-147	Provides for protection of underground sources of drinking water.	Yes/Yes	If an alternative developed would involve underground injection, this part could be applicable or relevant and appropriate.
Clean Water Act	33 USC Section 1251-1376			
National Pollutant Discharge Elimination System	40 CFR Parts 122-125	Requires permits for the discharge of pollutants from any point source into waters of the United States.	Yes/No	A permit is not required for onsite CERCLA response actions, but the substantive requirements would apply if an alternative developed would discharge into a creek or other surface water on the site. A permit would be required if the point of discharge is to a creek or surface water located offsite.

TABLE 11

Action-Specific ARARs

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Comment
National Pretreatment Standards	40 CFR Part 403	Sets standards to control pollutants which pass through or interfere with treatment processes in publicly-owned treatment works or which may contaminate sewage sludge.	Yes/No	If an alternative developed involves discharge to publicly owned treatment works, these standards would be applicable.
Clean Air Act	42 USC Section 7401-7642			
National Ambient Air Quality Standards/NESHAPS/ NSPS/BACT/PSD/LAER	40 CFR 50.1-.17, .50-.54, .15-.154, .480-.489, 40 CFR 53.1-.33, 40 CFR 61.01-.18, .50-.112, .240-.247	Treatment technology standard for emissions to air • incinerators • surface impoundments • waste piles • landfills • fugitive emissions	Yes/Yes	If an alternative developed would involve emissions governed by these standards, then the requirements are applicable.

TABLE 11

Action-Specific ARARs

Standard, Requirement Criteria, or Limitation	Citation	Description	Applicable/ Relevant and Appropriate	Comment
State				
Nebraska Environmental Protection Act	Chapter 81, Article 15			
Nebraska Pretreatment Regulations	Title 127	Establishes limitations on types of wastes which can be discharged to a POTW and requires a permit when a discharge may interfere with, pass through, or be incompatible with a POTW's treatment process.	Yes/Yes	Any alternatives which discharge contaminated ground water to a POTW will have to meet the substantive requirements of this regulation. Permit will be required.
Nebraska General NPDES Rules for New and Existing Sources	Title 121	Establishes point sources effluent standards.	Yes/Yes	May be applicable to any discharge of treatment effluent to a surface water body.
National Pollutant Discharge Elimination Systems	Title 119	Requires permit for discharge pollutants from a point source into the waters of the State.	Yes/Yes	May be applicable or relevant and appropriate if an effluent is discharged into an offsite surface water.
Rules and Regulations for Injection Wells and Mineral Production Wells	Title 122	Establishes procedures for permitting underground injection of hazardous wastes into or above an underground supply of drinking water.	Yes/Yes	May be applicable or relevant and appropriate if treated ground water is injected into aquifer. Will require permit if reinjection wells are located offsite. Reinjected water must comply with drinking water standards.
Nebraska Air Pollution Control Rules and Regulations	Title 129, Section 6007	Establishes control technology standards for emissions of toxic air pollutants from new modified or reconstructed sources.	Yes/Yes	May be applicable or relevant and appropriate to treatment processes with atmospheric emissions.

Revision May 1992

STATE ARARs		CITATION
I.	Nebraska Environmental Protection Act	Neb. Rev, Stat. Ch. 81 Article 15
A.	Rules and Regulations Governing the Nebraska Pretreatment Program	Neb. Adm. Rules & Regs. Title 127
B.	Effluent Guidelines and Standards	Neb. Adm. Rules & Regs. Title 121
C.	Rules and Regulations Pertaining to the Issuance of Permits Under the National Pollutant Discharge Elimination System	Neb. Adm. Rules & Regs. Title 119
D.	Rules and Regulations for Underground Injection and Mineral Production Wells	Neb. Adm. Rules & Reg. Title 122
E.	Air Pollution Control Rules and Regulations	Neb. Adm. Rules & Regs. Title 129
F.	Nebraska Surface Water Quality Standards	Neb. Adm. Rules & Regs. Title 117
G.	Ground Water Quality Standards and Use Classification	Neb. Adm. Rules & Regs. Title 118
H.	Rules and Regulations Pertaining to Solid Waste Management	Neb. Adm. Rules & Regs. Title 132
I.	Rules and Regulations Governing Hazardous Waste Management in Nebraska	Neb. Adm. Rules & Regs. Title 128
J.	Rules and Regulations Pertaining to the Management of Wastes	Neb. Adm. Rules & Regs. Title 126
II.	Water Well Standards and Contractors' Licensing Act	Neb. Rev. State. Ch. 46 Article 12
A.	Regulations Governing Licensure of Water Well and Pump Installation Contractors and Certification of Water Well Drilling and Pump Installation Supervisors	Neb. Adm. Rules & Regs. Title 178
III.	Statutes Relating to Ground Water	Neb. Rev. Stat. Ch. 46 Article 6
IV.	Nebraska Safe Drinking Water Act	Neb. Rev. Stat. Ch. 71 Article 53
A.	Regulations Governing Public Water Supply Systems	Neb. Adm. Rules & Regs. Title 179

TABLE 12

STATE ARARs			CITATION
V.	Flood Plain Management		Neb. Rev. Stat. Ch. 31 Article 10
	A.	Flood Plain Rules	Neb. Adm. Rules & Reg. Title 455
	B.	Rules Governing Flood Plain Management	Neb. Adm. Rules & Regs. Title 258
VI.	Statues Relating to Disposal Sites		Neb. Rev. Stat. Ch. 19 Articles 21 & 41
VII.	Nebraska Nongame and Endangered Species Conservation Act		Neb. Rev. Stat. ch. 37-430 to Ch. 37-438
	A.	Nebraska Game and Parks Commission Rules and Regulations Concerning Wildlife	Neb. Adm. Rules & Regs. Title 163, Chapter 6

TABLE 12

Cost Estimate for Alternative - Plume Management of the CCl_4 Plume to a $1X10^{-4}$ Risk Level with GAC Adsorption

<u>CAPITAL COST</u>		
CONSTRUCTION:		
Installation of New Wells	$30,000	
Well Pumps, Piping, and Manholes	$14,000	
Site Prep and Building	$17,000	
Underground Piping	$60,000	
Treatment Plant Mechanical	$24,000	
Electrical	$33,000	
Taxes/Small Tools and Supplies	$11,000	
Contractor Overhead and Fee	$26,000	
SUBTOTAL CONSTRUCTION COSTS		$215,000
CONTINGENCY @ 15%	$32,250	
TOTAL CONSTRUCTION COST	$247,250	
OTHER CAPITAL COSTS:		
Access Agreements, Permitting and Legal	$25,000	
RD Investigation/Studies	$135,000	
Engineering (10% of Construction)	$24,725	
Construction Mgmt. and Startup (15% of Construction)	$37,088	
TOTAL CAPITAL COST:	$469,063	
<u>ANNUAL O&M COSTS</u>		
Electricity	$1,350	
Carbon Purchase and Regeneration	$9,540	
O&M Labor	$25,500	
Maintenance Parts	$2,473	
Analytical	$16,000	
Taxes, Insurance and Admin.	$7,418	
Contingency	$9,342	
ANNUAL O&M COST		$71,622
<u>PRESENT WORTH (12 YEARS)</u>	$1,103,866	

Notes:

Discount rate = 5%
Duration = 12 years

TABLE 13

Cost Estimate for Alternative - Plume Management of the TCE Plume to a $1X10^{-4}$ Risk Level with GAC Adsorption

CAPITAL COST		
CONSTRUCTION:		
Installation of New Wells	$19,000	
Well Pumps, Piping, and Manholes	$10,000	
Site Prep and Building	$15,000	
Underground Piping	$17,000	
Treatment Plant Mechanical	$24,000	
Electrical	$16,000	
Taxes/Small Tools and Supplies	$7,000	
Contractor Overhead and Fee	$13,000	
SUBTOTAL CONSTRUCTION COSTS		$121,000
CONTINGENCY @ 15%	$18,150	
TOTAL CONSTRUCTION COST	$139,150	
OTHER CAPITAL COSTS:		
Access Agreements, Permitting and Legal	$25,000	
RD Investigation/Studies	$95,000	
Engineering (10% of Construction)	$13,915	
Construction Mgmt. and Startup (15% of Construction)	$20,873	
TOTAL CAPITAL COST:	$293,938	
ANNUAL O&M COSTS		
Electricity	$2,000	
Carbon Purchase and Regeneration	$11,200	
O&M Labor	$25,500	
Maintenance Parts	$1,392	
Analytical	$16,000	
Taxes, Insurance and Admin.	$4,175	
Contingency at 15%	$9,040	
ANNUAL O&M COST		$69,306
PRESENT WORTH (10 YEARS)	$829,099	

Notes:

Discount rate = 5%
Duration = 10 years

TABLE 14

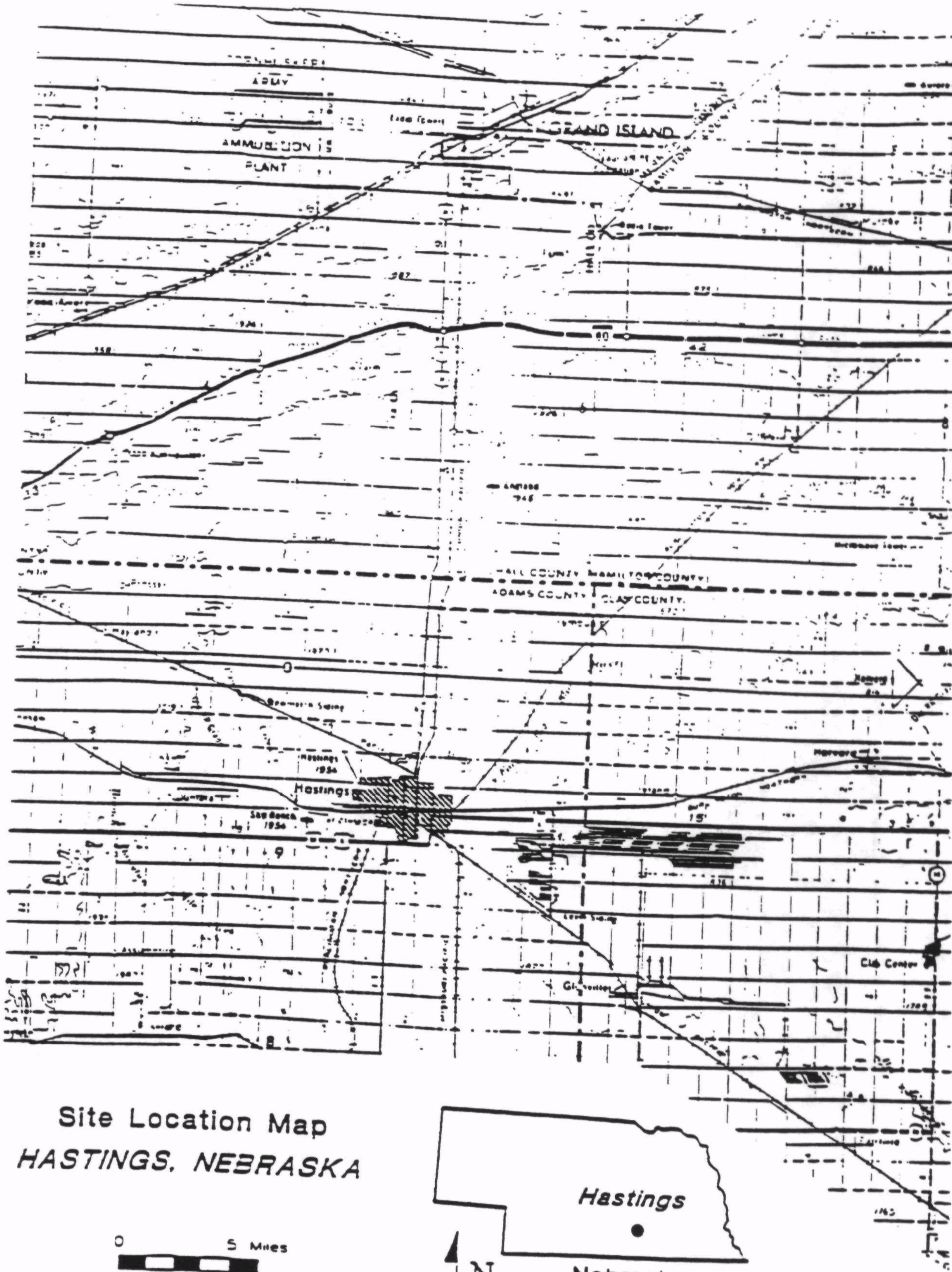
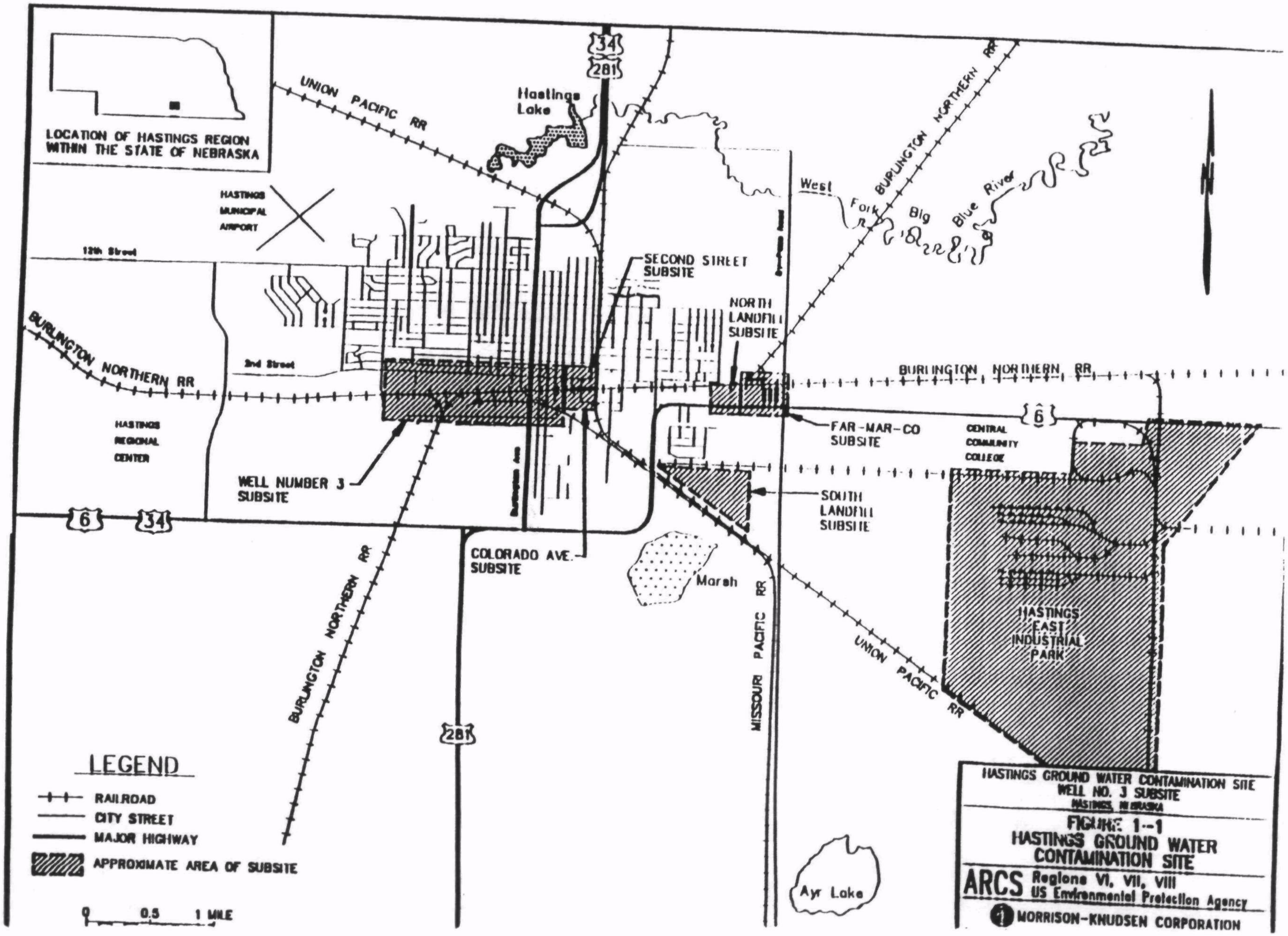


FIGURE 1

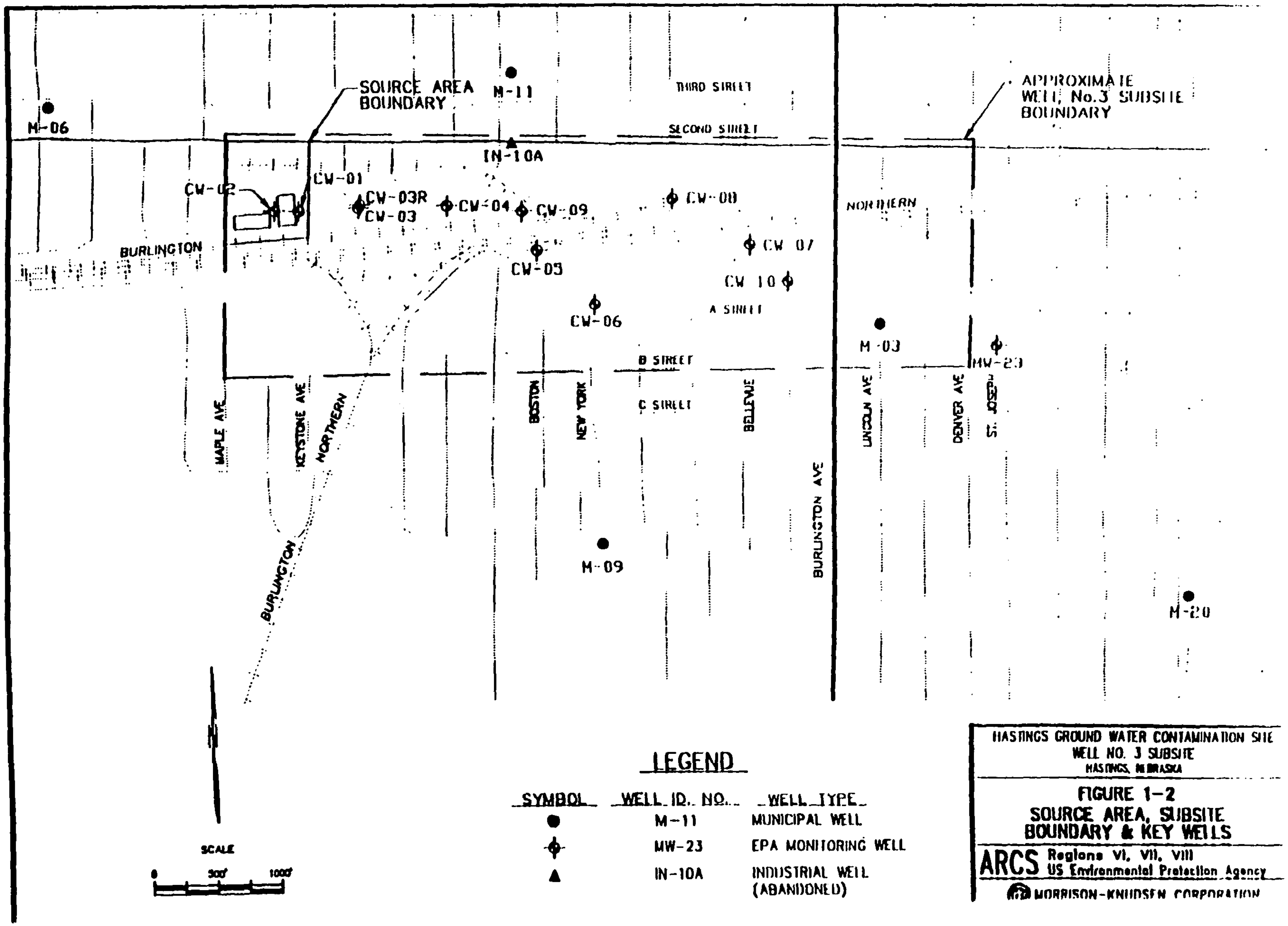
POOR QUALITY
ORIGINAL

FIGURE 2



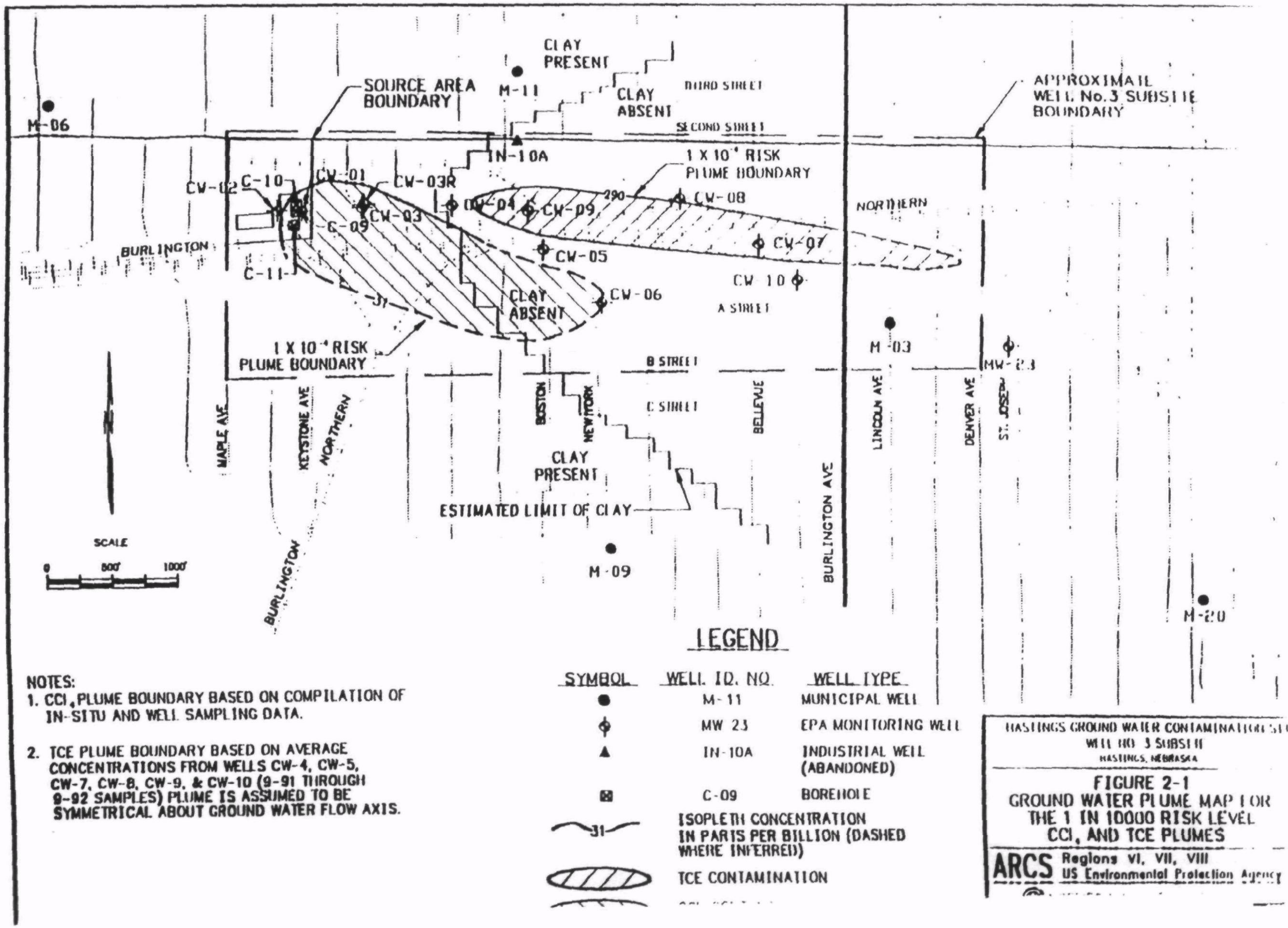
LOCATION OF HASTINGS REGION WITHIN THE STATE OF NEBRASKA
HASTINGS MUNICIPAL AIRPORT
12th Street
2nd Street
UNION PACIFIC RR
BURLINGTON NORTHERN RR
Hastings Lake
34
281
West Fork Big Blue River
SECOND STREET SUBSITE
NORTH LANDFILL SUBSITE
FAR-MAR-CO SUBSITE
CENTRAL COMMUNITY COLLEGE
6
SOUTH LANDFILL SUBSITE
HASTINGS REGIONAL CENTER
WELL NUMBER 3 SUBSITE
COLORADO AVE. SUBSITE
Marsh
MISSOURI PACIFIC RR
HASTINGS EAST INDUSTRIAL PARK
Ayr Lake
LEGEND
RAILROAD
CITY STREET
MAJOR HIGHWAY
APPROXIMATE AREA OF SUBSITE
0 0.5 1 MILE
HASTINGS GROUND WATER CONTAMINATION SITE
WELL NO. 3 SUBSITE
HASTINGS, NEBRASKA
FIGURE 1-1
HASTINGS GROUND WATER CONTAMINATION SITE
ARCS Regions VI, VII, VIII
US Environmental Protection Agency
MORRISON-KNUDSEN CORPORATION

FIGURE 3



POOR QUALITY ORIGINAL

FIGURE 4


CLAY PRESENT
M-11
CLAY ABSENT
THIRD STREET
SECOND STREET
SOURCE AREA BOUNDARY
M-06
IN-10A
1 X 10⁻⁴ RISK PLUME BOUNDARY
APPROXIMATE WELL No. 3 SUBSITE BOUNDARY
CW-02
C-10
CW-01
CW-03R
CW-04
CW-09
CW-08
C-09
CW-03
CW-07
CW-05
CW-10
CW-06
C-11
BURLINGTON
NORTHERN
CLAY ABSENT
A STREET
B STREET
C STREET
M-03
MW-23
1 X 10⁻⁴ RISK PLUME BOUNDARY
MAPLE AVE
KEYSTONE AVE
NORTHERN
BOSTON
NEW YORK
BELLEVUE
BURLINGTON AVE
LINCOLN AVE
DENVER AVE
ST. JOSEPH
CLAY PRESENT
ESTIMATED LIMIT OF CLAY
SCALE
0
500'
1000'
BURLINGTON
M-09
M-20
LEGEND
SYMBOL
WELL ID. NO.
WELL TYPE
M-11
MUNICIPAL WELL
MW 23
EPA MONITORING WELL
IN-10A
INDUSTRIAL WELL (ABANDONED)
C-09
BOREHOLE
31
ISOPLETH CONCENTRATION IN PARTS PER BILLION (DASHED WHERE INFERRED)
TCE CONTAMINATION
NOTES:
1. CCl₄ PLUME BOUNDARY BASED ON COMPILATION OF IN-SITU AND WELL SAMPLING DATA.
2. TCE PLUME BOUNDARY BASED ON AVERAGE CONCENTRATIONS FROM WELLS CW-4, CW-5, CW-7, CW-8, CW-9, & CW-10 (9-91 THROUGH 9-92 SAMPLES) PLUME IS ASSUMED TO BE SYMMETRICAL ABOUT GROUND WATER FLOW AXIS.
HASTINGS GROUND WATER CONTAMINATION SITE
WELL NO. 3 SUBSITE
HASTINGS, NEBRASKA
FIGURE 2-1
GROUND WATER PLUME MAP FOR THE 1 IN 10000 RISK LEVEL CCl₄ AND TCE PLUMES
ARCS Regions VI, VII, VIII
US Environmental Protection Agency

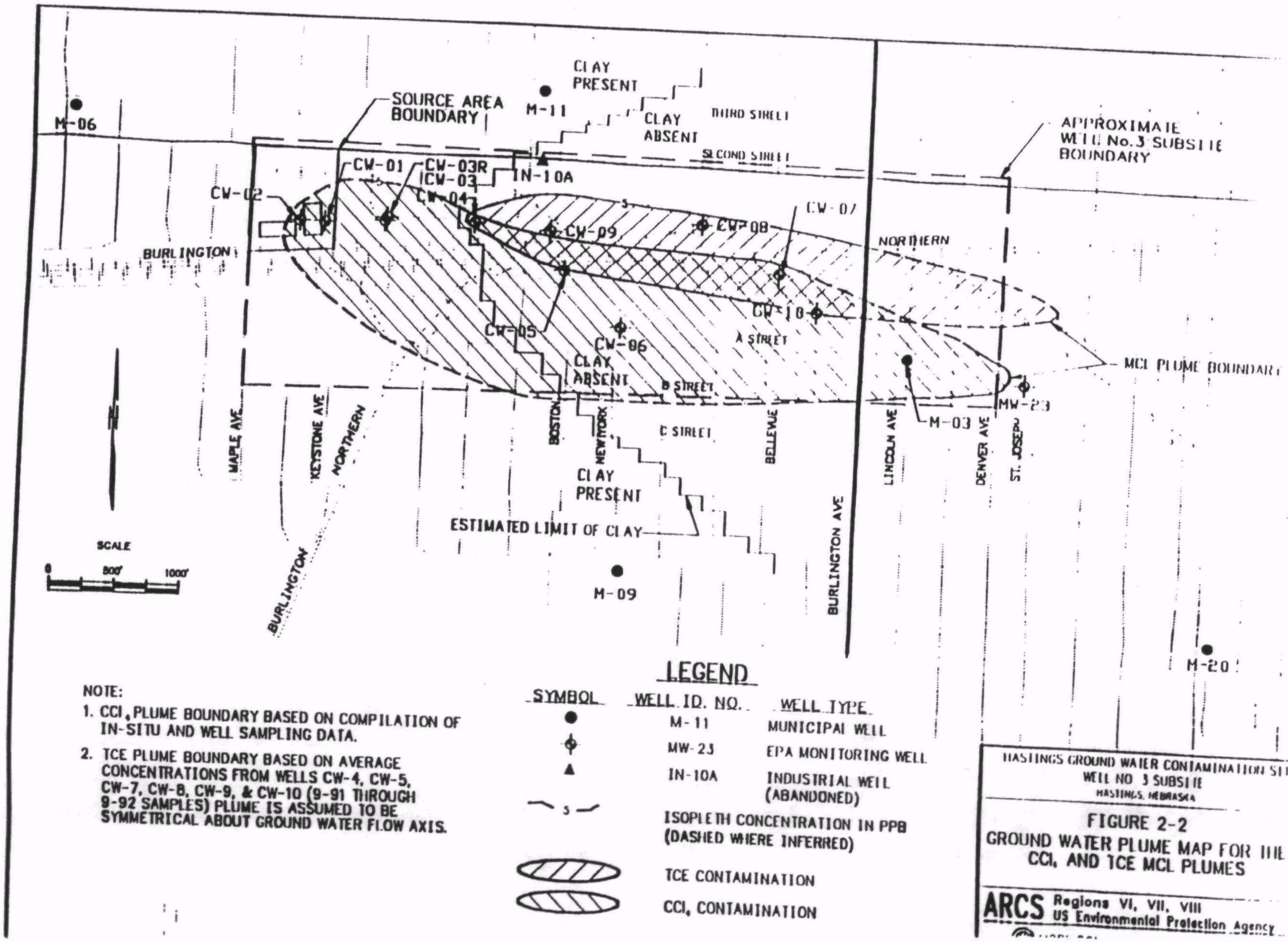

M-06
M-11
CLAY PRESENT
CLAY ABSENT
THIRD STREET
SECOND STREET
SOURCE AREA BOUNDARY
APPROXIMATE WELL No. 3 SUBSITE BOUNDARY
CW-01
CW-03R
ICW-03
IN-10A
CW-02
CW-04
CW-09
CW-08
CW-07
NORTHERN
BURLINGTON
CW-10
CW-05
CW-06
A STREET
CLAY ABSENT
B STREET
MCL PLUME BOUNDARY
MW-23
M-03
C STREET
MAPLE AVE
KEYSTONE AVE
NORTHERN
BOSTON
NEW YORK
BELLEVUE
LINCOLN AVE
DENVER AVE
ST. JOSEPH
CLAY PRESENT
ESTIMATED LIMIT OF CLAY
BURLINGTON AVE
BURLINGTON
SCALE
0
500'
1000'
M-09
M-20
NOTE:
1. CCl₄ PLUME BOUNDARY BASED ON COMPILATION OF IN-SITU AND WELL SAMPLING DATA.
2. TCE PLUME BOUNDARY BASED ON AVERAGE CONCENTRATIONS FROM WELLS CW-4, CW-5, CW-7, CW-8, CW-9, & CW-10 (9-91 THROUGH 9-92 SAMPLES) PLUME IS ASSUMED TO BE SYMMETRICAL ABOUT GROUND WATER FLOW AXIS.
LEGEND
SYMBOL
WELL ID. NO.
WELL TYPE
M-11
MUNICIPAL WELL
MW-23
EPA MONITORING WELL
IN-10A
INDUSTRIAL WELL (ABANDONED)
ISOPLETH CONCENTRATION IN PPB (DASHED WHERE INFERRED)
TCE CONTAMINATION
CCl₄ CONTAMINATION
HASTINGS GROUND WATER CONTAMINATION SITE
WELL NO. 3 SUBSITE
HASTINGS, NEBRASKA
FIGURE 2-2
GROUND WATER PLUME MAP FOR THE CCl₄ AND TCE MCL PLUMES
ARCS Regions VI, VII, VIII
US Environmental Protection Agency

FIGURE 5

INITIAL SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS FOR WELL NUMBER 3 GROUND WATER

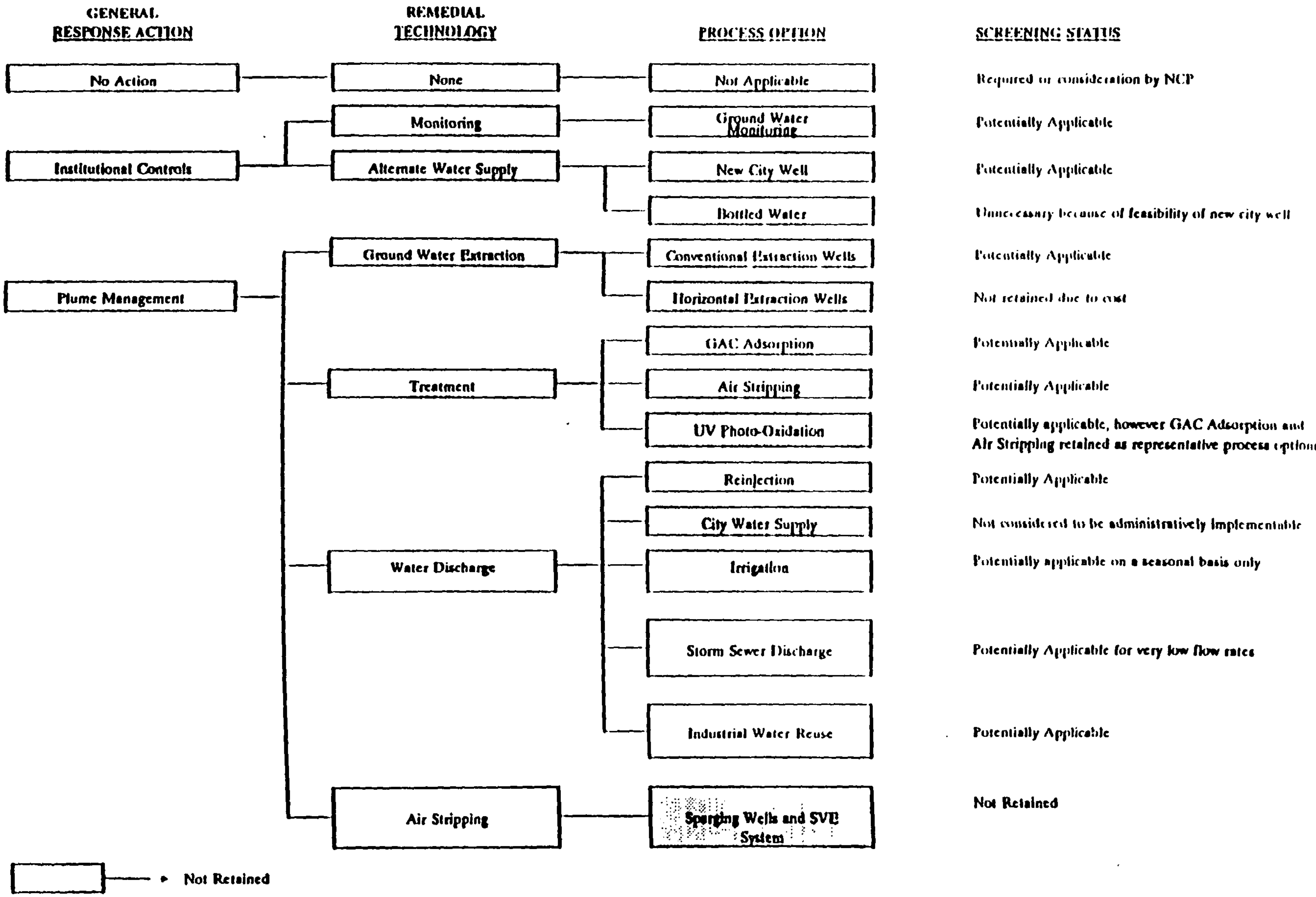


FIGURE 6

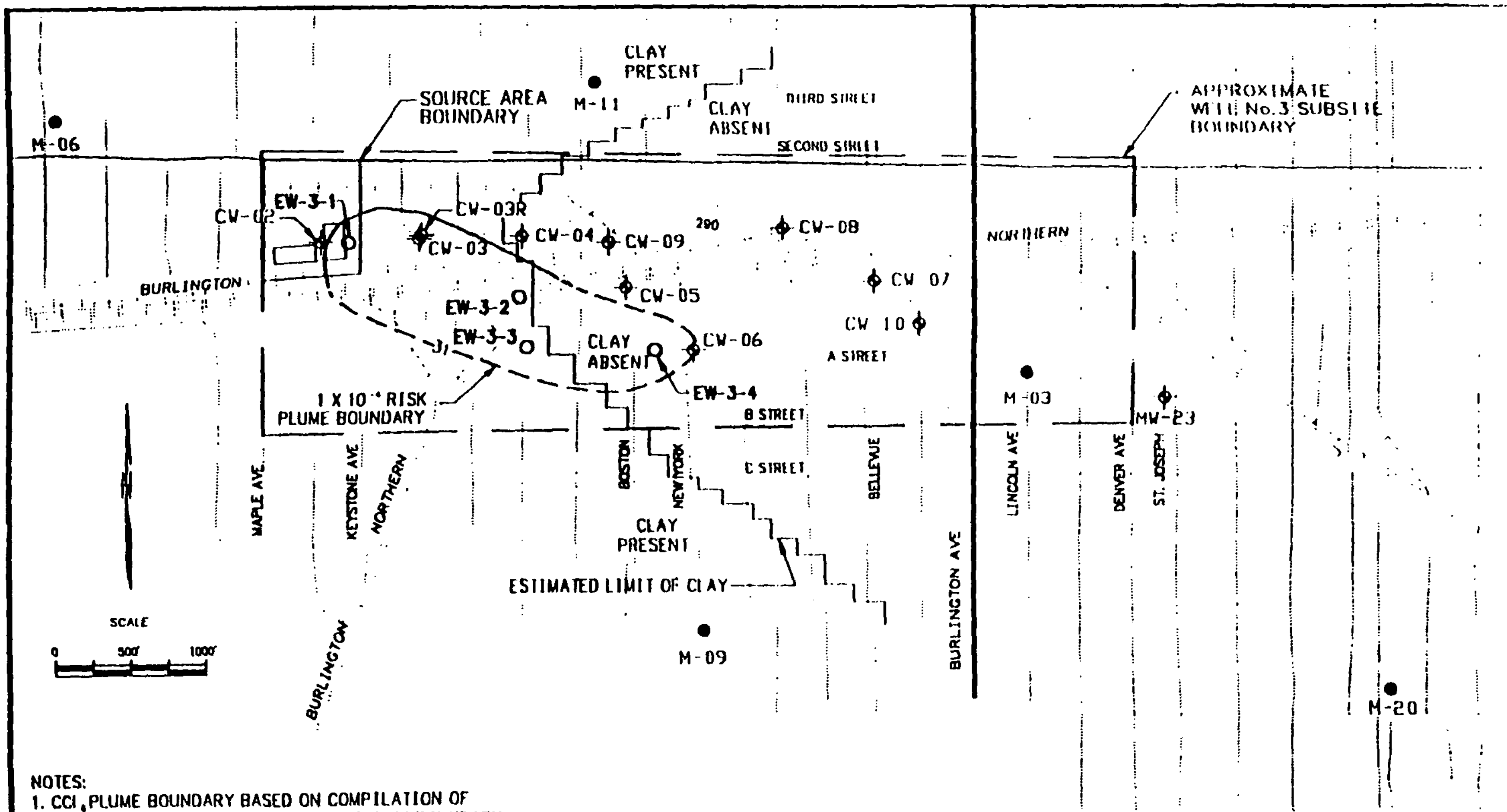
FIGURE 7

SUMMARY OF ASSEMBLED REMEDIAL ACTION ALTERNATIVES FOR WELL NUMBER 3 GROUND WATER

GENERAL RESPONSE ACTION		REMEDIAL ACTION ALTERNATIVES				
		1	2	3	4	5
TECHNOLOGY	PROCESS OPTION	NO ACTION	INSTITUTIONAL CONTROLS	EXTRACTION/ TREATMENT OF 10^{-4} CCl_4 PLUME	EXTRACTION/ TREATMENT OF 10^{-4} TCE PLUME	EXTRACTION/ TREATMENT OF MCL PLUME
MONITORING	GW MONITORING		●	●	●	●
ALTERNATE WATER SUPPLY	NEW CITY WELL		●			
GROUND WATER EXTRACTION	EXTRACTION WELLS			●	●	●
TREATMENT	GAC ADSORPTION			●(A)	●(A)	●(A)
	AIR STRIPPING			●(B)	●(B)	●(B)
TREATED WATER DISCHARGE	REINJECTION OR BENEFICIAL REUSE			●	●	●

NOTES:
1. "A" refers to plume management alternatives that utilize GAC adsorption for treatment. "B" refers to plume management alternatives that utilize air stripping for treatment
2. The alternatives are not mutually exclusive. Both Alternatives 3 and 4 are required to control the contaminants at the $1X10^{-4}$ risk level. Alternative 5 supplements Alternatives 3 and 4 by addressing long term objectives.

FIGURE 8



NOTES:

1. CCl_4 PLUME BOUNDARY BASED ON COMPILATION OF IN-SITU AND WELL SAMPLING DATA. PLUME BOUNDARY TO BE BETTER DELINEATED IN RD PHASE.

2. MONITORING WELL CW 01 WILL BE CONVERTED TO AN EXTRACTION WELL DURING RD PHASE. NUMBER AND PLACEMENT OF ADDITIONAL WELLS TO BE DETERMINED BASED ON DATA COLLECTED IN RD PHASE. WELL LOCATIONS SHOWN ARE CONCEPTUAL, BASED ON CURRENTLY AVAILABLE INFORMATION.

LEGEND

SYMBOL	WELL ID. NO.	WELL TYPE
O	EW-3-3	EXTRACTION WELL
●	M-11	MUNICIPAL WELL
⌖	MW-23	EPA MONITORING WELL
—31—	ISOPLETH CONCENTRATION IN PARTS PER BILLION (DASHED WHERE INFERRED)	

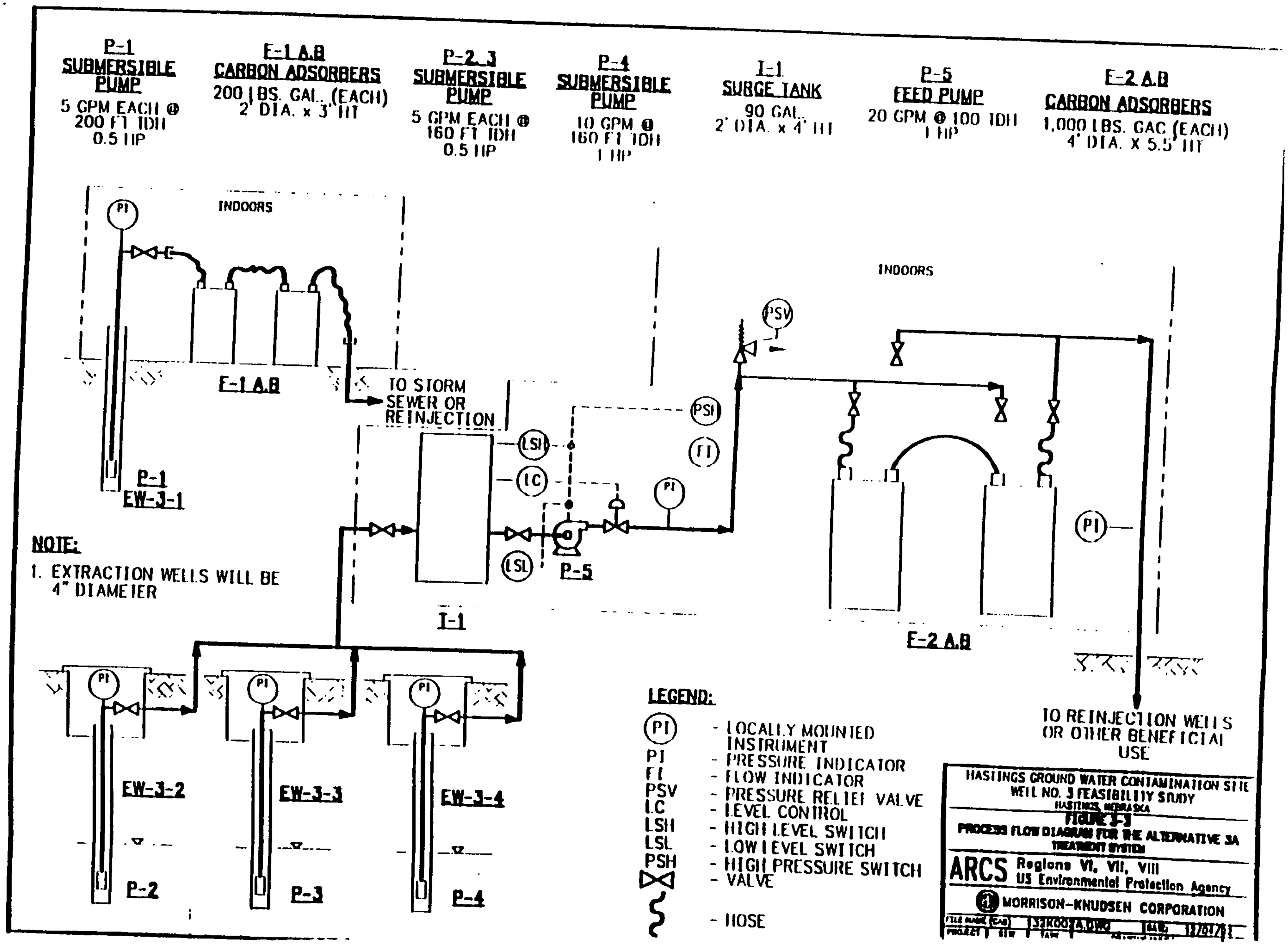
HASTINGS GROUND WATER CONTAMINATION SITE
WELL NO. 3 SUBSITE
HASTINGS, NEBRASKA

FIGURE 3-2
EXTRACTION WELL LOCATIONS FOR ALTERNATIVE 3

ARCS Regions VI, VII, VIII
US Environmental Protection Agency

MORRISON-KNUDSEN CORPORATION

FILE NAME (CAD) 132K302A.DWG DATE: 12/04/92
PROJECT | SITE | TASK | DRAWING NUMBER



P-1
SUBMERSIBLE PUMP
5 GPM EACH @ 200 FT TDH
0.5 HP
E-1 A,B
CARBON ADSORBERS
200 LBS. GAL. (EACH)
2' DIA. x 3' HT
P-2, 3
SUBMERSIBLE PUMP
5 GPM EACH @ 160 FT TDH
0.5 HP
P-4
SUBMERSIBLE PUMP
10 GPM @ 160 FT TDH
1 HP
T-1
SURGE TANK
90 GAL.
2' DIA. x 4' HT
P-5
FEED PUMP
20 GPM @ 100 TDH
1 HP
E-2 A,B
CARBON ADSORBERS
1,000 LBS. GAC (EACH)
4' DIA. X 5.5' HT
INDOORS
PI
E-1 A,B
TO STORM SEWER OR REINJECTION
P-1
EW-3-1
PSV
PSI
FI
LSH
LC
LSL
P-5
T-1
INDOORS
E-2 A,B
TO REINJECTION WELLS OR OTHER BENEFICIAL USE
NOTE:
1. EXTRACTION WELLS WILL BE 4" DIAMETER
EW-3-2
P-2
EW-3-3
P-3
EW-3-4
P-4
LEGEND:
(PI) - LOCALLY MOUNTED INSTRUMENT
PI - PRESSURE INDICATOR
FI - FLOW INDICATOR
PSV - PRESSURE RELIEF VALVE
LC - LEVEL CONTROL
LSH - HIGH LEVEL SWITCH
LSL - LOW LEVEL SWITCH
PSH - HIGH PRESSURE SWITCH
- VALVE
- HOSE
HASTINGS GROUND WATER CONTAMINATION SITE
WELL NO. 3 FEASIBILITY STUDY
HASTINGS, NEBRASKA
FIGURE 3-3
PROCESS FLOW DIAGRAM FOR THE ALTERNATIVE 3A TREATMENT SYSTEM
ARCS Regions VI, VII, VIII
US Environmental Protection Agency
MORRISON-KNUDSEN CORPORATION

FIGURE 9

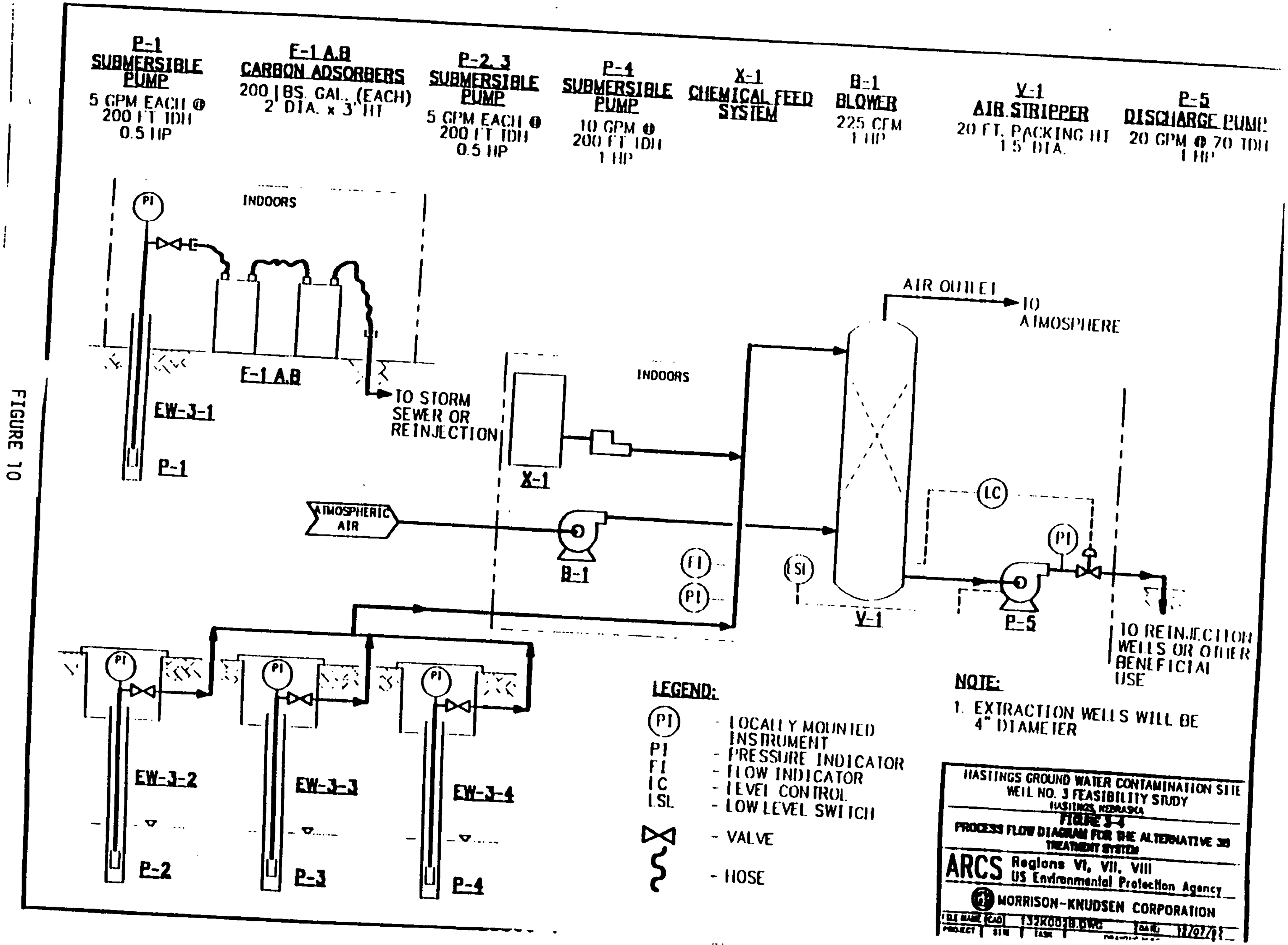
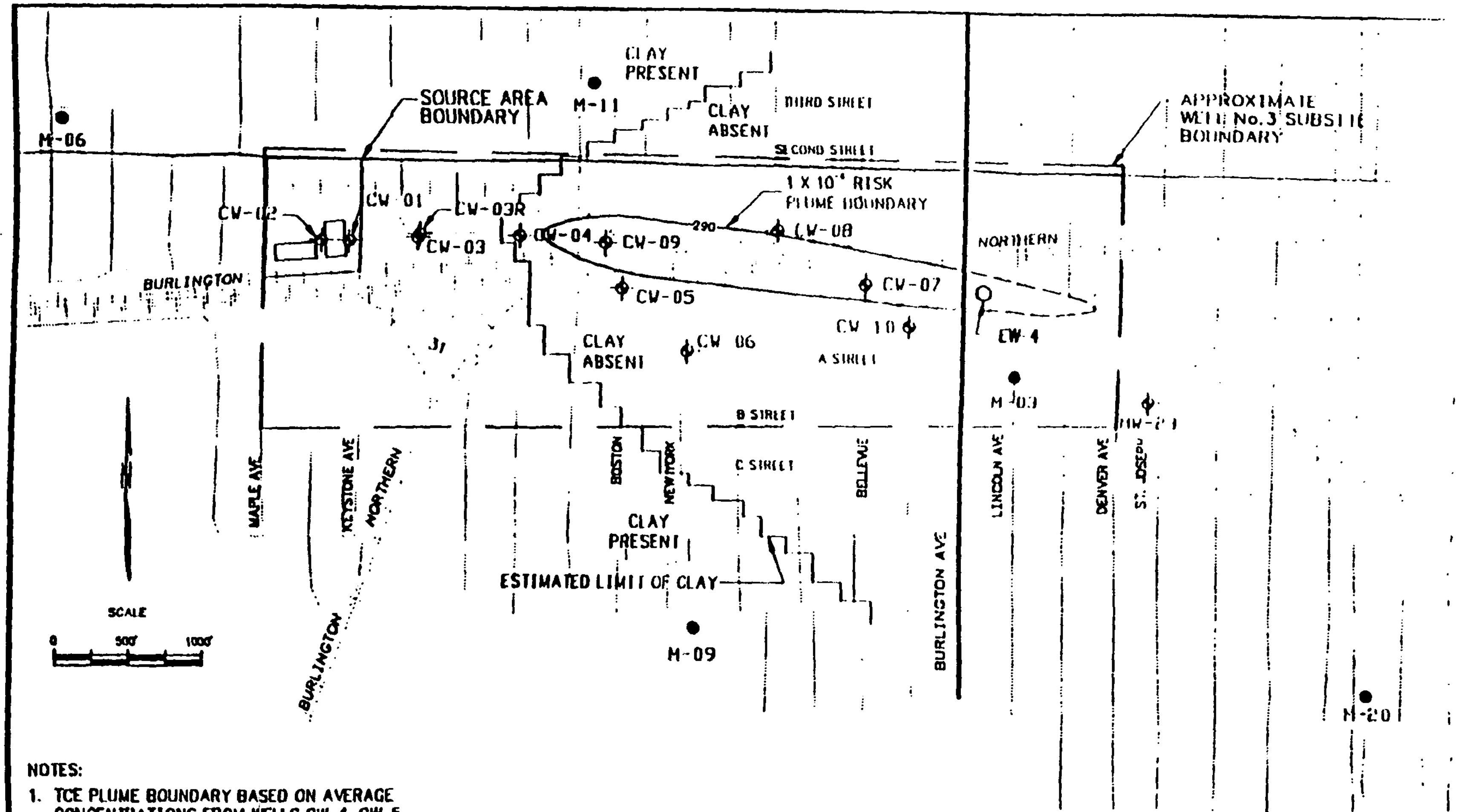

P-1
SUBMERSIBLE PUMP
5 GPM EACH @
200 FT TDH
0.5 HP
F-1 A,B
CARBON ADSORBERS
200 LBS. GAL. (EACH)
2' DIA. x 3' HT
P-2, 3
SUBMERSIBLE PUMP
5 GPM EACH @
200 FT TDH
0.5 HP
P-4
SUBMERSIBLE PUMP
10 GPM @
200 FT TDH
1 HP
X-1
CHEMICAL FEED SYSTEM
B-1
BLOWER
225 CFM
1 HP
V-1
AIR STRIPPER
20 FT. PACKING HT
1.5' DIA.
P-5
DISCHARGE PUMP
20 GPM @ 70 TDH
1 HP
INDOORS
PI
F-1 A,B
EW-3-1
P-1
TO STORM SEWER OR REINJECTION
INDOORS
X-1
ATMOSPHERIC AIR
B-1
FI
PI
LSL
AIR OUTLET
TO ATMOSPHERE
V-1
LC
PI
P-5
TO REINJECTION WELLS OR OTHER BENEFICIAL USE
EW-3-2
P-2
EW-3-3
P-3
EW-3-4
P-4
LEGEND:
(PI) - LOCALLY MOUNTED INSTRUMENT
PI - PRESSURE INDICATOR
FI - FLOW INDICATOR
LC - LEVEL CONTROL
LSL - LOW LEVEL SWITCH
- VALVE
- HOSE
NOTE:
1. EXTRACTION WELLS WILL BE 4" DIAMETER
HASTINGS GROUND WATER CONTAMINATION SITE
WELL NO. 3 FEASIBILITY STUDY
HASTINGS, NEBRASKA
FIGURE 3-4
PROCESS FLOW DIAGRAM FOR THE ALTERNATIVE 3B TREATMENT SYSTEM
ARCS Regions VI, VII, VIII
US Environmental Protection Agency
MORRISON-KNUDSEN CORPORATION

FIGURE 10

FIGURE 11



NOTES:

1. TCE PLUME BOUNDARY BASED ON AVERAGE CONCENTRATIONS FROM WELLS CW-4, CW-5, CW-7, CW-8, CW-9, & CW-10 (9-91 THROUGH 9-92 SAMPLES) PLUME IS ASSUMED TO BE SYMMETRICAL ABOUT GROUND WATER FLOW AXIS.
2. WELL LOCATION SHOWN IS CONCEPTUAL BASED ON CURRENTLY AVAILABLE DATA. ACTUAL LOCATION WILL BE DETERMINED DURING THE RD PHASE, BASED ON ADDITIONAL DATA AND ACCESS CONSIDERATION.

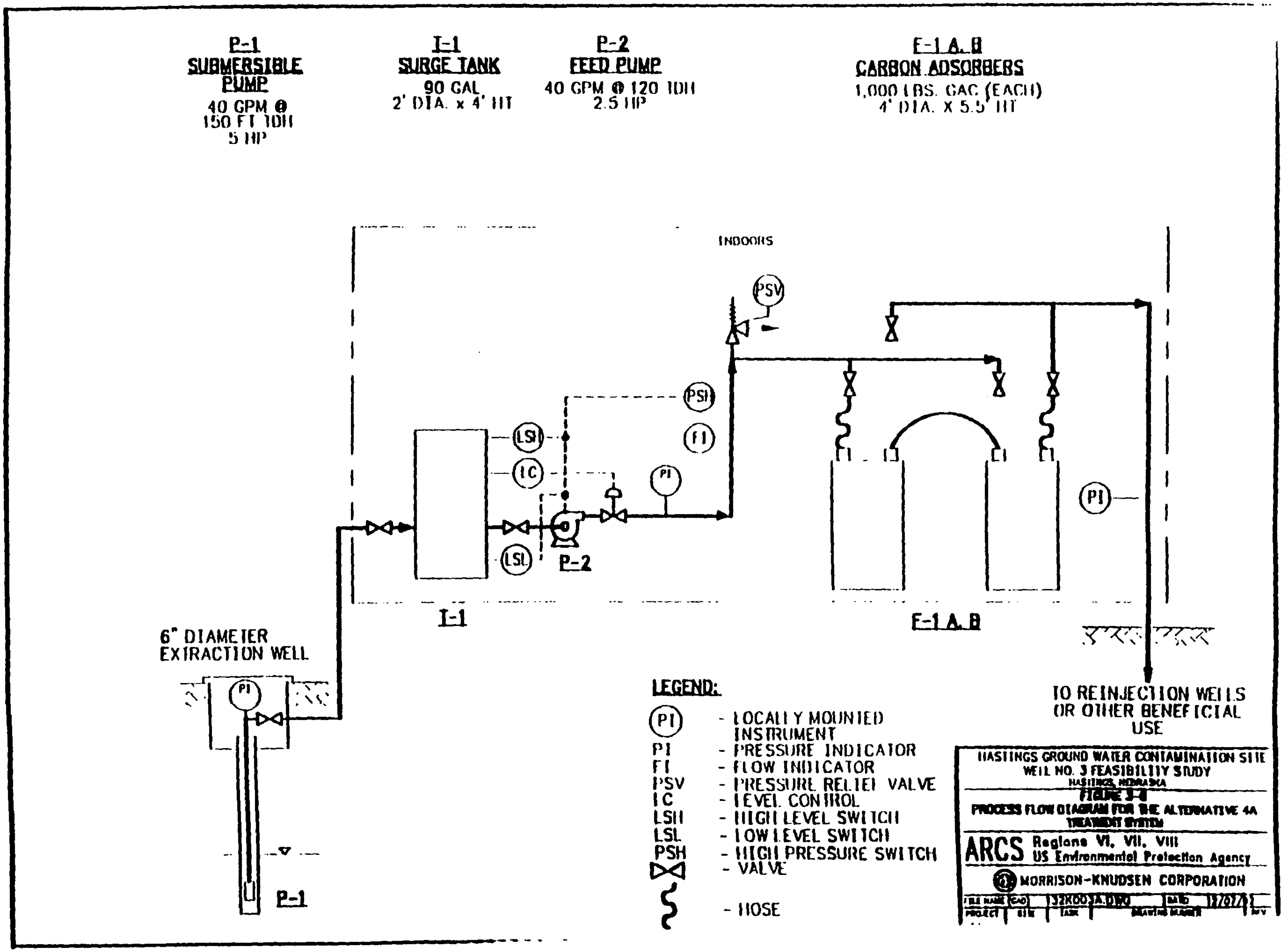
LEGEND

SYMBOL	WELL ID. NO.	WELL TYPE
O	EW-4	EXTRACTION WELL
●	M-11	MUNICIPAL WELL
⌖	MW-23	EPA MONITORING WELL
~290~	ISOPLETH CONCENTRATION IN PARTS PER BILLION (DASHED WHERE INFERRED)	

HASTINGS GROUND WATER CONTAMINATION SITE
WELL NO. 3 SUBSITE
HASTINGS, NEBRASKA

FIGURE 3-5
EXTRACTION WELL LOCATION FOR ALTERNATIVE 4

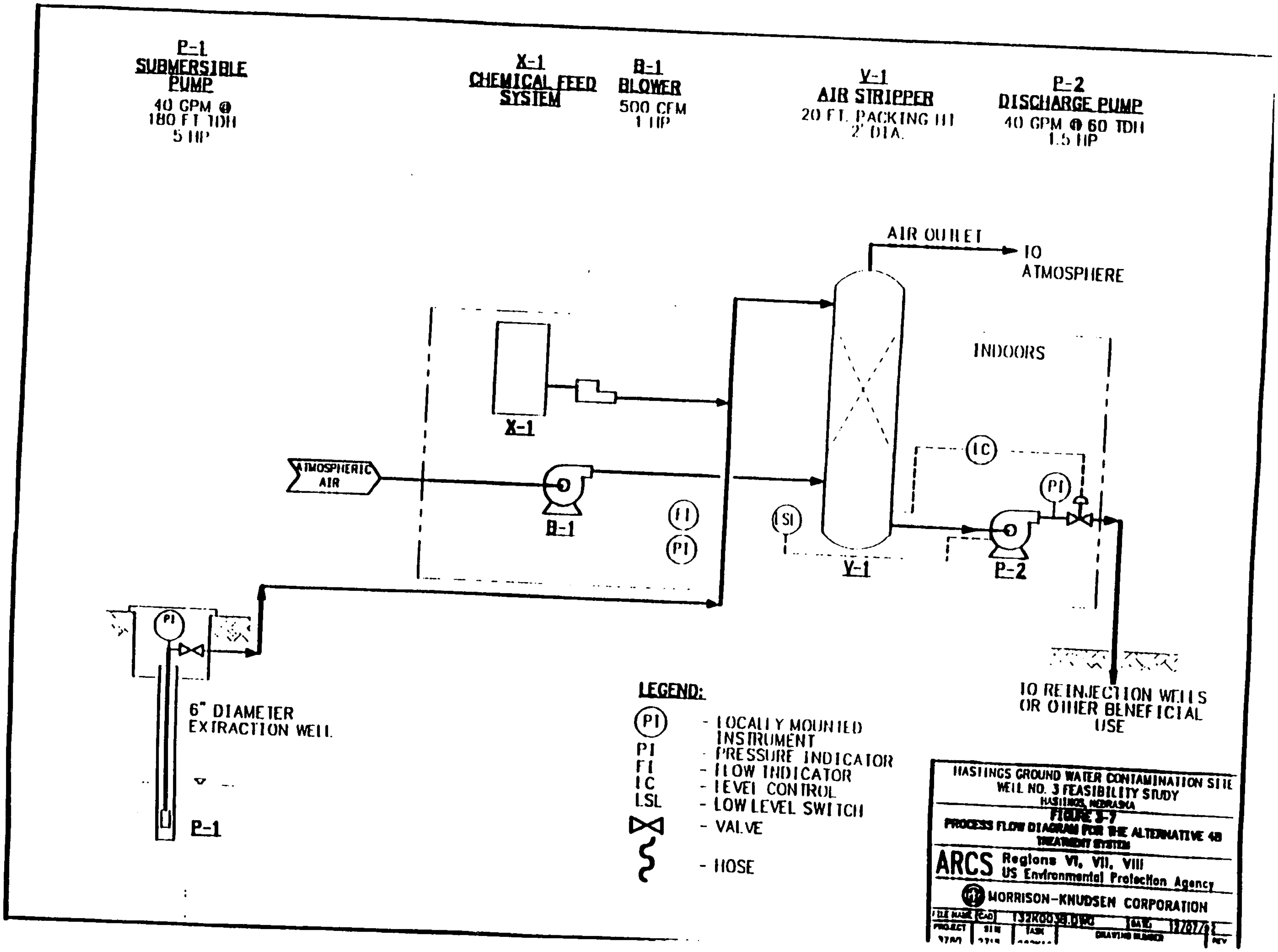
ARCS Regions VI, VII, VIII
US Environmental Protection Agency



P-1
SUBMERSIBLE PUMP
40 GPM @ 150 FT TDH
5 HP
T-1
SURGE TANK
90 GAL
2' DIA. x 4' HT
P-2
FEED PUMP
40 GPM @ 120 TDH
2.5 HP
E-1 A, B
CARBON ADSORBERS
1,000 LBS. GAC (EACH)
4' DIA. X 5.5' HT
INDOORS
PSV
PSH
FI
LSH
LC
LSL
PI
P-2
T-1
E-1 A, B
6" DIAMETER EXTRACTION WELL
P-1
TO REINJECTION WELLS OR OTHER BENEFICIAL USE
LEGEND:
PI - LOCALLY MOUNTED INSTRUMENT
PI - PRESSURE INDICATOR
FI - FLOW INDICATOR
PSV - PRESSURE RELIEF VALVE
LC - LEVEL CONTROL
LSH - HIGH LEVEL SWITCH
LSL - LOW LEVEL SWITCH
PSH - HIGH PRESSURE SWITCH
- VALVE
- HOSE
HASTINGS GROUND WATER CONTAMINATION SITE
WELL NO. 3 FEASIBILITY STUDY
HASTINGS, NEBRASKA
PROCESS FLOW DIAGRAM FOR THE ALTERNATIVE 4A TREATMENT SYSTEM
ARCS Regions VI, VII, VIII
US Environmental Protection Agency
MORRISON-KNUDSEN CORPORATION

FIGURE 12

FIGURE 13



P-1
SUBMERSIBLE PUMP
40 GPM @ 180 FT TDH
5 HP
X-1
CHEMICAL FEED SYSTEM
B-1
BLOWER
500 CFM
1 HP
V-1
AIR STRIPPER
20 FT. PACKING HT
2' DIA.
P-2
DISCHARGE PUMP
40 GPM @ 60 TDH
1.5 HP
AIR OUTLET
TO ATMOSPHERE
INDOORS
X-1
ATMOSPHERIC AIR
B-1
FI
PI
LSI
IC
PI
V-1
P-2
PI
6" DIAMETER EXTRACTION WELL
P-1
TO REINJECTION WELLS OR OTHER BENEFICIAL USE
LEGEND:
PI - LOCALLY MOUNTED INSTRUMENT
PI - PRESSURE INDICATOR
FI - FLOW INDICATOR
IC - LEVEL CONTROL
LSL - LOW LEVEL SWITCH
- VALVE
- HOSE
HASTINGS GROUND WATER CONTAMINATION SITE
WELL NO. 3 FEASIBILITY STUDY
HASTINGS, NEBRASKA
FIGURE 3-7
PROCESS FLOW DIAGRAM FOR THE ALTERNATIVE 4B TREATMENT SYSTEM
ARCS
Regions VI, VII, VIII
US Environmental Protection Agency
MORRISON-KNUDSEN CORPORATION
FILE NAME
CAD
T32R0038.DWG
DATE
PROJECT
SITE
TASK
DRAWING NUMBER
REV

GLOSSARY

Alternative -- an assemblage of representative Remedial Technologies: for example, containment, extraction, treatment, and disposal, as appropriate. Alternatives are ultimately further described to the level of assemblages of Process Options, each in turn belonging to a specific Remedial Technology.

Baseline Risk Assessment -- an evaluation which states the potential threat to human health and the environment in the absence of any remedial action.

Discount Rate -- the interest rate used to convert future money amounts to a common present worth to account for time value of money. The Superfund program recommends that a discount rate of 5 percent before taxes and after inflation be assumed.

General Response Action -- an action that will satisfy the remedial action objectives. A General Response Action may include no action, institutional controls, containment, excavation, extraction, treatment, disposal, or combinations of the above. A combination of General Response Actions may be considered in developing an alternative.

Operable Unit -- a discrete action that comprises an incremental step toward comprehensively addressing site problems. This discrete portion of a remedial response manages migration, or eliminates or mitigates a release, threat of a release, or pathway of exposure. The cleanup of a site can be divided into a number of operable units, depending on the complexity of the problems associated with the site. Operable units may address geographical portions of a site, specific site problems, or initial phases of an action, or may consist of any set of actions performed over time or any actions that are concurrent but located in different parts of a site.

Microgram per liter -- a measure of concentration of a constituent in ground water. A microgram per liter ($\mu g/l$) is used interchangeably with parts per billion (ppb). One microgram per liter of water is the equivalent of approximately one ounce of a constituent in 7.8 million gallons of water.

Pore Volume -- the amount of water contained in the aquifer pore space within the area and throughout the total depth of contamination.

Pore Volume Displacement -- the removal of one pore volume of water from the plume by replacement with water from outside of the plume limits.

Present Worth -- the amount of money that if invested at a given interest rate (the discount rate) at the time a project is initiated, would pay for the capital and annual operating and maintenance costs for the life of the project.

Process Option -- also known as "Technology Process Option," is a specific process that can be employed under a Remedial Technology. For example, the Remedial Technology of chemical treatment may have specific process options of ion exchange, solvent extraction, or others. A Process Option can belong to only one Remedial Technology.

Remedial Technology -- a type of technology that may be employed under a given General Response Action. For example, the response action of "Treatment" may have Remedial Technologies of physical, chemical, or thermal treatment. A Remedial Technology can be a part of more than one General Response Action.