# EVALUATION OF NORTH SOIL AREA REMEDIAL ALTERNATIVES

VacAir Alloys Division
Frewsburg, New York

MAY 1996
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CONESTOGA-ROVERS & ASSOCIATES

CRA

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May 31, 1996

Reference No. 2326

Mr. Gregory P. Sutton, P. E.
Environmental Engineer II
New York State Department of Environmental Conservation
270 Michigan Avenue
Buffalo, New York 14203-2999

Dear Mr. Sutton:

Re: Evaluation of North Soil Area
Remedial Alternatives Report
VacAir Alloys Division - Frewsburg, New York

Conestoga-Rovers & Associates (CRA) is pleased to submit, on behalf of Keywell Corporation, the results of the evaluation of the North Soil Area remedial alternatives. This report presents the results of the evaluation performed by CRA as discussed with DEC during the course of the study.

As agreed at the progress review meeting held on May 17, 1996 at your offices, Alternative NSSA-2 was selected as the preferred remedy for the Site. This alternative contains all common components, including SVE in the Center Soil Area, plus the immediate installation of a vibrated beam barrier wall in the vicinity of the North Soil Area. The remainder of the barrier wall considered in the Feasibility Study will remain as a contingency action.

We trust this evaluation is satisfactory. However, if you have any questions regarding this matter please contact the writer at your convenience.

Yours truly,

CONESTOGA-ROVERS & ASSOCIATES

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TABLE OF CONTENTS

# LIST OF FIGURES

## LIST OF TABLES



## LIST OF APPENDICES

## 1.0 INTRODUCTION

A Feasibility Study (FS) Report, dated March 28, 1995 and revised by letter dated August 29, 1995, was prepared for the Vac Air Alloys Division Plant Site (Site) in Frewsburg, New York. The FS Report stated that a Pre-Design Soil Sampling Program and a Soil Vapor Extraction/Air Sparging (SVE/AS) pilot study would be performed prior to selecting the component of the remedy dealing with the Center and North Soil Areas. (The locations of these soil areas are shown on Figure 1.1). The purpose of the Pre-Design Soil Sampling Program was to better define the limits of the two primary contaminant source areas identified during the Remedial Investigation (RI). The purpose of the SVE/AS pilot study was to evaluate the effectiveness of SVE and/or AS technologies in cost effectively remediating the impacted Site soils to the applicable Remedial Action Objectives (RAOs) and in reducing the overall remediation time for the Site.

The results of the pre-design studies were submitted to the New York State Department of Environmental Protection (DEC) on January 15, 1996. The Pre-Design Soil sampling program defined the limits of the soil requiring remediation. The SVE/AS pilot study confirmed that SVE was an effective technology for the remediation of the Center Soil Area. However, SVE was determined not to be effective in reducing soil and groundwater contamination in the North Soil Area to RAOs. The North Soil Area contains very high concentrations of contaminants in the soil and groundwater. The DEC's primary concern with respect to the North Soil Area is the potential for future releases of contaminants via the groundwater to Conewango Creek. As a result, DEC requested that Conestoga-Rovers & Associates (CRA) evaluate, on behalf of Keywell, other remedial alternatives for the North Soil Area.

The following report presents the results of this evaluation. Section 2.0 of the report identifies the remedial technologies considered for the remediation of the North Soil Area soils. Section 3.0 describes the estimated impact of soil treatment or contaminant mass removal on the groundwater chemistry and the groundwater treatment costs. Section 4.0 presents the detailed analysis of each alternative, while Section 5.0

compares the alternatives against the seven evaluation criteria used in the FS. Section 6.0 presents the preferred alternative.

## 2.0 POTENTIAL REMEDIAL TECHNOLOGIES

Soil remedial technologies were originally screened in the FS report (CRA, March 1995) using the soil volumes available at that time. The technologies retained in the FS following the initial screening were:

- In Situ Treatment - SVE;
- Physical Containment - Capping;
- Ex Situ On-Site Treatment - Landfarming,
  - SVE, and
  - Low temperature thermal desorption (LTTD); and
- Ex Situ Off-Site Treatment - Excavation and landfilling.

The results of the pre-design investigations indicated that the volume of contaminated soil in the Center and North Soil Areas is approximately 13,400 cubic yards, as opposed to the 36,100 cubic yards used in evaluating remedial alternatives in the FS.

In addition, since the writing of the FS, New York implemented regulations allowing the construction of a Corrective Action Management Unit, (CAMU) on Site. The CAMU rule allows the owner of a facility to designate an area of the facility (subject to regulatory approval), as a CAMU. Once designated, remediation of wastes in the CAMU are not subject to Land Disposal Restrictions (LDRs), and the minimum technology requirements (MTRs). For the Vac Air Site, the CAMU rule would allow remediation waste (e.g., treated soil), to be placed in the CAMU area (e.g., the excavation from which the contaminated soil was removed), without triggering LDRs and MTRs. With the CAMU rule in place, the evaluation of on-Site ex situ treatment options, such as LTTD or soil vapor extraction is more feasible.

Under the CAMU rule, it is also possible to create a "temporary unit" or TU, for temporary storage of remediation wastes. The advantage is that the tanks or containers used for storage are subject to less stringent design, operating as closure standards that would otherwise be

required for this type of structure. This would have applicability to the recovery and temporary storage of recovered DNAPL, and spent carbon resulting from groundwater or soil vapor treatment.

The following technologies were screened using the new data, and the ability where appropriate, to establish as CAMU. The scope of the technology screening was previously presented to DEC in a CRA letter dated March 5, 1996, and was revised at a meeting held on April 17, 1996.

Dense Non-Aqueous Phase Liquids (DNAPL) Recovery Wells

The discovery of free phase DNAPLs in the North Soil Area during the SVE/AS pilot study confirmed their presence at the Site. Previously, the presence of DNAPLs was suspected based on the concentrations of contaminants in the soil and groundwater. The use of DNAPL recovery wells is commonly conducted at DNAPL sites. One well in the North Soil Area, is currently being used for DNAPL recovery. Therefore, this technology was evaluated for the North Soil Area. Since DNAPL has not been found in the Center Soil Area, DNAPL recovery would not be applicable to that area.

Limited SVE

The SVE/AS pilot study confirmed that SVE was not effective in reducing the concentration of contaminants in the soil to RAOs. However, a significant amount of contaminant mass was removed during the pilot study. The use of SVE in the most contaminated portions of the North Soil Area for the purpose of mass removal was evaluated. The same SVE equipment (i.e., blowers and headers) would be used in both the North, and Center Soil Areas where possible, with initial priority given to the North Soil Area.

Physical Containment/Isolation

This technology involves the immediate placement of a portion of the contingent barrier wall around the east and north sides of the

North Soil Area, to isolate the contaminants from the surrounding environment. The barrier wall would prevent downgradient migration of the highly contaminated groundwater from the North Soil Area, to Conewango Creek. Additions to this portion of the barrier wall would remain a contingency measure. The need for implementation of the contingent component, will be based on the effectiveness of the groundwater extraction system.

Excavation and On-Site Treatment

The excavation of the entire North Soil Area was evaluated in conjunction with on-Site treatment. The treatment alternatives considered were ex situ SVE and LTTD. The treated soil would be placed in the excavation. This evaluation was only undertaken because of the development of the CAMU rule. Prior to development of this rule, the use of on-Site treatment was eliminated from consideration, due to the need to dispose of the treated soil off Site. The made costs of this alternative is excessive.

Selected Excavation of DNAPL Contaminated Soil

This technology involves the limited excavation of the North Soil Area soils containing free phase DNAPLs. The location of free phase DNAPL has not been determined, and therefore, the volume of these soils cannot been defined. It is believed, that selective excavation is not a practical alternative, for the potential costs cannot be defined.

## 3.0 IMPACT ON THE GROUNDWATER REMEDY

### 3.1 OVERVIEW

The evaluation of these soil technologies for the North Soil Area also included an estimation of the impact of soil treatment or contaminant mass removal on the duration, and cost, of the groundwater remedy. The treatment of the North Soil Area soil or the removal of contaminant mass is expected to impact the quality of groundwater entering the groundwater treatment system (influent). Any treatment or contaminant mass removal may ultimately reduce the influent chemistry, and, therefore, the cost of groundwater treatment. However, the precise benefit of any soil treatment or contaminant mass removal in the North Soil Area is difficult to assess given the uncertainty of the impact of this work on the groundwater chemistry.

The following sections of this report describe the methods used to estimate the influent chemistry to the groundwater treatment system, with and without treatment/contaminant mass removal in the North Soil Area. Based on these projected influent chemistries, the costs of groundwater treatment were estimated and potential savings calculated.

### 3.2 ESTIMATED INFLUENT CHEMISTRY

For cost estimation purposes, the potential influent chemistry was originally estimated in the FS using an arithmetic average of groundwater analytical data from the RI. The estimated influent chemistry was originally presented on Table 3.2 of the FS, and is summarized on Table 2.1 of this report. However, groundwater samples collected during the SVE/AS pilot study from the North Soil Area contained contaminants at a much higher concentration than previously detected. Therefore, revising the evaluation of the potential influent chemistry was warranted.

The groundwater analytical data confirm that the primary contaminants of concern are trichloroethene (TCE), 1,2-dichloroethene

(1,2-DCE), and vinyl chloride. The distribution of these compounds in the groundwater was determined using groundwater data from the SI, RI, and the SVE/AS Pilot Study. The resulting concentration contours are illustrated in Figures 2.1, 2.2, and 2.3, respectively. Examination of these figures shows that the highest concentrations of 1,2-DCE, and vinyl chloride are found in the North Soil Area. It is also evident that the TCE plume is the largest plume, and that this plume will control the duration of the groundwater remedy. As a result, soil treatment in the North Soil Area, no matter how effective, is not likely to reduce the scope or duration of the groundwater remedy.

The locations of the proposed well points for the groundwater extraction system also are shown on Figures 2.1, 2.2, and 2.3. (These locations are based on the evaluation presented in the FS. The actual locations may change during the detailed design). For the soil remedial technologies that do not include treatment or mass removal of the North Soil Area, the influent concentrations were estimated in the following manner.

- Contaminant concentrations were assigned to each well point based on the concentration at the nearest contaminant contour;

- An average well point concentration was calculated for each contaminant using 12 of the 14 well points. (Two well points [1 and 12] were excluded based on their location outside the plume); and,

- An average well point concentration was also calculated for the five well points nearest the North Area Soil (well points 6, 7, 8, 9, and 10).

To account for treatment/excavation of North Soil Area, the contaminant concentrations assigned to the five well points nearest to the North Soil Area were decreased to concentrations used for well points beyond the area of excavation/treatment. Based on these revised values, the average well point concentration was recalculated for the 12-well point system and the five well points nearest the North Soil Area.

The revised estimated influent concentrations are presented on Table 2.1, along with the influent concentrations used to evaluate groundwater treatment costs in the FS.

## 3.3 COST IMPLICATIONS

The revised influent profiles presented on Table 2.1 were given to Calgon to provide estimated treatment costs. It is noted that Calgon now owns both SolarChem and Peroxidation, the suppliers of UV oxidation systems, so that the cost estimates for the Vac Air groundwater would be reasonable. The estimated treatment costs provided by Calgon are summarized below:

| | |
|---|---|
| Estimated GWTS Costs if North Area Soil Not Treated: | $7.60/1,000 gals |
| Estimated GWTS Costs if North Area Soil Treated: | $6.10/1,000 gals. |

For the alternatives where soil excavation or in situ treatment is not undertaken (i.e., DNAPL recovery and barrier wall installation), the higher unit treatment cost where applied.

The lower treatment costs assumed to apply to the remedial technologies where treatment is performed in the North Soil Area (i.e., excavation and ex situ SVE, excavation and LTTD, and in situ SVE). This assumption is most valid for the excavation and ex situ treatment options for full treatment to SCGs occurs in less than one year. However, in the case of in situ SVE, full treatment of the North Soil Area does not occur, even after eight years of operation. Nevertheless, CRA applied the reduced treatment cost over an assumed pumping period of 30 years. This assumption may overestimate the benefit of in situ SVE on the groundwater remedy.

The total capital and operation and maintenance (O&M) cost for the groundwater treatment component of the remedy were calculated assuming a total flow rate of 20 gallons per minute (gpm), and pumping duration of 30 years. The detailed cost breakdowns are presented on

Tables A-1 and A-2 of Appendix A for the no treatment and treatment technologies, respectively. Examination of these tables shows that the total groundwater treatment costs are approximately $2.3 million without North Soil Area treatment, and $1.9 million with North Soil Area treatment.

# 4.0 DETAILED ANALYSES OF ALTERNATIVES

## 4.1 GENERAL

The following section of this report presents the detailed evaluation of the remedial technologies considered for the North Soil Area in conjunction with the other common remedial action components. Alternative 4A from the FS, (the selected remedy for the Site), was used a basis for this evaluation. Five alternatives were developed for this evaluation, the first (4A-R), representing a revision of Alternative 4A, and the remaining four representing new North Soil Area Alternatives. The only variations were the remedial technologies used for the North Soil Area.

The five remedial alternatives were analyzed against the seven of the USEPA's detailed evaluation criteria presented in "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA" (EPA/540/G-89/004, OSWER Directive 9355.3-01, October 1988). The criteria used were:

i) overall protection of human health and the environment;
ii) compliance with ARARs/SCGs;
iii) long-term effectiveness and permanence;
iv) reduction in toxicity, mobility and volume;
v) short-term effectiveness;
vi) implementability; and.
vii) cost.

## 4.2 REMEDIAL ACTION GOALS AND OBJECTIVES

### 4.2.1 Remedial Action Goals

The remedial action goals for the remedial action at the Site have been defined in Section 4 of the Record of Decision (ROD). The primary goal of the remedial action is to eliminate or mitigate all significant threats to public health and to the environment presented by the hazardous

waste disposed at the Site through the proper application of scientific and engineering principles. The remedial action also has the general goal of attaining cleanup criteria for the groundwater, surface water, subsurface soil, surface soil sediment to the maximum extent practicable.

The following remedial action goals for the various contaminated media are summarized below:

Groundwater:

- To restore groundwater in the Frewsburg Aquifer to levels acceptable for future use (i.e. drinking water supply);
- To prevent the existing or future exposure of human receptors to contaminated groundwater;
- to prevent via groundwater, releases to surface water bodies; and,
- To prevent or mitigate contaminant migration from the Water table Aquifer to the Frewsburg Aquifer.

Soil:

- To prevent or mitigate the migration of contaminants in the soil that will cause groundwater and surface water contamination above standards; and
- Eliminate, to the maximum extent practicable, the potential for direct human or animal contact with contaminated soil.

Surface Water/Sediment:

- To prevent direct contact/ingestion of contaminated surface water and sediments;
- To prevent off-Site migration of contaminated surface water and sediment;
- To prevent the release of contaminants from sediments that will result in excellence of surface water standards;
- To prevent adverse impacts to human or fish and wildlife from contact and/or ingestion.

Air:

- To prevent or mitigate the release and inhalation of airborne contaminants above acceptable standards.

Keywell does not agree with the remedial action goal with respect to the restoration of the Frewsburg Aquifer.

### 4.2 2 Remedial Action Objectives

Remedial action objectives (RAOs) for each component of the remedial action for the Site have also been developed. These technology-specific RAOs will be used to determine the effectiveness of the remedial action. A summary of the technology-specific RAOs for the actions to be undertaken at the Site is provided below.

DNAPL Pumping

The primary objective of the DNAPL pumping system is to recover, to the extent practicable, any free flowing DNAPL present in the North Soil Area.

Groundwater Extraction and Treatment System

The objectives of the groundwater extraction and treatment system are:

- To create an inward hydraulic gradient between Conewango Creek and the Site, to the extent possible, given the changes in stage in Conewango Creek;
- To prevent migration of contaminated groundwater in the Water Table Aquifer to surface water bodies and the Frewsburg Aquifer; and
- To treat and/or destroy the contaminants in the extracted groundwater.

Barrier Wall

The objective of the barrier wall is to prevent the migration of highly contaminated groundwater from the North Soil Area to Conewango Creek.

Center Soil Area SVE System

The RAOs of the Center Soil Area SVE system are:

- To reduce the concentrations of contaminants in the soil and groundwater to SCGs to the maximum extent practicable; and,
- To prevent or mitigate the release of airborne contaminants above acceptable standards.

## 4.3 COMMON REMEDIAL ACTION COMPONENTS

For the five alternatives evaluated, there are ten components of the remedial action that are common to all alternatives. These common components are as follows:

- institutional controls;
- paving of the unpaved areas north of the plant;
- runoff isolation;
- surface water discharge system;
- sediment excavation and off-Site disposal;
- groundwater monitoring;
- well point groundwater extraction system;
- ultra-violet oxidation groundwater treatment system;
- contingency barrier wall; and
- Center Soil Area in situ SVE system.

The full details of these remedial components are described in the FS Report and Pre -Design Investigation Results Report (CRA, January 1995) and are not presented here. It is also noted that

depending on the remedial technology used in the North Soil Area, all the common components are not identical. In the case of the groundwater treatment system, the capital and O&M cost will vary with the influent chemistry. Therefore, where soil treatment will occur in the North Soil Area, the influent chemistry is reduced as presented on Table 2.1. In addition, for the alternatives using physical barriers to isolate the North Soil Area, the contingency barrier wall was reduced accordingly.

## 4.4 ALTERNATIVE 4A-R

### 4.4.1 Description

Alternative 4A-R is a revision of Alternative 4A based on the results of the Pre-Design investigations. The Pre-Design studies refined the delineation of the North and Center Soil Areas and the design parameters for SVE systems to attempt to treat the soil to RAOs. It includes the common components previously described. The major components of the alternative are shown on Figure 4.1.

A DNAPL recovery system for North Area soils is now included. The system includes four DNAPL recovery wells equipped with total fluid pumps. The DNAPL/water mixture would be separated and stored in dedicated containers. Collected DNAPL would be disposed at an off-Site licensed facility as needed. The costs assume operation for 1 year after which time implementation of the groundwater extraction system and/or soil remedial components such as SVE or excavation would reduce the need for dedicated DNAPL recovery or allow for continued operations as part of the groundwater treatment system.

The in situ SVE would be performed as a soil source area remediation. SVE costs were adjusted based on the pilot study results (reference Appendix H of the Pre-Design Investigation Summary) and have been defined separately for the Center Soil Area and the North Soil Area. The SVE system is expected to be constructed with 35 extraction wells in the North Area and nine extraction wells in the Center Area. In addition, 14 air

injection wells would be installed in the North Soil Area and six air injection wells would be installed in the South Soil Area. Extracted soil gases from the North Soil Area would be treated with a catalytic-oxidizer equipped with a scrubber to remove acid gas produced during the combustion of the chlorinated VOCs. Alternatively, extracted soil gases at lower concentrations from the Center Soil Area would be treated through vapor phase carbon units. The planned duration for the North Soil Area is 8 years compared to 5 years for the Center Soil Area, due to the higher levels of contamination (including DNAPL) in the former. Separate equipment would be used for each system so they could be implemented concurrently.

A subsurface barrier wall to prevent downgradient plume migration is included as a contingency. This wall would serve as a back up to the hydraulic containment provided by groundwater extraction system.

### 4.4.2 Assessment

Overall Protection of Human Health and the Environment

Alternative 4A-R is protective of human health through the placement of institutional controls preventing the use of groundwater on the Site. This alternative is protective of the environment by collecting and treating contaminated groundwater in the Water Table Aquifer thereby preventing off-Site migration.

Compliance with SCGs

The SVE/air sparring pilot test conducted in the North Soil Area concluded this technology would have limited effectiveness in achieving soil SCGs. Factors influencing the decision were as follows:

- the discovery of DNAPL;
- the tight soil conditions resulting in only a 15-foot SVE radius of influence; and
- the lack of detectable influence during the air sparging test.

The presence of DNAPL and the very high concentrations of contaminates in the groundwater make it unlikely that groundwater SCGs will be obtained at the Site. Surface water and air SCGs can be met with this remedy.

Alternative 4A-R would comply will all action-specific and location specific SCGs.

Long-Term Effectiveness and Permanence

The groundwater extraction system will provide long-term hydraulic containment of the Water table Aquifer. During low base flow in Conewango Creek, there may be some loss of containment. However, the magnitude is expected to be small and the impact on surface water minimal. A groundwater quality and hydraulic monitoring program will be implemented to determine the effectiveness of the groundwater extraction system.

The on-Site groundwater treatment system will destroy or remove contaminants from the groundwater. The only treatment residuals are spent carbon and inorganic sludges. Both types of residuals will be shipped off Site to a permitted facility for regeneration and disposal, respectively.

This alternative will remove contaminants from the soil throughout the Center Soil Area and North Soil Area SVE system and through DNAPL recovery. The contaminants will be destroyed. However, the residual groundwater contamination could result in passive recontamination of the treated soil.

Reduction in Toxicity, Mobility and Volume

Alternative 4A-R would result in the active reduction of toxicity, mobility, and volume of contaminants associated with the groundwater in the Water Table Aquifer. The mobility of the contaminants

in the groundwater will be reduced by the operation of the groundwater extraction system. The toxicity of plume will be reduced through continuous collection and treatment of the contaminated groundwater.

The SVE systems in the Center and North Soil Areas will reduce the toxicity, mobility, and volume of contaminants in the soil. This will also result in reduction in the mobility of these contaminants to the groundwater.

Short-Term Effectiveness

Extraction and treatment of contaminated groundwater and soil vapors could be commenced within one year of approval of the remedial design (RD). The groundwater extraction system would achieve hydraulic containment within a short period of time. There would be minimal risks to the community and workers during the implementation of this remedy.

Implementability

The groundwater extraction and treatment system and the SVE systems are readily implementable.

Cost

The total estimated cost to implement this alternative is approximately $5.7 million, including the contingency barrier wall. The details of this estimated cost are presented in Table 4.1. The groundwater treatment system component costs (capital and O&M) for this alternative have been revised from those presented in the FS in accordance with the expected groundwater influent chemistry. As the North Soil Area soils will be somewhat treated, the groundwater treatment system costs are based on the low range of aqueous phase VOCs (Table A-2, Appendix A). The estimated capital cost for this alternative is approximately $2.2 million with a total operation and maintenance cost of approximately $3.5 million. The total

cost of the component of the remedy dealing exclusively with the North Soil Area is approximately $1 million.

## 4.5 NORTH SOIL AREA ALTERNATIVE 1

### 4.5.1 Description

North Soil Area Alternative 1 (NSAA-1) includes all the components described in Alternative 4A-R except for SVE in the North Area, which is eliminated. The barrier wall to prevent groundwater contaminant migration remains as a contingency. The major components of the alternative are depicted on Figure 4.2.

### 4.5.2 Assessment

Overall protection of Human Health and the Environment

This alternative is protective of human health and the environment in a similar manner to Alternative 4A-R.

Compliance with SCGs

Alternative NSAA-1 would equally comply with SCGs as Alternative 4A-R.

Long-Term Effectiveness and Permanence

This alternative offers an effective and permanent remedy for the groundwater in a similar manner as Alternative 4A-4. However, this alternative is less effective with respect to soil, because of the elimination of treatment in the North Soil Area.

Reduction in Toxicity, Mobility, and Volume

Alternative NSAA-1 reduces the toxicity, mobility, and volume of groundwater contaminants in the same manner as Alternative 4A-R.

This alternative removes less of the volume of contaminants in the soil.

Short-Term Effectiveness

Relative to Alternative 4A-R, the short-term effectiveness is similar.

Implementation

This alternative is readily implementable.

Cost

The total estimated cost to implement Alternative NSAA-1 is approximately $5.3 million, including the contingent barrier wall. The details of this estimated cost are provided in Table 4.2. The estimated capital cost is approximately $1.9 million, while the total O&M Cost is approximately $3.4 million. The estimated cost for the North Soil Area component is $83,000.

## 4.6 NORTH SOIL AREA ALTERNATIVE 2

### 4.6.1 Description

North Soil Area Alternative 2 (NSAA-2) is similar to NSAA-1 except that a segment of the barrier wall adjacent to and west of the North Soil Area would be installed rather than proposed as a contingency. The remaining portion of the wall remains as a contingency. The mid range

of aqueous phase VOCs in the groundwater are expected and groundwater treatment costs are the same as for NSAA-1 (Table A-1, Appendix A).

Costs for this alternative are detailed in Table 4.3. The major components of the alternative are depicted on Figure 4.3.

### 4.6.2 Assessment

Relative to Alternative NSAA-1, the assessment is the same except that the inclusion of the barrier wall significantly reduces the potential for off-Site migration of the highly concentrated plume, and therefore is more protective of human health and the environment.

The total cost to implement Alternative NSAA-2 is approximately $5.3 million (see Table 4.3). The total capital cost is $1.9 million, with the total O&M cost of $3.4 million. The total cost of the North Soil Area component is approximately $420,000.

## 4.7 NORTH SOIL AREA ALTERNATIVE 3

### 4.7.1 Description

North Soil Area Alternative(s) 3A and 3B (NSAA-3A, 3B) includes most of the components described in Alternative 4A-R except that in situ SVE in the North Area would be replaced by excavation and on-Site ex situ treatment of the contaminated soils. Versions A and B account for the difference in ex situ treatment technologies. Ex situ SVE for Version A and LTTD for Version B. The proposed duration for ex situ SVE would be 8 months; while the proposed duration for the low temperature desorption would be 5 months. Upon completion, treated soil would be backfilled in the excavation. For both alternatives, the groundwater treatment system costs are based on the low range of aqueous phase VOCs (Table A-2, Appendix A).

The major components of the alternative are depicted on Figure 4.4.

4.7.2 Assessment

Relative to Alternative 4A-R, the effectiveness of the North Area soil treatment is higher, especially if Low Temperature Thermal Desorption is used for the ex situ treatment. Remediation of the Center and North Area soils is to SCG levels is more likely to occur. As such, the groundwater chemistry would be impacted favorably (in a shorter time frame than will occur by implementing in situ SVE as proposed for Alternative 4A-R). Conversely, groundwater remediation will not be as far along when the treated North Area soils are replaced and passive recontamination from the groundwater could be at levels in excess of RAOs.

Long-term risks to human health and environment would be minimized compared to other alternatives because the reduction of the volume and toxicity of contaminants will be more effective and the potential for human/environmental impact off the Site much less than alternatives that least in higher residuals.

Conversely, excavation and ex situ treatment requires higher initial capital costs and air emissions during the process may have to be controlled to address concerns about short term risks to the community, including personnel at the Vac Air facility. Vinyl chloride has a low threshold limit and preliminary emission models indicate the potential for excessive exposure beyond the immediate work zone thus posing a hazard to people at the Site and beyond.

Implementation of this alternative would be more technically challenging due to Health and Safety requirements and the additional equipment required.

Costs for this alternative are detailed in Tables 4.4 and 4.5. The North Soil Area excavation and treatment costs included in Tables 4.4

and 4.5 are detailed in Tables A-4 and A-5 (Appendix A). Contingencies are included for air emission control during excavation and soil processing due to the presence of vinyl chloride in the North Soil Area. The total cost for the implementation of these alternatives range from approximately $6.5 to ____ million. However, if air emission controls are required the total cost increase from $8.7 to ___ million.

## 4.8 NORTH SOIL AREA ALTERNATIVE 4

### 4.8.1 Description

North Soil Area Alternative 4 (NSAA-4) is similar to Alternative 4A-R and NSAA-2 in that like 4A-R in situ SVE for the North Area soils is proposed and like NSAA-2 a portion of the barrier wall nearest the North Area would be installed. The lower range of aqueous phase VOCs would be expected after treatment of North Area soils and the lower costs for groundwater treatment (Table A-2), are included.

The SVE system for the North Soil Area would be a scaled down version of that proposed in Alternative 4A-R with the intent of addressing a target zone inclusive of Test Pits TP1-A and TP2-A and the SVE pilot study locations where soil contamination is believed to be the highest. This target zone would encompass an area of approximately 100 feet by 80 feet and include all soils from the ground surface to the clay layer at approximately 15 feet BGS. The North Soil Area SVE system would be constructed with 14 extraction wells and six injection wells. Extracted soil gases from the North Area would be treated with a catalytic-oxidizer equipped with a scrubber to neutralize acid gas produced during the combustion of the chlorinated VOCs. The planned duration for the North Soil Area SVE system would be 2 years and it would be implemented before the Center Soil Area so that equipment could be reused for the Center Soil Area SVE system.

The major components of the alternative are depicted on Figure 4.5.

### 4.8.2 Assessment

This alternative utilizes in situ SVE in the North Area, but, because of uncertainties in its effectiveness in achieving RAOs, the process is restricted to a target zone of highly contaminated soil where efficient soil gas removal is possible in a reasonable period of time. In recognition that residual soil contamination could still be quite significant after the 2-year period, the barrier wall installed adjacent to the North Area provides a safe guard to reduce contaminant mobility towards the creek.

Remediation of soils and groundwater to RAOs is unlikely, however, significant reductions in VOCs will occur resulting in overall protection of human health and the environment with institutional controls in place, and the barrier wall for reducing potential impacts off the Site.

Costs for this alternative are detailed in Table 4.5. The North Area Target Soil SVE component costs are detailed in Table A-3 (Appendix A). The total cost to implement this alternative is approximately $__ million, including the contingent barrier wall.

## 5.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section of the report analyzes and compares the relative degree to which each remedial alternative satisfies the seven evaluation criteria. The results of this comparison are discussed below and summarized in Table 5.1.

### 5.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

All alternatives are equally protective of human health by preventing the potential exposure to contaminated media through the use of institutional controls.

In addition, all alternatives are protective of the environment. Although this protection is achieved in different ways. All alternatives provide for the collection and treatment of contaminated groundwater through hydraulic containment of the Water Table Aquifer to minimize the off-Site migration of contaminants. Alternative NSAA-2 and NSAA-4 provide for the additional protection through the installation of the barrier wall downgradient of the North Soil Area. Alternatives 4A-R, NSAA-3A and NSAA-3B provide additional protection through the treatment of the contaminated soil and groundwater in the North Soil Area.

### 5.2 COMPLIANCE WITH SCGs

Given the demonstrated presence of DNAPL at the Site and the very high concentrations of contaminants in the groundwater, it is highly unlikely that the chemical-specific SCGs for groundwater will ever be achieved. Similarly, soil RAOs for the north soil area can only be achieved with Alternatives NSSA-3A and NSSA-3B. However, following backfilling, passive recontamination of the soil below the water table would occur due to residual groundwater contamination in other areas of the Site. All alternatives will achieve chemical-specific SCGs for surface water and sediment.

All alternatives would comply with the chemical-specific SCGs governing air emissions. All alternatives require a treatment system to remove VOCs from the air emissions of the Center Soil Area SVE system, and Alternatives 4A-R, and NSAA-4 would require treatment of the North Soil Area SVE air emissions. Alternatives NSSA-3A, and NSSA-3B may require fugitive emissions control during construction, but SCGs could be achieved.

All alternatives will comply with action-specific and location-specific SCGs.

## 5.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

All the evaluated alternatives offer a long-term and permanent solution with respect to the contaminated groundwater. The groundwater extraction and treatment system will remove contaminated groundwater from the Water Table Aquifer and destroy or separate the contaminants from the groundwater. All treatment will occur on Site. The only treatment residuals generated will be inorganic sludges and spent carbon. All treatment residuals will be sent to a permitted facility off-Site for disposal or regeneration. The components of the groundwater extraction and treatment system are easily replaceable during the lifetime of the remedy and will pose a risk to human health or the environment during any replacement activities.

Alternatives NSSA-2 and NSAA-4 also include the installation of the barrier wall adjacent to the North Soil Area. The barrier wall will effectively and significantly reduce the mobility of contaminants in the groundwater.

With respect to soil contamination, all alternatives offer a permanent solution with respect to the Center Soil Area. This area will be treated by SVE in an attempt to achieve soil SCGs. Alternatives NSAA-3A and NSAA-3B will remove the bulk of soil contamination from the North Soil Area, but will place the treatment residuals on Site. There is also the

possibility of the recontamination of the treated soil through the migration of contaminated groundwater into excavated area. Alternatives 4A-R and NSAA-4 will remove contaminant mass from the North Soil Area through the operation of an in situ SVE system. However, it is not expected that soil SCGs will be achieved in the North Soil Area using in situ SVE.

Reliable operational controls will be in place for the groundwater extraction and treatment system. In addition a groundwater monitoring program will be implemented to ensure the effectiveness of remedial actions for all alternatives.

## 5.4 REDUCTION IN TOXICITY, MOBILITY AND VOLUME

All alternatives reduce the mobility of contaminants due to the hydraulic containment achieved in the Water Table Aquifer by the groundwater extraction system. However, Alternative NSAA-2 has the greatest reduction in mobility because of the immediate installation of the barrier wall adjacent to the North Soil Area.

The reduction of the volume of contaminants is achieved in all alternatives through the continuous pumping and treatment of contaminated groundwater; the operation of the Center Soil Area SVE system; and, the pumping of DNAPL is the North Soil Area. Alternatives 4A-R, NSAA-3A and NSAA-3B will remove a greater volume of the contaminants on Site than the remaining alternatives through the treatment of the North Soil Area.

The toxicity of the contaminants in the groundwater is reduced in all alternatives through their destruction by the UV oxidation treatment system. Granular activated carbon will also be used in the treatment process. The expended carbon will be sent of-Site for regeneration.

## 5.5 SHORT-TERM EFFECTIVENESS

All alternatives, except Alternatives NSAA-3A and NSAA-3B, present very low risk to the community, workers and the environment during implementation. Alternatives NSAA-3A and NSAA-3B, because of the degree and duration (5 to 7 months) of the soil excavation in the North Soil Area present a much greater risk to the community, workers and the environment during implementation. It maybe necessary during the implementation of these alternatives to use air emissions controls to mitigate risk to the community.

The achievement of hydraulic containment in the Water Table Aquifer is expected to be rapid (i.e., within 1 month of startup of the groundwater extraction system). Alternative NSAA-2 will achieve containment most rapidly, through the installation of the barrier wall in the North Soil Area. The achievement of hydraulic containment will result in the protection of the environment by mitigating the off-Site migration of contaminants through the Water Table Aquifer.

The remaining Site threats (e.g., contaminated sediment and discharge of contaminated water from the existing culvert) will be addressed in a rapid fashion (approximately 6 months commencement of construction) for Alternatives 4A-R, NSAA-2, and NSAA-4. Alternatives NSAA-3A and NSAA-3B, will take at least an additional 5 to 7 months to achieve protection due to the length of the excavation and treatment of the North Soil Area.

## 5.6 IMPLEMENTABILITY

All alternatives, except Alternative NSAA-3B, are readily implementable. Required services are generally available and the technologies rely on standard construction methods and demonstrated technologies. The required equipment for LTTD are not as readily available. In addition, the potential for delays in the construction schedule for Alternatives NSAA-3A and NSAA-3B are greater than the other alternatives,

due to potential requirement for air emission controls of the excavation and/or soil stockpiles.

## 5.7 COSTS

The total costs, including the contingency barrier wall, associated with the implementation of the remedial alternatives are lowest for Alternatives NSAA-1 and NSAA-2, and increase successively for Alternatives NSAA-4, 4A-R, NSAA-3A and NSAA-3B. Table 5.2 presents a comparison of the estimated capital and O&M cost for each of the remedial alternatives evaluated. The estimated net present worth ranges from approximately $5.3 million (Alternatives NSSA-1 and NSAA-2) to $7.6 million (Alternative NSSA-3B).

The total capital costs for these alternatives range from approximately $1.9 million for Alternatives NSSA-1 and NSAA-2 to $4.4 million for Alternative NSAA-3B.

Long-term operation and maintenance costs for all the alternatives are based on the operation of the groundwater extraction and treatment system for 30 years, the operation of the Center Soil Area SVE system for five years, the operation of the North Soil Area DNAPL recovery wells for one year, and 30 years of groundwater monitoring. For Alternatives 4A-R and NSAA-4, the O&M costs also include the operation of the North Soil Area SVE system for eight and two years, respectively.

## 6.0 PREFERRED ALTERNATIVE

Based on the additional evaluation of the North Soil Area remediation presented in this report, the preferred alternative for the Vac Air Site is Alternative NSAA-2. This alternative will satisfy the remedial action goals stated in the ROD as well as any of the alternatives evaluated. The following paragraphs.

Alternatives NSAA-3A and NSAA-3B (excavation and on-Site treatment of The North Soil Area) were eliminated from consideration because of their higher short-term risks to the community and workers and the implementation difficulties. The excavation of the North Soil Area would result in fugitive air emissions during the construction period (5 to 7 months). There was also a high probability of delays due to the potential need for air emissions controls. The greater reduction of volume of contaminants in these alternatives is not offset by the potential short-term risks, implementation issues and extremely high cost.

Alternative NSAA-2 provides the greatest degree of reduction of contaminant mobility and essentially removes the risk to the environment from the highly contaminated soil and groundwater in the North Soil Area through the immediate placement of the barrier wall and the operation of the groundwater extraction system. This alternative is protective of human health and the environment and offers the best combination of contaminant volume reduction, contaminant mobility reduction, and implementability for the cost.

The presence of DNAPL on the Site and the high concentrations of TCE and other contaminants in the groundwater make the achievement of groundwater SCGs improbable. This places a greater importance on institutional controls and hydraulic containment to protect human health and the environment. The performance of any form of treatment on the North Soil Area will not markedly reduce the time frame of the groundwater remedy.

# FIGURES

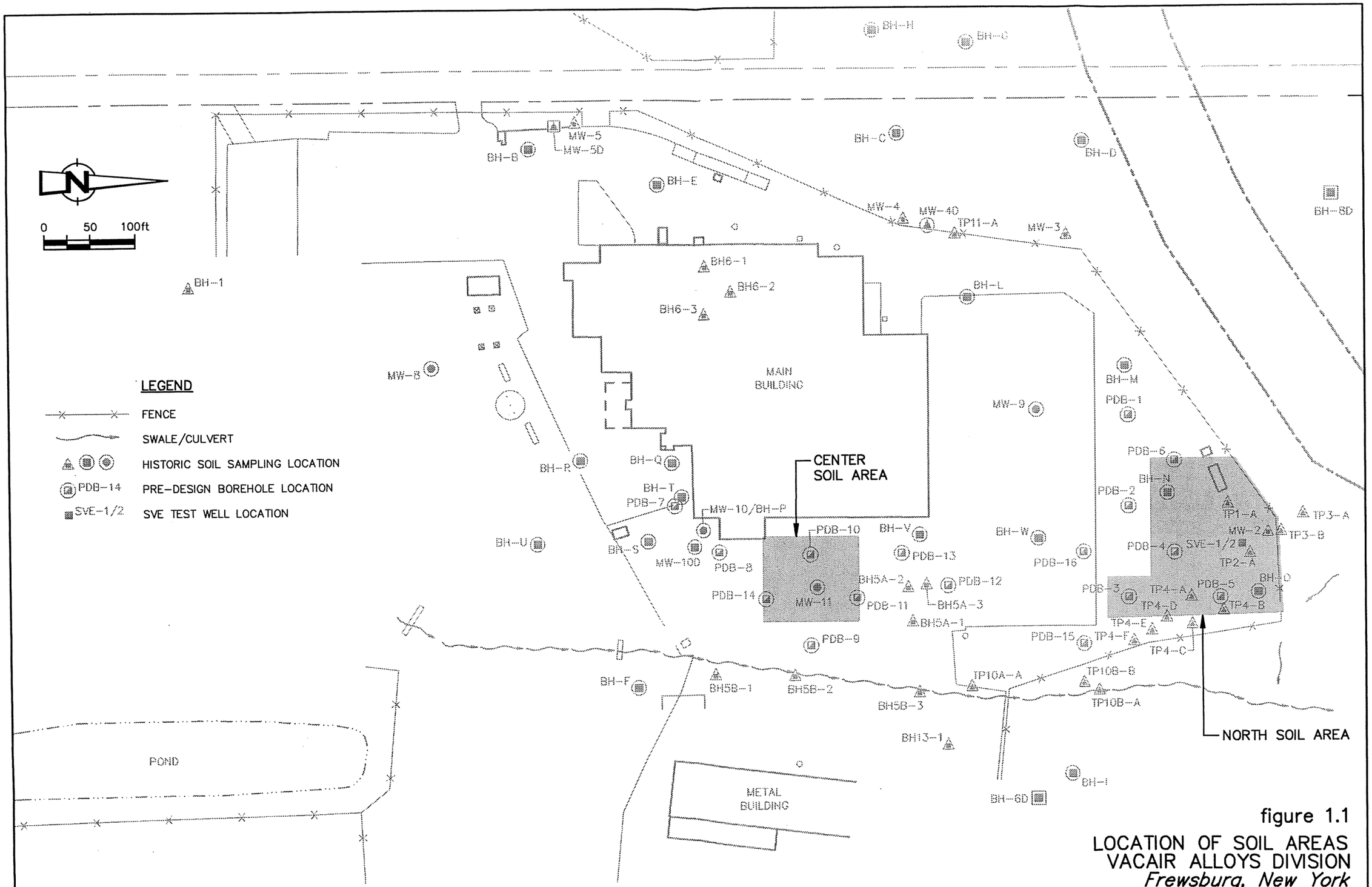



figure 1.1
LOCATION OF SOIL AREAS
VACAIR ALLOYS DIVISION
*Frewsburg, New York*

**CRA**

2326 (25) MAY 28/96(W) REV.0 (P-95)

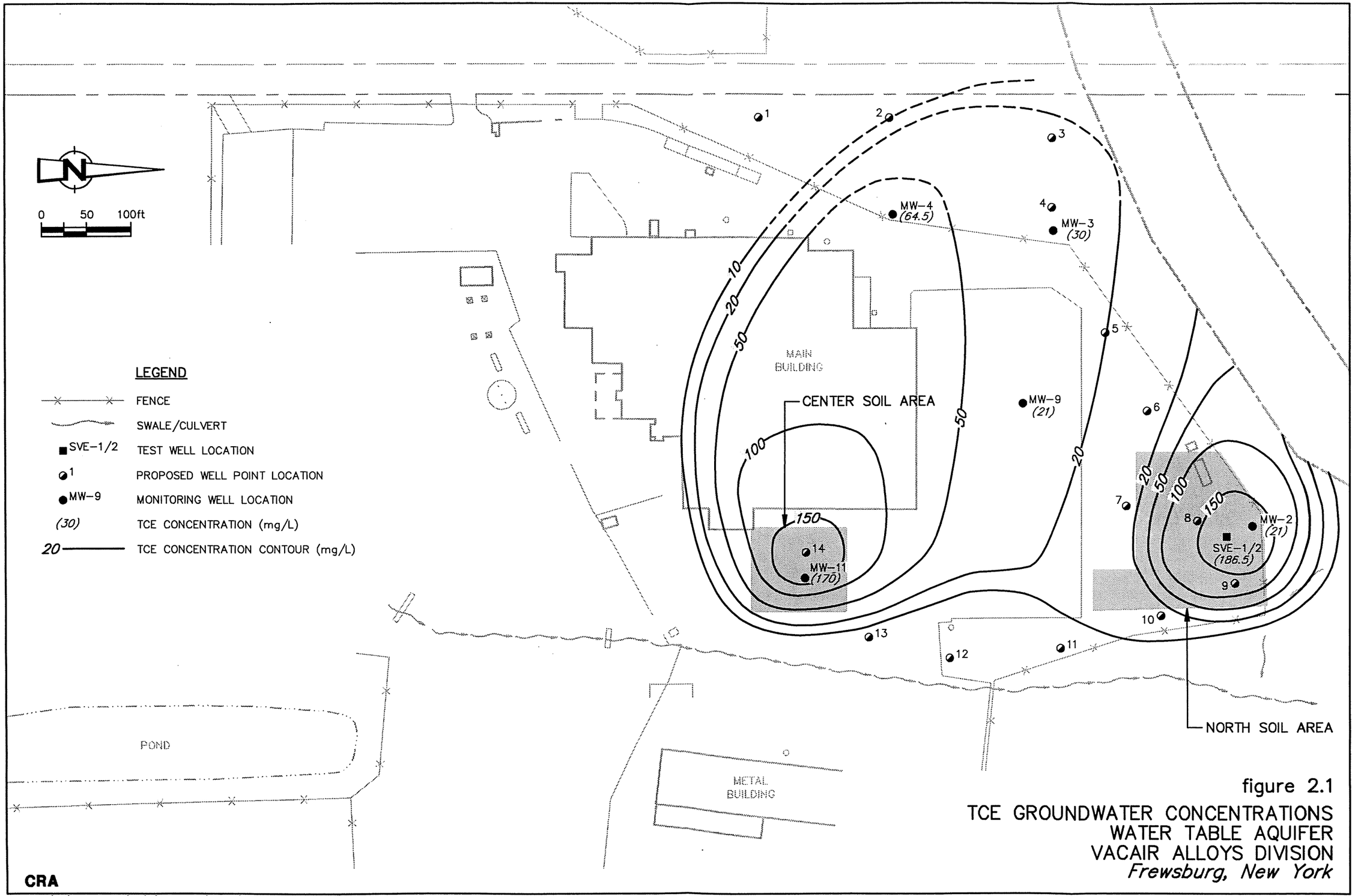



figure 2.1
TCE GROUNDWATER CONCENTRATIONS
WATER TABLE AQUIFER
VACAIR ALLOYS DIVISION
*Frewsburg, New York*

**CRA**

2326 (25) MAY 28/96(W) REV.0 (P-96)

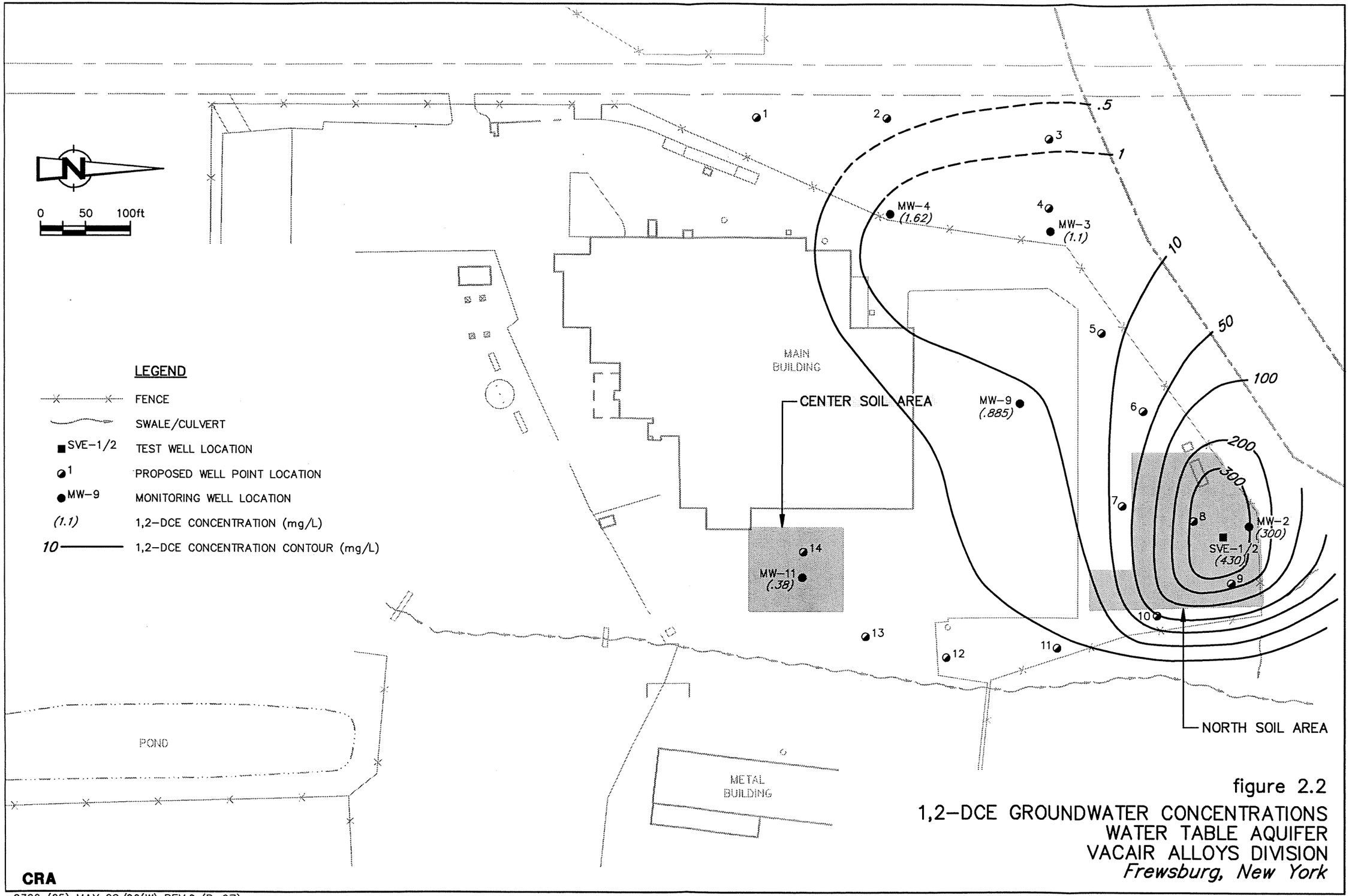



figure 2.2
1,2-DCE GROUNDWATER CONCENTRATIONS
WATER TABLE AQUIFER
VACAIR ALLOYS DIVISION
*Frewsburg, New York*

**CRA**

2326 (25) MAY 28/96(W) REV.0 (P-97)

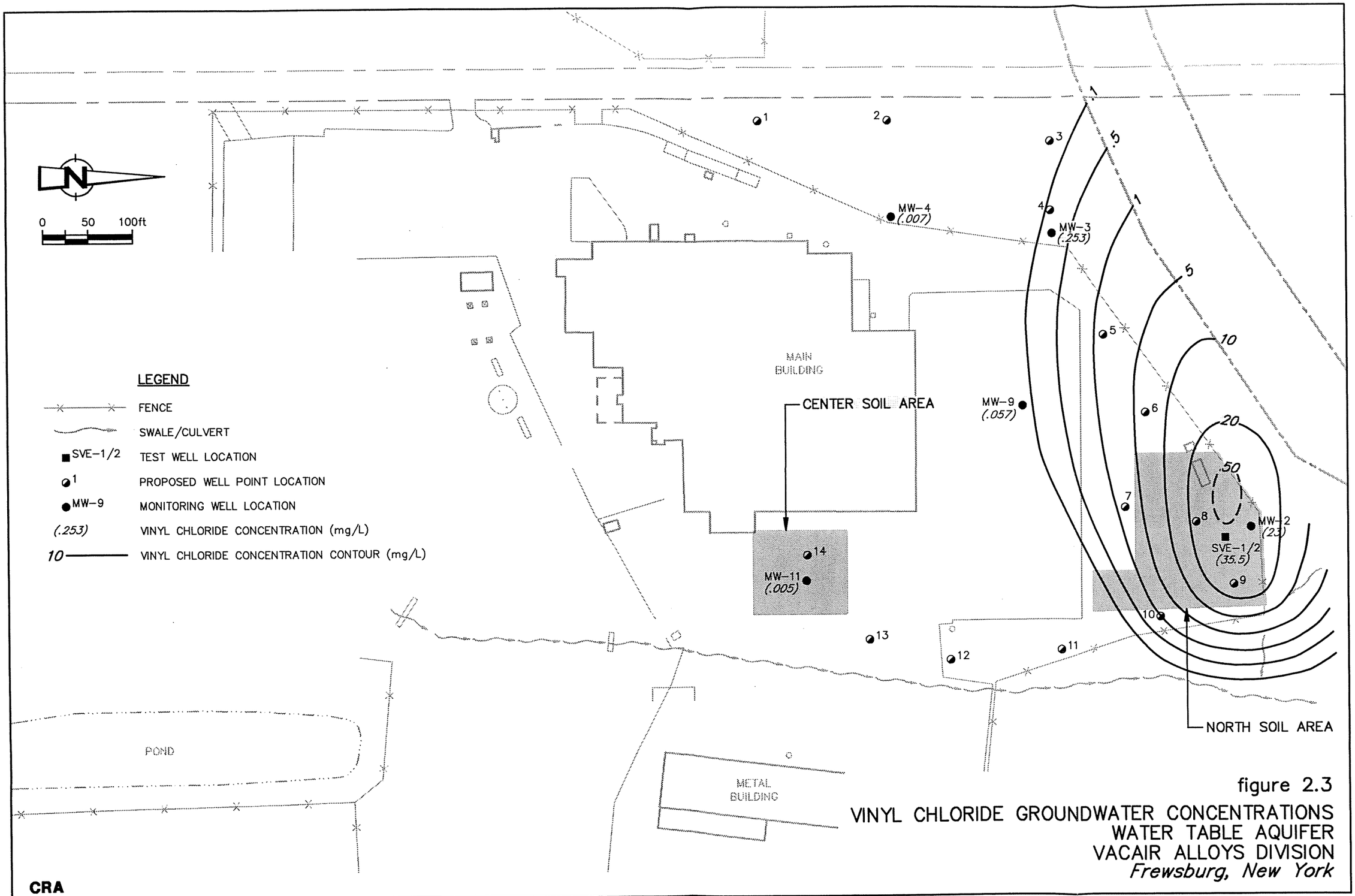
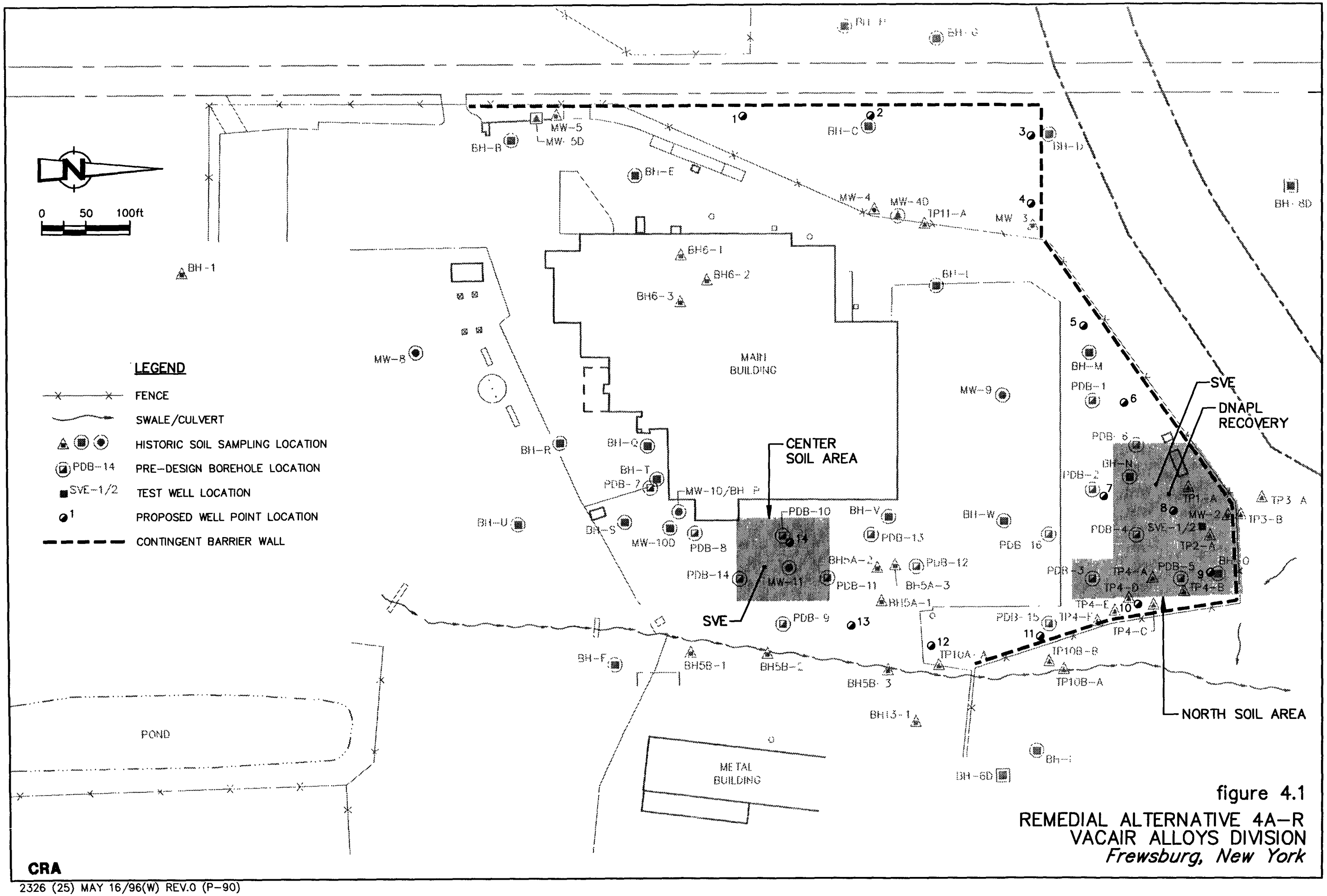



figure 2.3

VINYL CHLORIDE GROUNDWATER CONCENTRATIONS
WATER TABLE AQUIFER
VACAIR ALLOYS DIVISION
*Frewsburg, New York*

**CRA**

2326 (25) MAY 28/96(W) REV.0 (P-98)




**CRA**

2326 (25) MAY 16/96(W) REV.0 (P-90)

figure 4.1

REMEDIAL ALTERNATIVE 4A-R
VACAIR ALLOYS DIVISION
*Frewsburg, New York*

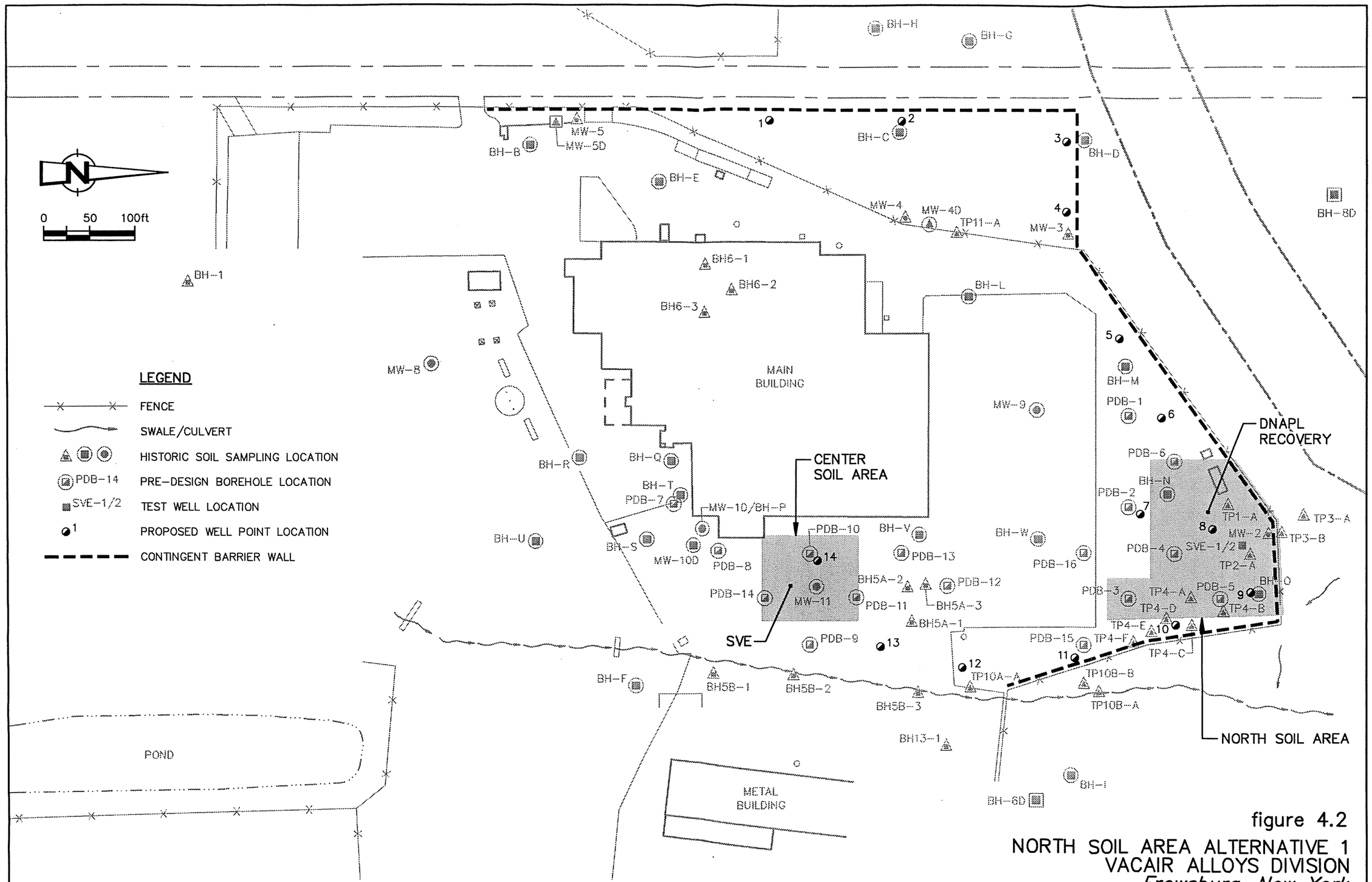



figure 4.2

NORTH SOIL AREA ALTERNATIVE 1
VACAIR ALLOYS DIVISION
*Frewsburg, New York*

**CRA**

2326 (25) MAY 16/96(W) REV.0 (P-91)

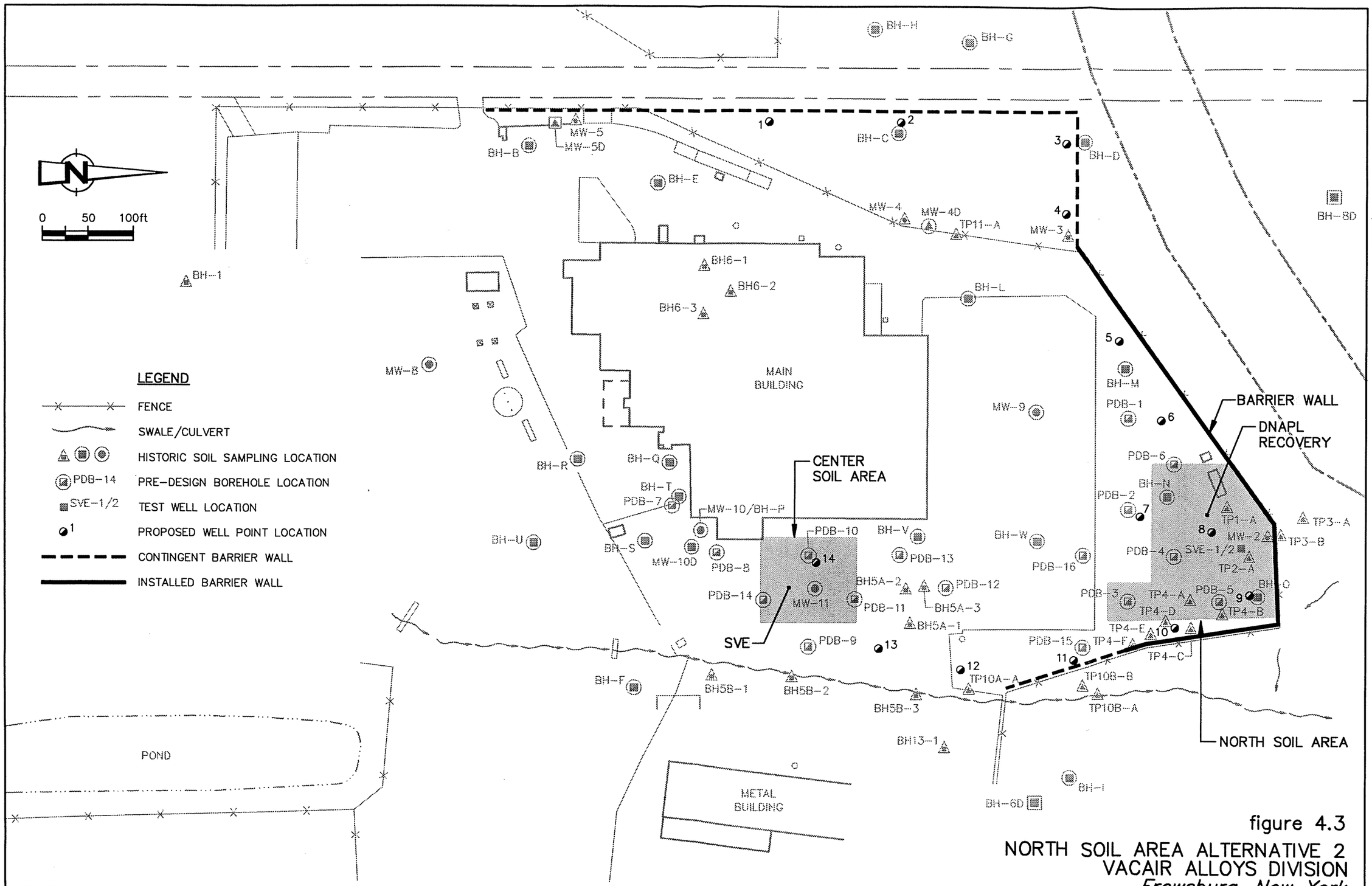



figure 4.3
NORTH SOIL AREA ALTERNATIVE 2
VACAIR ALLOYS DIVISION
*Frewsburg, New York*

**CRA**

2326 (25) MAY 16/96(W) REV.0 (P-92)

N

0 50 100ft

**LEGEND**

- FENCE
- SWALE/CULVERT
- HISTORIC SOIL SAMPLING LOCATION
- PDB-14 PRE-DESIGN BOREHOLE LOCATION
- SVE-1/2 TEST WELL LOCATION
- 1 PROPOSED WELL POINT LOCATION
- CONTINGENT BARRIER WALL

BH-H
BH-G
BH-B
MW-5
MW-5D
1
2
BH-C
3
BH-D
BH-E
MW-4
MW-4D
TP11-A
MW-3
4
BH-8D
BH-1
BH6-1
BH6-2
BH6-3
BH-L
MW-8
MAIN BUILDING
5
BH-M
PDB-1
6
MW-9
EXCAVATE, TREAT AND BACKFILL
DNAPL RECOVERY
BH-R
BH-Q
BH-T
PDB-7
CENTER SOIL AREA
MW-10/BH-P
PDB-6
BH-N
PDB-2
7
TP1-A
TP3-A
BH-U
BH-S
MW-10D
PDB-8
PDB-10
14
BH-V
PDB-13
BH-W
PDB-16
8
MW-2
TP3-B
PDB-4
SVE-1/2
TP2-A
PDB-14
MW-11
BH5A-2
PDB-12
PDB-11
BH5A-3
PDB-3
TP4-A
PDB-5
9
BH-O
TP4-D
TP4-B
BH5A-1
SVE
PDB-9
13
TP4-E
10
PDB-15
TP4-F
TP4-C
11
12
TP10A-A
TP10B-B
TP10B-A
BH-F
BH5B-1
BH5B-2
BH5B-3
NORTH SOIL AREA
POND
BH13-1
METAL BUILDING
BH-I
BH-6D

**CRA**

2326 (25) MAY 16/96(W) REV.0 (P-93)

figure 4.4

NORTH SOIL AREA ALTERNATIVE 3A AND 3B
VACAIR ALLOYS DIVISION
*Frewsburg, New York*

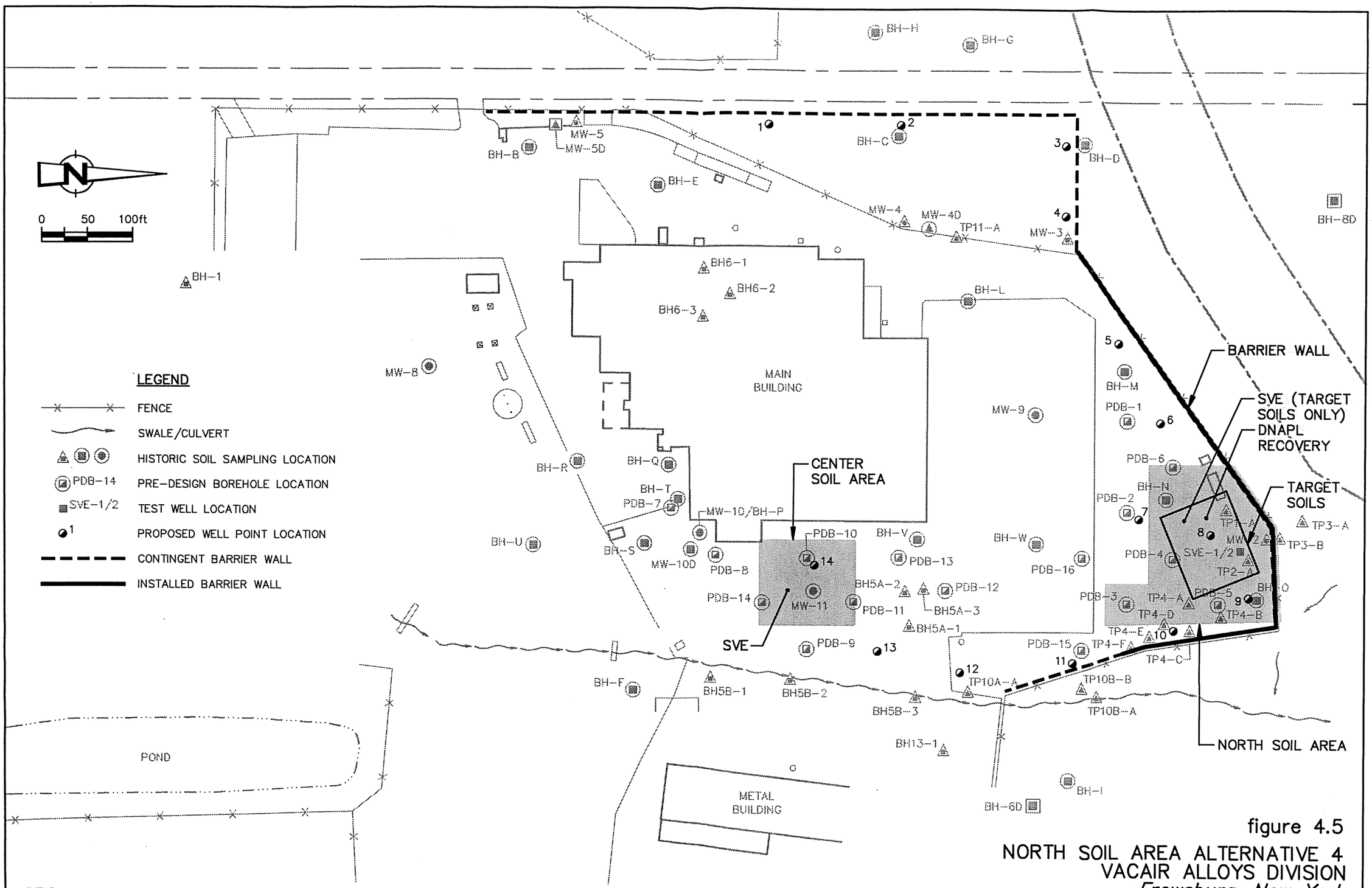



figure 4.5

NORTH SOIL AREA ALTERNATIVE 4
VACAIR ALLOYS DIVISION
*Frewsburg, New York*

**CRA**

2326 (25) MAY 16/96(W) REV.0 (P-94)

**TABLE 2.1**

**ESTIMATED INFLUENT CHEMISTRY**
**VAC AIR ALLOYS DIVISION**
**FREWSBURG, NEW YORK**

WITHOUT TREATMENT OF NORTH AREA SOILS

| | *TCE (mg/L)* | *1, 2-DCE (mg/L)* | *VC (mg/L)* |
|---|---|---|---|
| FS Estimate + | 57 | 24 | 2 |
| Site-Wide Average: (using 12 well points) | 47 | 64 | 7 |
| North Soil Area Average: (5 well points near North Area Soils) | 62 | 150 | 16 |

WITH TREATMENT OF NORTH AREA SOILS

| | *TCE (mg/L)* | *DCE (mg/L)* | *VC (mg/L)* |
|---|---|---|---|
| FS Estimate | 57 | 24 | 2 |
| Site-Wide Average:* (using 12 well points) | 29 | 22 | 2 |
| North Soil Area Average (5 well points near North Area Soils) | 20 | 50 | 4 |

\+ These values were used in the FS for evaluating groundwater treatment costs.
* These values were used for evaluating revised groundwater treatment costs.

Note: Because the TCE plume is much more extensive than the other VOC plumes, TCE will control cleanup time.

TABLE 4.1

COST SUMMARY - DETAILED ANALYSIS
ALTERNATIVE #4A-R
VAC AIR ALLOYS DIVISION
FREWSBURG, NEW YORK

| *Components* | *Direct Capital Costs* | *Indirect Capital Costs* | *Total Capital Costs* | *Annual O & M Costs* | *Net Present Worth (7%)* |
|---|---|---|---|---|---|
| COMMON ITEMS | | | | | |
| Paving of Unpaved Area North of Site | $45,000 | $4,500 | $49,500 | $0 | $49,500 |
| Sediment Excavation and Off-Site Disposal | $93,900 | $42,300 | $136,200 | $0 | $136,200 |
| Runoff Isolation | $74,900 | $16,300 | $91,200 | $1,500 | $109,800 |
| Surface Water Discharge System | $36,500 | $11,900 | $48,400 | $1,500 | $67,000 |
| Institututional Controls | $10,000 | $0 | $10,000 | $0 | $10,000 |
| Groundwater Monitoring | | | | | |
| Years 0 to 5 | $0 | $0 | $0 | $93,300 | $382,600 |
| Years 6 to 30 | $0 | $0 | $0 | $50,900 | $422,900 |
| Wellpoint Extraction System | $301,400 | $97,900 | $399,300 | $16,000 | $597,800 |
| UV Oxidation | $270,000 | $65,000 | $335,000 | $126,000 | $1,898,200 |
| Center Area Soils | | | | | |
| SVE & Treatment System - In Situ | $85,050 | $21,300 | $106,350 | $32,500 | $225,450 |
| **Subtotal:** | **$916,750** | **$259,200** | **$1,175,950** | | **$3,899,450** |
| NORTH AREA SOIL | | | | | |
| North Area Soils | | | | | |
| SVE & Treatment System - In Situ | $414,000 | $83,000 | $497,000 | $76,500 | $913,300 |
| DNAPL Recovery System | $49,000 | $15,000 | $64,000 | $19,000 | $83,000 |
| **Subtotal:** | **$463,000** | **$98,000** | **$561,000** | **$95,500** | **$996,300** |
| **Total Without Contingency:** | **$1,379,750** | **$357,200** | **$1,736,950** | | **$4,895,750** |
| **Contingency For Barrier Wall:** | $318,100 | $174,900 | $493,000 | $30,000 | $865,500 |
| **Total with Contingency:** | **$1,697,850** | **$532,100** | **$2,229,950** | | **$5,761,250** |

**TABLE 4.2**

**COST SUMMARY - DETAILED ANALYSIS**
**NORTH SOIL AREA ALTERNATIVE 1**
**VAC AIR ALLOYS DIVISION**
**FREWSBURG, NEW YORK**

| *Components* | *Direct Capital Costs* | *Indirect Capital Costs* | *Total Capital Costs* | *Annual O & M Costs* | *Net Present Worth (7%)* |
|---|---|---|---|---|---|
| COMMON ITEMS | | | | | |
| Paving of Unpaved Area North of Site | $45,000 | $4,500 | $49,500 | $0 | $49,500 |
| Sediment Excavation and Off-Site Disposal | $93,900 | $42,300 | $136,200 | $0 | $136,200 |
| Runoff Isolation | $74,900 | $16,300 | $91,200 | $1,500 | $109,800 |
| Surface Water Discharge System | $36,500 | $11,900 | $48,400 | $1,500 | $67,000 |
| Institututional Controls | $10,000 | $0 | $10,000 | $0 | $10,000 |
| Groundwater Monitoring | | | | | |
| Years 0 to 5 | $0 | $0 | $0 | $93,300 | $382,600 |
| Years 6 to 30 | $0 | $0 | $0 | $50,900 | $422,900 |
| Wellpoint Extraction System | $301,400 | $97,900 | $399,300 | $16,000 | $597,800 |
| UV Oxidation | $420,000 | $65,000 | $485,000 | $150,600 | $2,353,400 |
| Center Area Soils | | | | | |
| SVE and Treatment System - In Situ | $85,050 | $21,300 | $106,350 | $32,500 | $225,450 |
| **Subtotal:** | **$1,066,750** | **$259,200** | **$1,325,950** | | **$4,354,650** |
| NORTH AREA SOIL | | | | | |
| North Area Soils | | | | | |
| DNAPL Recovery System | $49,000 | $15,000 | $64,000 | $19,000 | $83,000 |
| **Subtotal:** | **$49,000** | **$15,000** | **$64,000** | **$19,000** | **$83,000** |
| **Total Without Contingency:** | **$1,115,750** | **$274,200** | **$1,389,950** | | **$4,437,650** |
| **Contingency:** | $318,100 | $174,900 | $493,000 | $30,000 | $865,500 |
| **Total With Contingency:** | **$1,433,850** | **$449,100** | **$1,882,950** | | **$5,303,150** |

**TABLE 4.3**

**COST SUMMARY - DETAILED ANALYSIS**
**NORTH SOIL AREA ALTERNATIVE 2**
**VAC AIR ALLOYS DIVISION**
**FREWSBURG, NEW YORK**

| *Components* | *Direct Capital Costs* | *Indirect Capital Costs* | *Total Capital Costs* | *Annual O & M Costs* | *Net Present Worth (7%)* |
|---|---|---|---|---|---|
| COMMON ITEMS | | | | | |
| Paving of Unpaved Area North of Site | $45,000 | $4,500 | $49,500 | $0 | $49,500 |
| Sediment Excavation and Off-Site Disposal | $93,900 | $42,300 | $136,200 | $0 | $136,200 |
| Runoff Isolation | $74,900 | $16,300 | $91,200 | $1,500 | $109,800 |
| Surface Water Discharge System | $36,500 | $11,900 | $48,400 | $1,500 | $67,000 |
| Institututional Controls | $10,000 | $0 | $10,000 | $0 | $10,000 |
| Groundwater Monitoring | | | | | |
| Years 0 to 5 | $0 | $0 | $0 | $93,300 | $382,600 |
| Years 6 to 30 | $0 | $0 | $0 | $50,900 | $422,900 |
| Wellpoint Extraction System | $301,400 | $97,900 | $399,300 | $16,000 | $597,800 |
| UV Oxidation | $420,000 | $65,000 | $485,000 | $150,600 | $2,353,400 |
| Center Area Soils | | | | | |
| SVE and Treatment System - In Situ | $85,050 | $21,300 | $106,350 | $32,500 | $225,450 |
| **Subtotal:** | **$1,066,750** | **$259,200** | **$1,325,950** | | **$4,354,650** |
| NORTH AREA SOIL | | | | | |
| North Area Soils | | | | | |
| DNAPL Recovery System | $49,000 | $15,000 | $64,000 | $19,000 | $83,000 |
| Barrier Wall - Modified | $124,000 | $68,200 | $192,200 | $11,700 | $337,400 |
| **Subtotal:** | **$173,000** | **$83,200** | **$256,200** | **$30,700** | **$420,400** |
| **Total Without Contingency:** | **$1,239,750** | **$342,400** | **$1,582,150** | | **$4,775,050** |
| **Contingency:** | $194,000 | $106,700 | $300,700 | $18,300 | $527,800 |
| **Total With Contingency:** | **$1,433,750** | **$449,100** | **$1,882,850** | | **$5,302,850** |

TABLE 4.4

COST SUMMARY - DETAILED ANALYSIS
NORTH SOIL AREA ALTERNATIVE 3A
VAC AIR ALLOYS DIVISION
FREWSBURG, NEW YORK

| *Components* | *Direct Capital Costs* | *Indirect Capital Costs* | *Total Capital Costs* | *Annual O & M Costs* | *Net Present Worth (7%)* |
|---|---|---|---|---|---|
| COMMON ITEMS | | | | | |
| Paving of Unpaved Area North of Site | $45,000 | $4,500 | $49,500 | $0 | $49,500 |
| Sediment Excavation and Off-Site Disposal | $93,900 | $42,300 | $136,200 | $0 | $136,200 |
| Runoff Isolation | $74,900 | $16,300 | $91,200 | $1,500 | $109,800 |
| Surface Water Discharge System | $36,500 | $11,900 | $48,400 | $1,500 | $67,000 |
| Institututional Controls | $10,000 | $0 | $10,000 | $0 | $10,000 |
| Groundwater Monitoring | | | | | |
| Years 0 to 5 | $0 | $0 | $0 | $93,300 | $382,600 |
| Years 6 to 30 | $0 | $0 | $0 | $50,900 | $422,900 |
| Wellpoint Extraction System | $301,400 | $97,900 | $399,300 | $16,000 | $597,800 |
| UV Oxidation | $270,000 | $65,000 | $335,000 | $126,000 | $1,898,200 |
| Center Area Soils | | | | | |
| SVE and Treatment System - In Situ | $65,000 | $21,300 | $86,300 | $32,500 | $205,450 |
| **Subtotal:** | **$896,700** | **$259,200** | **$1,155,900** | | **$3,879,450** |
| NORTH AREA SOIL | | | | | |
| North Area Soils | | | | | |
| DNAPL Recovery System | $49,000 | $15,000 | $64,000 | $19,000 | $83,000 |
| SVE and Treatment System - Ex Situ | $1,153,800 | $485,000 | $1,638,800 | $102,000 | $1,740,800 |
| **Subtotal:** | **$1,202,800** | **$500,000** | **$1,702,800** | **$121,000** | **$1,823,800** |
| **Total Without Contingency:** | **$2,099,500** | **$759,200** | **$2,858,700** | **$121,000** | **$5,703,250** |
| **Contingency:** | $318,100 | $174,900 | $493,000 | $30,000 | $865,500 |
| **Total with Contingency:** | **$2,417,600** | **$934,100** | **$3,351,700** | | **$6,568,750** |

Center soil SVE system to reuse equipment after completion of the North Site Area SVE remediation.
Costs do not include provisions for emission control during excavation and soil handling, approximately $2,200,000.

**TABLE 4.5**

**COST SUMMARY - DETAILED ANALYSIS**
**NORTH SOIL AREA ALTERNATIVE 3B**
**VAC AIR ALLOYS DIVISION**
**FREWSBURG, NEW YORK**

| *Components* | *Direct Capital Costs* | *Indirect Capital Costs* | *Total Capital Costs* | *Annual O & M Costs* | *Net Present Worth (7%)* |
|---|---|---|---|---|---|
| COMMON ITEMS | | | | | |
| Paving of Unpaved Area North of Site | $45,000 | $4,500 | $49,500 | $0 | $49,500 |
| Sediment Excavation and Off-Site Disposal | $93,900 | $42,300 | $136,200 | $0 | $136,200 |
| Runoff Isolation | $74,900 | $16,300 | $91,200 | $1,500 | $109,800 |
| Surface Water Discharge System | $36,500 | $11,900 | $48,400 | $1,500 | $67,000 |
| Institututional Controls | $10,000 | $0 | $10,000 | $0 | $10,000 |
| Groundwater Monitoring | | | | | |
| Years 0 to 5 | $0 | $0 | $0 | $93,300 | $382,600 |
| Years 6 to 30 | $0 | $0 | $0 | $50,900 | $422,900 |
| Wellpoint Extraction System | $301,400 | $97,900 | $399,300 | $16,000 | $597,800 |
| UV Oxidation | $270,000 | $65,000 | $335,000 | $126,000 | $1,898,200 |
| Center Area Soils | | | | | |
| SVE and Treatment System - In Situ | $85,050 | $21,300 | $106,350 | $32,500 | $225,450 |
| **Subtotal:** | **$916,750** | **$259,200** | **$1,175,950** | | **$3,899,450** |
| NORTH AREA SOIL | | | | | |
| North Area Soils | | | | | |
| DNAPL Recovery System | $49,000 | $15,000 | $64,000 | $19,000 | $83,000 |
| On-Site Thermal Desorption - Ex Situ | $1,801,600 | $900,000 | $2,701,600 | $0 | $2,701,600 |
| **Subtotal:** | **$1,850,600** | **$915,000** | **$2,765,600** | **$19,000** | **$2,784,600** |
| **Total Without Contingency:** | **$2,767,350** | **$1,174,200** | **$3,941,550** | **$19,000** | **$6,684,050** |
| **Contingency For Barrier Wall:** | $318,100 | $174,900 | $493,000 | $30,000 | $865,500 |
| **Total with Contingency:** | **$3,085,450** | **$1,349,100** | **$4,434,550** | | **$7,549,550** |

Costs do not include provisions for emission control during excavation and soil handling, approximately $1,730,000.

**TABLE 4.6**

**COST SUMMARY - DETAILED ANALYSIS**
**NORTH SOIL AREA ALTERNATIVE 4**
**VAC AIR ALLOYS DIVISION**
**FREWSBURG, NEW YORK**

| *Components* | *Direct Capital Costs* | *Indirect Capital Costs* | *Total Capital Costs* | *Annual O & M Costs* | *Net Present Worth (7%)* |
|---|---|---|---|---|---|
| COMMON ITEMS | | | | | |
| Paving of Unpaved Area North of Site | $45,000 | $4,500 | $49,500 | $0 | $49,500 |
| Sediment Excavation and Off-Site Disposal | $93,900 | $42,300 | $136,200 | $0 | $136,200 |
| Runoff Isolation | $74,900 | $16,300 | $91,200 | $1,500 | $109,800 |
| Surface Water Discharge System | $36,500 | $11,900 | $48,400 | $1,500 | $67,000 |
| Institututional Controls | $10,000 | $0 | $10,000 | $0 | $10,000 |
| Groundwater Monitoring | | | | | |
| Years 0 to 5 | $0 | $0 | $0 | $93,300 | $382,600 |
| Years 6 to 30 | $0 | $0 | $0 | $50,900 | $422,900 |
| Wellpoint Extraction System | $301,400 | $97,900 | $399,300 | $16,000 | $597,800 |
| UV Oxidation | $270,000 | $65,000 | $335,000 | $126,000 | $1,898,200 |
| Center Area Soils | | | | | |
| SVE and Treatment System - In Situ | $85,050 | $21,300 | $106,350 | $32,500 | $225,450 |
| **Subtotal:** | **$916,750** | **$259,200** | **$1,175,950** | | **$3,899,450** |
| NORTH AREA SOIL | | | | | |
| North Area Soils | | | | | |
| DNAPL Recovery System | $49,000 | $15,000 | $64,000 | $19,000 | $83,000 |
| Barrier Wall - Modified | $124,000 | $68,200 | $192,200 | $11,700 | $337,400 |
| SVE and Treatment System - Target Area | $329,470 | $65,900 | $395,370 | $53,100 | $491,370 |
| **Subtotal:** | **$502,470** | **$149,100** | **$651,570** | **$83,800** | **$911,770** |
| **Total Without Contingency:** | **$1,419,220** | **$408,300** | **$1,827,520** | **$83,800** | **$4,811,220** |
| **Contingency For Barrier Wall:** | $194,000 | $106,700 | $300,700 | $18,300 | $527,800 |
| **Total with Contingency:** | **$1,613,220** | **$515,000** | **$2,128,220** | | **$5,339,020** |

The SVE System for the North Area soils will be limited to an 8000 sq.feet area encompassing the hottest soils. Duration is two years.

**TABLE 5.1**

**DETAILED EVALUATION SUMMARY**
**VAC AIR ALLOYS DIVISION**
**FREWSBURG, NEW YORK**

| *Evaluation Criteria* | *Alternative 4A-R* | *North Soil Area Alternative 1* | *North Soil Area Alternative 2* | *North Soil Area Alternative 3A* | *North Soil Area Alternative 3B* | *North Soil Area Alternative 4* |
|---|---|---|---|---|---|---|
| **Overall Protection of Human Health and Environment** | | | | | | |
| • Reduction of Risks to Chemicals in | | | | | | |
| - Groundwater | Yes | Yes | Yes | Yes | Yes | Yes |
| - Surface Water | Yes | Yes | Yes | Yes | Yes | Yes |
| - Soil | Yes | Yes | Yes | Yes | Yes | Yes |
| • Use of Site After Remediation | Restricted | Restricted | Restricted | Restricted | Restricted | Restricted |
| **Compliance with SCGs** | | | | | | |
| • Chemical-Specific SCGs | | | | | | |
| - Groundwater | No | No | No | No | No | No |
| - Surface Water | Yes | Yes | Yes | Yes | Yes | Yes |
| - Air | Yes | Yes | Yes | Yes | Yes | Yes |
| - Soil | No | No | No | Yes | Yes | No |
| • Action-Specific SCGs | Yes | Yes | Yes | Yes | Yes | Yes |
| • Location-Specific SCGs | Yes | Yes | Yes | Yes | Yes | Yes |
| **Reduction of Toxicity, Mobility and Volume** | | | | | | |
| • Quantity of Chemicals Treated or Destroyed in | | | | | | |
| - Soils | Moderate | Low | Low | High | High | Moderate |
| - Groundwater | High | Moderate | Moderate | High | High | High |
| • Disposition of Treatment Residuals | On-Site Treatment | On-Site Treatment | On-Site Treatment | On-Site Treatment | On-Site Treatment | On-Site Treatment |
| **Long-Term Effectiveness and Permanence** | | | | | | |
| • Permanence of Remedial Alternative | | | | | | |
| - Chemicals in Soil | Not Permanent | Not Permanent | Not Permanent | Permanent (1) | Permanent (1) | Not Permanent |
| - Chemicals in Groundwater | Permanent (2) | Not Permanent | Not Permanent | Permanent | Permanent | Permanent (2) |
| • Satisfaction of Remedial Action Objectives | Yes | Yes | Yes | Yes | Yes | Yes |
| • Adequacy and Reliability of Controls After Remediation | High | High | High | High | High | High |

**TABLE 5.1**

**DETAILED EVALUATION SUMMARY**
**VAC AIR ALLOYS DIVISION**
**FREWSBURG, NEW YORK**

| *Evaluation Criteria* | *Alternative 4A-R* | *North Soil Area Alternative 1* | *North Soil Area Alternative 2* | *North Soil Area Alternative 3A* | *North Soil Area Alternative 3B* | *North Soil Area Alternative 4* |
|---|---|---|---|---|---|---|
| **Short-Term Effectiveness and Permanence** | | | | | | |
| • Significant Short-Term Effects to Community, Environment, or Workers | Low | Low | Low | Moderate | Moderate | Low |
| • Time Until Response Options Acheived | Low | Low | Low | Moderate | Moderate | Low |
| **Implementability** | | | | | | |
| • Technical Feasibility | | | | | | |
| - Difficulty in Construction | Low | Low | Low | Moderate | Moderate | Low |
| - Potential for Delays Due technical Problems | Moderate | Moderate | Moderate | High | High | Moderate |
| • Level of Coordination with Agencies | Low | Low | Low | Moderate | Moderate | Low |
| • Availability of Services and Materials | High | High | High | Moderate | Low | High |
| **Costs ($1,000)** | | | | | | |
| • Capital Costs | 1,737 | 1,390 | 1,582 | 2,859 | 3,942 | 1,828 |
| • Operation and Maintenance ($/Year) | 417 | 365 | 377 | 443 | 341 | 406 |
| • Total Present Worth (Discount Rate of 7%) | 4,896 | 4,438 | 4,775 | 5,703 | 6,684 | 4,811 |
| • With Barrier Wall Contingency | 5,761 | 5,304 | 5,303 | 6,569 | 7,550 | 5,339 |

Notes:

(1) Treated soils are subject to passive recontamination from the residual contaminants in the groundwater.
(2) Treated groundwater is subject to recontamination from the residual contaminants in the soil.

**TABLE 5.2**

**COST COMPARISON**
**VAC AIR ALLOYS DIVISION**
**FREWSBURG, NEW YORK**

| *Alternative* | *North Soil Area Remedy Component* | *Total Capital Cost* | *Total O&M Cost* | *Total Net Present Worth* |
|---|---|---|---|---|
| 4A - revised | - SVE entire area concurrent with Center Soil area<br>- SVE for eight years<br>- DNAPL recovery | $2,700,000 | $3,500,000 | $5,700,000 |
| North Soil Area 1 | - DNAPL recovery | $1,900,000 | $3,400,000 | $5,300,000 |
| North Soil Area 2 | - DNAPL recovery<br>- barrier wall | $1,900,000 | $3,400,000 | $5,300,000 |
| North Soil Area 3A | - excavation of entire area<br>- on-Site ex situ SVE<br>- backfill treated soil in excavation | $3,300,000<br><br>($5,200,000)(2) | $3,300,000 | $6,600,000<br><br>($8,800,000) (2) |
| North Soil Area 3B | - excavation of entire area<br>- on-Site LTTD<br>- backfill treated soil in the excavation | $4,400,000<br><br>($6,100,000) | $3,100,000 | $7,500,000<br><br>($9,300,000) |
| North Soil Area 4 | - SVE in target area for two years<br>- DNAPL recovery<br>- barrier wall | $2,100,000 | $3,200,000 | $5,300,000 |

Notes:

(1) Cost includes contingency barrier wall
(2) Cost includes contingency for air emissions control

# APPENDIX A

# DETAILED COST ESTIMATES

**TABLE A-1**

**DETAILED COST ESTIMATE**
**UV OXIDATION TREATMENT SYSTEM WITHOUT NORTH SOIL AREA TREATMENT**
**VAC AIR ALLOYS DIVISION**
**FREWSBURG, NEW YORK**

| *Components* | *Unit* | *Quantity* | *Unit Cost* | *Direct Capital Costs* | *Indirect Capital Costs* | *Total Capital Costs* | *Annual O & M Costs* | *Net Present Worth (1)* |
|---|---|---|---|---|---|---|---|---|
| ***UV Oxidation Treatment System*** | | | | | | | | |
| Bench scale testing | L.S. | 1 | $10,000 | $10,000 | | $10,000 | | $10,000 |
| UV Oxidation system | L.S. | 1 | $125,000 | $125,000 | | $125,000 | | $125,000 |
| Tanks/piping/filter/pumps | L.S. | 1 | $40,000 | $40,000 | | $40,000 | | $40,000 |
| Instrumentation/elec. | L.S. | 1 | $25,000 | $25,000 | | $25,000 | | $25,000 |
| Civil/mechanical | L.S. | 1 | $50,000 | $50,000 | | $50,000 | | $50,000 |
| Installation | L.S. | 1 | $40,000 | $40,000 | | $40,000 | | $40,000 |
| Pretreatment units (pH adjust.) | L.S. | 1 | $60,000 | $60,000 | | $60,000 | | $60,000 |
| Liquid phase carbon (backup) | L.S. | 1 | $70,000 | $70,000 | | $70,000 | | $70,000 |
| Design & Engineering | % | | | | $65,000 | $65,000 | | $65,000 |
| Power Supply at $0.08/KWH | L.S. | 1 | $16,000 | | | | $16,000 | $198,600 |
| Liquid phase carbon | L.S. | 1 | $38,600 | | | | $38,600 | $478,900 |
| Sludge disposal | L.S. | 1 | $30,000 | | | | $30,000 | $372,000 |
| Chemicals (hydrogen peroxide) | L.S. | 1 | $10,000 | | | | $10,000 | $124,100 |
| Operator labor | L.S. | 1 | $40,000 | | | | $40,000 | $496,400 |
| Misc. parts & materials | L.S. | 1 | $16,000 | | | | $16,000 | $198,600 |
| ***Total Costs:*** | | | | **$420,000** | **$65,000** | **$485,000** | **$150,600** | **$2,353,600** |

Note:

(1) Net present worth is calculated using a 7 percent compound interest factor and an operational life of 30 years.

TABLE A-2

DETAILED COST ESTIMATE
UV OXIDATION TREATMENT SYSTEM WITH NORTH SOIL AREA TREATMENT
VAC AIR FEASIBILITY STUDY
FREWSBURG, NEW YORK

| *Components* | *Unit* | *Quantity* | *Unit Cost* | *Direct Capital Costs* | *Indirect Capital Costs* | *Total Capital Costs* | *Annual O & M Costs* | *Net Present Worth (1)* |
|---|---|---|---|---|---|---|---|---|
| *UV Oxidation Treatment System* | | | | | | | | |
| Bench scale testing | L.S. | 1 | $10,000 | $10,000 | | $10,000 | | $10,000 |
| UV Oxidation system | L.S. | 1 | $50,000 | $50,000 | | $50,000 | | $50,000 |
| Tanks/piping/filter/pumps | L.S. | 1 | $30,000 | $30,000 | | $30,000 | | $30,000 |
| Instrumentation/elec. | L.S. | 1 | $25,000 | $25,000 | | $25,000 | | $25,000 |
| Civil/mechanical | L.S. | 1 | $50,000 | $50,000 | | $50,000 | | $50,000 |
| Installation | L.S. | 1 | $25,000 | $25,000 | | $25,000 | | $25,000 |
| Pretreatment units (pH adjust.) | L.S. | 1 | $60,000 | $60,000 | | $60,000 | | $60,000 |
| Liquid phase carbon (backup) | L.S. | 1 | $20,000 | $20,000 | | $20,000 | | $20,000 |
| Design & Engineering | % | | | | $65,000 | $65,000 | | $65,000 |
| Power Supply at $0.08/KWH | L.S. | 1 | $7,000 | | | | $7,000 | $86,900 |
| Liquid phase carbon | L.S. | 1 | $32,000 | | | | $32,000 | $397,000 |
| Sludge disposal | L.S. | 1 | $30,000 | | | | $30,000 | $372,000 |
| Chemicals (hydrogen peroxide) | L.S. | 1 | $5,000 | | | | $5,000 | $62,000 |
| Operator labor | L.S. | 1 | $40,000 | | | | $40,000 | $496,400 |
| Misc. parts & materials | L.S. | 1 | $12,000 | | | | $12,000 | $148,900 |
| *Total Costs:* | | | | **$270,000** | **$65,000** | **$335,000** | **$126,000** | **$1,898,200** |

Note:

(1) Net present worth is calculated using a 7 percent compound interest factor and an operational life of 30 years.

TABLE A-3

DETAILED COST ESTIMATE
NORTH AREA TARGET SOILS - SOIL VAPOR EXTRACTION AND TREATMENT SYSTEM
VAC AIR FEASIBILITY STUDY
FREWSBURG, NEW YORK

| *Components* | *Unit* | *Quantity* | *Unit Cost* | *Direct Capital Costs* | *Indirect Capital Costs* | *Total Capital Costs* | *Annual O & M Costs* | *Net Present Worth (1)* |
|---|---|---|---|---|---|---|---|---|
| ***Soil Vapor Extraction & Treatment System*** | | | | | | | | |
| Pre-design pilot test | L.S. | 1 | $40,000 | $40,000 | | $40,000 | | $40,000 |
| Surface Asphalt (120' x 100') | sq. yd. | 1,333 | $8 | $10,667 | | $10,667 | | $10,667 |
| Install extraction wells | Each | 14 | $1,500 | $21,000 | | $21,000 | | $21,000 |
| Install injection wells | Each | 6 | $800 | $4,800 | | $4,800 | | $4,800 |
| Underground piping | L.F. | 1,200 | $40 | $48,000 | | $48,000 | | $48,000 |
| Blowers and equipment | L.S. | 1 | $20,000 | $20,000 | | $20,000 | | $20,000 |
| CAT-OX, scrubber, 250 cfm | L.S. | 1 | $160,000 | $160,000 | | $160,000 | | $160,000 |
| Instrumentation/elec. | L.S. | 1 | $7,500 | $7,500 | | $7,500 | | $7,500 |
| Civil/mechanical | L.S. | 1 | $10,000 | $10,000 | | $10,000 | | $10,000 |
| Installation | L.S. | 1 | $7,500 | $7,500 | | $7,500 | | $7,500 |
| Design & Engineering | 20% | | | | $65,900 | $65,900 | | $65,900 |
| Utilities for SVE System | L.S. | 1 | $9,600 | | | | $9,600 | $17,350 |
| Utilities: Year 1-2 CAT-OX/scrubber system | L.S. | 1 | $21,500 | | | | $21,500 | $38,900 |
| Equipment maintenance | L.S. | 1 | $4,000 | | | | $4,000 | $7,200 |
| Operator labor | L.S. | 1 | $18,000 | | | | $18,000 | $32,550 |
| ***Total Costs:*** | | | | **$329,467** | **$65,900** | **$395,367** | **$53,100** | **$491,367** |

Note:

(1) Net present worth is calculated using a 7 percent compound interest factor and an operational life of 2 years.

TABLE A-4

SOIL - DETAILED COST ESTIMATE
NORTH AREA SUBSURFACE SOILS EXCAVATION AND ON-SITE TREATMENT WITH EX SITU SVE
VAC AIR FEASIBILITY STUDY
FREWSBURG, NEW YORK

| *Components* | *Unit* | *Quantity* | *Unit Cost* | *Direct Capital Costs* | *Indirect Capital Costs* | *Total Capital Costs* | *Annual O & M Costs* | *Net Present Worth (1)* |
|---|---|---|---|---|---|---|---|---|
| *Subsurface soils excavation and on-Site treatment* | | | | | | | | |
| Mobilization/startup | L.S. | 1 | $25,000 | $25,000 | | $25,000 | | $25,000 |
| Insurance | L.S. | 1 | $40,000 | $40,000 | | $40,000 | | $40,000 |
| Health and safety | L.S. | 1 | $20,000 | $20,000 | | $20,000 | | $20,000 |
| Site Preparation (2) | sq. ft. | 36,600 | $1 | $36,600 | | $36,600 | | $36,600 |
| Excavation (incl. dewatering) (3) | cu. yd. | 9,260 | $35 | $324,100 | | $324,100 | | $324,100 |
| Stockpile/SVE construction | cu. yd. | 9,260 | $20 | $185,200 | | $185,200 | | $185,200 |
| SVE Blower(s) & Tanks | each | 2 | $50,000 | $100,000 | | $100,000 | | $100,000 |
| Instruments & controls | L.S. | 2 | $5,000 | $10,000 | | $10,000 | | $10,000 |
| SVE emissions control (CAT-OX) | L.S. | 1 | $250,000 | $250,000 | | $250,000 | | $250,000 |
| Backfill treated soils | cu. yd. | 9,260 | $5 | $46,300 | | $46,300 | | $46,300 |
| Site restoration | sq. ft. | 36,600 | $1 | $36,600 | | $36,600 | | $36,600 |
| Staging area & weigh scales | L.S. | 1 | $20,000 | $20,000 | | $20,000 | | $20,000 |
| Analytical testing | L.S. | 1 | $40,000 | $40,000 | | $40,000 | | $40,000 |
| Demobilization/closeout | L.S. | 1 | $20,000 | $20,000 | | $20,000 | | $20,000 |
| Design & Engineering | % | | | | $160,000 | $160,000 | | $160,000 |
| Construction Management | % | | | | $110,000 | $110,000 | | $110,000 |
| Contingency Allowance | % | | | | $215,000 | $215,000 | | $215,000 |
| Operator Labor | Mons. | 8 | $4,500 | | | | $36,000 | $36,000 |
| CAT-OX Utilities | Mons. | 8 | $1,500 | | | | $12,000 | $12,000 |
| SVE Utilities | Mons. | 8 | $5,500 | | | | $44,000 | $44,000 |
| Aanlytical Testing | L.S. | 1 | $10,000 | | | | $10,000 | $10,000 |
| *Total Costs:* | | | | **$1,153,800** | **$485,000** | **$1,638,800** | **$102,000** | **$1,740,800** |
| Contingency for Fugitive Emissions Control: | | $2,200,000 | | | | | | |

Notes:

(1) Project duration estimated to be 8 months.
(2) Site Prepartion Area: Excavation (21,000) + stockpile (15,000). Includes removal of uncontaminated overburden.
(3) Water treatment for dewatering at on-Site water treatment system.

TABLE A-5

SOIL - DETAILED COST ESTIMATE
NORTH AREA SUBSURFACE SOILS EXCAVATION AND ON-SITE TREATMENT WITH LOW TEMPERATURE THERMAL DESORPTION
VAC AIR FEASIBILITY STUDY
FREWSBURG, NEW YORK

| *Components* | *Unit* | *Quantity* | *Unit Cost* | *Direct Capital Costs* | *Indirect Capital Costs* | *Total Capital Costs* | *Annual O & M Costs* | *Net Present Worth (1)* |
|---|---|---|---|---|---|---|---|---|
| *Subsurface soils excavation and on-Site treatment* | | | | | | | | |
| Mobilization/startup | L.S. | 1 | $70,000 | $70,000 | | $70,000 | | $70,000 |
| Insurance and Bonds | L.S. | 1 | $80,000 | $80,000 | | $80,000 | | $80,000 |
| Health and safety | Mon | 5 | $10,000 | $50,000 | | $50,000 | | $50,000 |
| Site Preparation (2) | sq. ft. | 36,600 | $1 | $36,600 | | $36,600 | | $36,600 |
| Civil/Mechanical/Electrical | L.S. | 30,000 | $1 | $30,000 | | $30,000 | | $30,000 |
| Excavation (incl. dewatering) (3) | cu. yd. | 9,260 | $35 | $324,100 | | $324,100 | | $324,100 |
| Thermal desportion | ton | 13,600 | $55 | $748,000 | | $748,000 | | $748,000 |
| Stack emissions control | L.S. | 1 | $250,000 | $250,000 | | $250,000 | | $250,000 |
| Backfill Treated soils | sq. yd. | 9,260 | $5 | $46,300 | | $46,300 | | $46,300 |
| Site restoration | sq. ft. | 36,600 | $1 | $36,600 | | $36,600 | | $36,600 |
| Ambient air monitoring | L.S. | 1 | $20,000 | $20,000 | | $20,000 | | $20,000 |
| Staging area & weigh scales | L.S. | 1 | $20,000 | $20,000 | | $20,000 | | $20,000 |
| Analytical testing | L.S. | 1 | $40,000 | $40,000 | | $40,000 | | $40,000 |
| Demobilization/closeout | L.S. | 1 | $50,000 | $50,000 | | $50,000 | | $50,000 |
| Design & Engineering | % | | | | $360,000 | $360,000 | | $360,000 |
| Construction Management | % | | | | $180,000 | $180,000 | | $180,000 |
| Contingency Allowance | % | | | | $360,000 | $360,000 | | $360,000 |
| *Total Costs:* | | | | **$1,801,600** | **$900,000** | **$2,701,600** | **$0** | **$2,701,600** |

Contingency for Fugitive Emissions Control $1,730,000

Notes:

(1) Project duration estimated to be 5 months.
(2) Site Preparation Area: Excavation (21,000) + Stockpile (15,000). Includes removal of uncontaminated overburden.
(3) Water Treatment for dewatering at on-Site water treatment system.