

RECORD OF DECISION AMENDMENT #2

**FOR
OPERABLE UNIT 2 (OU2):**

SITE I GROUNDWATER

**NEW BRIGHTON/ARDEN HILLS SUPERFUND SITE
ARDEN HILLS, MINNESOTA**

May 2009

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1.0 INTRODUCTION

This decision document amends the 1997 Record of Decision (ROD) for Operable Unit 2 (OU2) (U.S. Army Environmental Command [USAEC], 1997). There was a previous amendment to the OU2 ROD in 2007, so this decision document is referred to as Amendment #2. This decision document presents the amended selected remedial action for Site I at the New Brighton/Arden Hills (NB/AH) Superfund Site, also known as the Twin Cities Army Ammunition Plant (TCAAP), located in Arden Hills, Minnesota. The Superfund site includes TCAAP (a former small arms ammunition plant) as well as portions of several surrounding residential communities. The NB/AH site was placed on the National Priorities List (NPL) for cleanup in September 1983 and is CERCLIS # MN7213820908. Figure 1 shows the site location map. Figure 2 shows the TCAAP Site Layout.

Under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA), 42 U.S.C. §9601, et seq., and Executive Order 12580, the United States Army (Army) is the lead federal agency for remedial actions at the site. All remedial actions are subject to the provisions of the Federal Facilities Agreement (FFA) among the Army, U.S. Environmental Protection Agency (USEPA) and the Minnesota Pollution Control Agency (MPCA).

This decision document was developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), the Minnesota Environmental Response and Liability Act, and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) promulgated in Title 40 of the Code of Federal Regulations (CFR) Part 300 (40 CFR 300). Specifically, this decision document has been prepared in compliance with CERCLA Section 117 and the NCP in 40 CFR 300.435(c)(2)(ii). This decision is based on the Administrative Record file for OU2 within NB/AH Superfund Site.

The NB/AH Superfund Site has been divided into three Operable Units. OU1 consists of the North Plume of off-TCAAP contaminated groundwater. OU2 consists of affected environmental media on the original TCAAP facility. OU3 consists of the South Plume of off-TCAAP contaminated groundwater.

1.1 Proposed Changes in the Remedies

The 1997 OU2 ROD selected a remedy for shallow groundwater at Site I that included the following: groundwater monitoring, shallow groundwater extraction and discharge to a Publicly Owned Treatment Works (POTW), and characterization of the Unit 1 and Unit 2 soil and groundwater. Based on the results of further investigations at Site I, the groundwater extraction and discharge portion of the selected remedy was found to be ineffective, given the geologic conditions of the Site that limited groundwater extraction rates.

Through the results of field studies (discussed herein) conducted at Site I, the Army has determined that a modification to the selected remedy is necessary.

The proposed change is:

- The removal of the “shallow groundwater extraction and discharge to a POTW” elements of the 1997 OU2 ROD for Site I shallow groundwater,
- Implement Land Use Controls (LUCs) to prohibit water supply wells within the plume,
- Implement LUCs to protect the groundwater monitoring infrastructure, and
- Implement LUCs to prevent human exposure to the contaminated soils that remain beneath Building 502.

The proposed remedy is not expected to take appreciably longer than the original selected remedy to meet all applicable or relevant and appropriate requirements (ARARs), given the technical constraints on groundwater extraction. For the purposes of estimating the costs of the different alternatives, the Army assumes a time frame of 30 years to achieve the ARARs.

1.2 Procedures for Changing the Remedies and Documenting a No Further Action

Under Section 117 of CERCLA and Section 300.435(c)(2)(ii) of the NCP, if the remedial action differs significantly with respect to the scope, performance or cost from a final ROD, the Lead Agency shall either issue an explanation of the significant differences with the reasons such changes were made or propose an amendment to the ROD if the basic features of remedy are fundamentally altered in regard to scope, performance or cost. The decision to change the remedies for Site I constitutes such a fundamental difference, necessitating the issuance of a new proposed plan and an amended ROD.

This ROD Amendment and all supporting documents will become part of the NB/AH Administrative Record file in accordance with Section 300.825(a)(2) of the NCP. The Administrative Record is available during business hours and is located at:

Twin Cities Army Ammunition Plant Office
470 West Highway 96, Suite 100
Shoreview, MN 55126

2.0 BACKGROUND

The NB/AH site consists of a 25-square-mile area located in Ramsey County, Minnesota (Figure 1). This includes the 4-square-mile area of the original TCAAP facility and portions of seven nearby communities: New Brighton, Arden Hills, St. Anthony, Shoreview, Mounds View, Columbia Heights, and Minneapolis. TCAAP is a former small arms ammunition manufacturing plant.

TCAAP was constructed in 1941 to produce small-caliber ammunition for the United States military. Production activities included manufacturing small arms ammunition and related materials, proof-testing small arms ammunition and items as required, and handling and storing strategic and critical materials for other government agencies. Ammunition production and related activities have occurred periodically, commensurate with operations in wars, conflicts, and other national emergencies. Information from past studies indicates that between 1941 and 1981, waste materials such as volatile organic compounds (VOCs), heavy metals, corrosive materials, and explosives were used and disposed at a number of locations within TCAAP. The use and disposal of these materials at TCAAP resulted in soil, groundwater, surface water and sediment contamination at the facility.

2.1 Site History – Site I

Site I consists of Building 502 and its associated structures, facilities, and surrounding property. Site I occupies approximately 43 acres and is approximately 700 feet north of the southern boundary of TCAAP. Building 502 was constructed in 1942 to produce small arms ammunition, and in 1944 was converted to produce artillery projectiles. International Harvester Company operated Building 502 until August 1945. After World War II, Building 502 was processed for standby status, and a portion of the building was used to store some Ordnance Corps Industrial Reserve machines. In December 1951, the Moline Company began to use Building 502 to manufacture and store for shipment artillery ammunition components.

Honeywell began operations in Building 502 in December 1958 for general metalworking activities, including manufacturing ordnance items such as non-explosive components of 30-mm ammunition. Alliant was divested by Honeywell as a separate company in September 1990. Alliant discontinued manufacturing at Building 502 in 2004. The building remains in place and is vacant.

Soluble and quench oils were used in Building 502 in the 1940s and 1950s. Oils were distributed throughout the building by a piping system routed in floor trenches. In the 1960s, part of the floor trench was converted to a TCE distribution system, which included a 28,000-gallon storage tank.

The primary contaminant identified in the Unit 1 (shallow) groundwater at Site I is TCE. Some breakdown products of TCE have also been detected, often at concentrations higher than TCE. The source of TCE in shallow groundwater has been attributed to leakage from the distribution system that served Building 502.

2.2 Site I Geology/Hydrology

Surficial soil deposits at Site I are referred to as Unit 1 soils and are composed of fine sands and silts with some organic material. These deposits occur, both naturally and as fill associated with past construction activities, and are generally less than 40 feet thick. A shallow water table aquifer (Unit 1 aquifer) exists within these soil/fill materials over portions of the western side of Site I. Figure 3 shows the plan view of the Site. Figure 4 shows a geologic cross-section depicting the various geologic units present at Site I.

Unit 1 soils are underlain by Unit 2, an aquitard consisting of the Twin Cities Till; a regionally extensive, low permeability, clay till. Unit 2 varies in thickness from 0 to 30 feet and historical soil boring data indicate that Unit 2 is at least discontinuous, if not completely absent, immediately northeast of Building 502 at Site I (see Figure 4). Below Unit 2 is the Arsenal Sand/Hillside Sand formation known as Unit 3. Unit 3 is approximately 227 feet thick and overlies bedrock (Unit 4), which consists of the Prairie du Chien and Jordan Sandstone formations with a thickness of approximately 130 feet. The Unit 3 aquifer is a regionally extensive sand and gravel aquifer and is considered part of the deep groundwater system at TCAAP, along with the deeper Prairie du Chien and the Jordan Sandstone.

The depth to Unit 1 groundwater is typically within 10 feet of the ground surface. There appears to be little horizontal flow within Unit 1, because the wells at the perimeter of Site I are dry. The water appears to be ponded under the western portion of the building on top of the Unit 2 till where it slowly flows downward through Unit 2 soils into Unit 3 soils and eventually encounters the Unit 3 aquifer. Based on previous investigations, the Unit 1 groundwater at Site I is discontinuous and does not extend off Site I.

The elevation of the top of Unit 2 is irregular and varies greatly across Site I. This is clearly shown in the attached Figure 5 depicting the "Top of Clay Contours" and in the Figure 4 cross-section. As such, it appears that the groundwater in the Unit 1 aquifer is pooled within depressions in the clay surface and is effectively limited from horizontal migration. A depression in the till layer observed near the western edge of the building (see Figures 4 and 5) is consistent with the area of observed groundwater at Site I. Higher elevations of the till layer in the areas south of Building 502 contain dry Unit 1 wells indicating a lack of groundwater.

The surface of the water table in Unit 3 is approximately 100 feet below ground surface (BGS) and the aquifer is unconfined with an unsaturated zone immediately below Unit 2. The aquifer becomes confined toward the west. Groundwater in Unit 3 flows west-southwest.

2.3 1997 OU2 ROD-Selected Remedy

Site I is identified in the 1997 OU2 ROD as a shallow groundwater site. The selected remedy in the 1997 OU2 ROD for Site I required the following components:

- Groundwater monitoring to track remedy performance;
- Use of an existing well to remove impacted Unit 1 groundwater;
- POTW discharge of extracted groundwater; and
- Additional characterization of the Unit 1 and Unit 2 soil and groundwater.

3.0 BASIS FOR THE FUNDAMENTAL CHANGE TO THE SELECTED REMEDY

In January 1997, Alliant retained Conestoga-Rovers & Associates (CRA) to conduct a Source Investigation of the shallow soil and groundwater at Site I. As required by the 1997 OU2 ROD, this investigation characterized the Unit 1 and Unit 2 soil and groundwater for the purpose of identifying potential sources of contamination. Next, the Predesign Investigation Work Plan for Site I was prepared noting that due to the thin discontinuous nature and low permeability of the shallow aquifer, groundwater recovery would be limited with traditional extraction wells. It was also reported that the applicability of air sparging would be questionable due to the same characteristics. Consequently, dual phase vacuum extraction was evaluated because it combines the benefits of SVE and vacuum enhanced groundwater extraction.

In March 2001, CRA completed a “*Dual Phase Vacuum Extraction Pilot Study, Predesign Investigation Report*” for Site I (CRA, 2001). Figure 6, taken from that report, is included and depicts the equipment layout for the study. The Dual Phase Vacuum Extraction (DPVE) pilot study was conducted at existing monitoring well 01U667 (known in the pilot study as the test well). During the Source Investigation, the highest VOC concentration was located in the shallow soil and groundwater in the area where 01U667 is located (see Figure 4). The screen of 01U667 is located in the water-bearing unit where the contamination that is targeted for remediation is located. Before the test, four monitoring probes were installed within 40 feet of 01U667 to measure the potential effects of DPVE on the surrounding subsurface.

The pilot study was operated in two stages, with a different method of groundwater extraction in each stage. During the first stage, groundwater was removed through vacuum extraction (i.e., air and water removed through the same drop pipe). The first stage ran for two weeks, from March 23 through April 6, 2000. During the second stage, groundwater was removed with a bladder pump, while the vacuum applied to the test well removed primarily air. The second stage ran from April 7 through April 11, 2000.

Groundwater was measured for the quantity of water removed and the VOC concentration in the extracted groundwater. Groundwater samples were collected for analysis before system startup and at the end of the test. Samples were collected directly from the test well while the system was turned off. Groundwater samples were analyzed for the Site I list of VOCs by USEPA Method 8260. Other measurements recorded during the test included: air flow rate, vacuum applied at the well and monitoring probes, and photoionization detector measurements in the exhaust gas and monitoring probes.

The most prominent result of the pilot study was that the vacuum applied at the test well did not affect the monitoring probes. Two measurements of this were the lack of vacuum observed in the probes and the constant or increasing water levels in the probes. During the test, no vacuum was measured in any of the probes. This would indicate the presence of very tight soils in the test well and monitoring probes that are not very conducive to soil gas removal or groundwater extraction technologies.

Approximately 325 gallons of water were removed during the first two weeks and another 109 gallons were removed during the last four days, when the vacuum on the test well was increased.

The calculated flow rates during these times were 0.96 gallons per hour (gph) and 1.17 gph. The higher vacuum placed on the well resulted in the greater flow rate; however, both flow rates were very low.

Based on the approximately 1.0 gph groundwater extraction rate observed during the pilot study and the lack of negative pressure observed in the monitoring probes located in close proximity to the test well, it appears that groundwater extraction, soil vapor extraction, and DPVE would not be effective in remediating shallow soil and groundwater at Site I.

The ineffectiveness of the DPVE pilot study is most likely the result of the heterogeneity of the soil and fill materials on-Site. Based on the well logs and geologic cross-section, there is significant heterogeneity within the clayey soils between the fine sand and the clay till. These clayey soils contain the groundwater that is the target of the remediation. Sandy clay lenses, peat, and saturated zones are not continuous within a 5 to 20-foot area. In addition, the depth to the Unit 2 till varies from 30 feet bgs at the test well, to 17 feet bgs 20 feet from the test well, back down to 22 feet bgs 40 feet from the test well. In addition there is a 10-foot drop in groundwater level between SVP-3 and SVP-4 (20 feet apart). There is a thin unit of perched groundwater within the fine sand on top of the clayey soils at approximately 10 feet bgs. This perched groundwater unit was not observed at SVP-4.

The perched groundwater unit within the fine sand is not significantly impacted compared to the groundwater monitored by 01U667 and is not the goal of the remediation beneath Building 502. The clayey soils between the fine sand and the clay till, where the pilot test was targeted, had the highest level of contamination. However, this location has fairly tight soils that are not favorable for groundwater extraction or soil vapor extraction.

As discussed earlier, the Unit 1 aquifer under Building 502 is discontinuous and does not flow horizontally off Site I. While vertical migration occurs, the bulk of the contamination has already migrated to the Unit 3 aquifer in the 30 to 40 years since the release occurred, and current vertical migration is probably minor compared to the existing contamination of the Unit 3 aquifer. In addition, contaminants in the Unit 3 aquifer below Site I are contained by the TCAAP Groundwater Recovery System (TGRS). See attached Figure 7 for the location of Site I in relation to the TGRS. Contaminant concentrations in the Unit 3 aquifer have decreased significantly under Site I since the TGRS began operation, indicating that the contribution of contaminants from the source has been eliminated or reduced significantly. Figure 8 shows a graph comparing the TCE concentrations from wells B1 and SC1 that extract groundwater in the Unit 3 downgradient from Site I.

Figure 9 shows a graph of historical TCE, cis-1,2-dichloroethene and vinyl chloride concentrations versus time since 1989 at well 01U064. This well is located next to Building 502 and has been consistently sampled. As shown, there is a general decrease in the main contaminants in Site I groundwater. Also, cis-1,2-dichloroethene and vinyl chloride were detected in the groundwater samples at higher concentrations than TCE.

Based on the findings of the additional investigations, active groundwater removal previously selected for Site I should not be implemented and the ROD is being amended to reflect the change.

The elimination of active groundwater removal will still be protective of public health. As stated on Page 44 of the 1997 OU2 ROD (Page 44) regarding the long term effectiveness of the No Action Alternative (Alternative 1):

“The shallow groundwater at Site I is contained in a depression in the surface of the Unit 2 and does not flow horizontally and; therefore, does not flow off Site I but trickles down to the more highly contaminated Unit 3 groundwater. As long as the TGRS is operational there is no risk of exposure to Site I shallow groundwater contaminants”.

The major differences between the 1997 OU2 ROD and this ROD Amendment for Site I are summarized as follows:

1997 OU2 ROD	Investigation Results and/or Remedial/Removal Actions	2008 OU2 ROD Amendment
<p><u>Site I</u> Groundwater monitoring, Unit 1 groundwater extraction, POTW discharge, and additional characterization of the Unit 1 and Unit 2 soil and groundwater.</p>	<p>The required characterization was completed in 1997. A 2000 pilot study for groundwater and/or vapor extraction determined that the low permeability soils make extraction infeasible. Monitoring has shown that contaminant concentrations are decreasing and minimal downward migration is contained by the TGRS Unit 3 groundwater remedy.</p>	<p>Remove groundwater extraction and POTW discharge component of remedy. Continue to rely on the TGRS as a component of the remedy. Implement LUCs to 1) prohibit water supply wells within the plume, 2) protect the groundwater monitoring infrastructure, and 3) prevent human exposure to contaminated soils remaining beneath Building 502.</p>

4.0 DESCRIPTION OF REMEDY CHANGES

The remedy selected in the 1997 OU2 ROD included shallow groundwater extraction and discharge to a POTW. The observed ineffectiveness of soil vapor removal technology and the very low groundwater extraction rate obtained during the pilot test indicate that groundwater extraction, soil vapor extraction, or DPVE would not advance the attainment of the cleanup criteria for Site I. Moreover, the geological data for Site I indicate that the affected Unit 1 groundwater is most likely migrating vertically through Unit 2 into Unit 3 and eventually to the Unit 3 aquifer. There are no data to indicate that affected Unit 1 groundwater is migrating horizontally away from Site I.

Thus, the new proposed remedy differs significantly from the 1997 OU2 ROD in that aggressive shallow groundwater extraction (and discharge to the POTW) is NOT recommended. However, the Site I groundwater remedy will continue to rely on operation of the TGRS to capture contamination that migrates downward. The other elements of the 1997 OU2 ROD, including shallow groundwater monitoring, remain intact in the ROD amendment. The proposed remedy would also include LUCs to 1) prohibit water supply wells within the plume, 2) protect the groundwater monitoring infrastructure, and 3) prevent human exposure to contaminated soils that remain beneath Building 502.

General LUCs would include actions to be taken by the Army while the property is under Federal control, and if transferred from Federal control, then deed restrictions and State Environmental Covenants. The Army has already been restricting installation of water supply wells, avoiding land uses that could potentially disturb the groundwater monitoring system, and avoiding land uses that could result in human exposure to contaminated soil beneath Building 502.

LUCs will be maintained until the concentration of hazardous substances in the soil and/or groundwater is reduced to levels that allow for unlimited use and unrestricted exposure. The anticipated LUC area encompasses the area of Site I. The Remedial Design (RD) will include a detailed map or a descriptive survey plan with specific locations and design details for each LUC. If the site is subsequently remediated to unrestricted use, the LUCs can be changed or eliminated in the future, provided that the landowner demonstrates that the property is suitable for unrestricted (or less restricted) use and obtains the approval of Army, USEPA, and MPCA. CERCLA 121(c) five-year reviews will be conducted to assess the long-term effectiveness of the remedy, including LUCs. Additional reviews will be conducted to the extent that they are required by the land use control remedial design (LUCRD) document.

The LUCRD will be submitted in accordance with the RD schedule provisions of the FFA and will include a LUC component describing the details of LUC implementation and maintenance, including periodic inspections. The Army shall be responsible for implementation, maintenance, periodic reporting, and enforcement of LUCs in accordance with the LUCRD. Although the Army may transfer these responsibilities to another party by contract, property transfer agreement, or through other means, the Army shall remain ultimately responsible for remedy integrity to include: (1) CERCLA 121(c) five year reviews; (2) notification of the appropriate regulators and/or local government representatives of any known LUC deficiencies or violations; (3) reservation of access to the property to conduct any necessary response; (4) the ability to change,

modify or terminate LUCs and any related deed or lease provisions with the concurrence of the USEPA and MPCA and (5) ensure that the LUC objective is met to maintain remedy protectiveness.

As a condition of property transfer or lease, the Army may require the transferee or lessee in cooperation with other stakeholders to assume responsibility for various implementation actions. Third party LUC responsibility will be incorporated into pertinent contractual, property and remedial documentation, such as a purchase agreement, deed, lease, and RD addendum. To the extent permitted by law, a transfer deed shall require the LUCs imposed as part of a CERCLA remedy to run with the land and bind all property owners and users.

Because the Army intends to transfer ownership, the Army shall, if Federal and/or State law allows, upon transfer of fee title grant the State an environmental covenant or easement that would allow the State to enforce LUC terms and conditions against the transferee(s), as well as subsequent property owner(s) or user(s) or their contractors, tenants, lessees or other parties. This covenant will be incorporated by reference in the transfer deed and will run with the land in accordance with State realty law. This state enforcement right would supplement, not replace, the Army's and USEPA's right and responsibility to enforce the LUCs.

The change in the remedy should have little effect on the Remedial Action Objectives (RAOs). There are four RAOs that apply to the shallow groundwater within the TCAAP boundaries that are designed to protect human health and the environment from exposure to contaminants:

- Prevent human exposure to water contaminated with carcinogens in excess of ARARs and having a total excess cancer risk for all contaminants of greater than 10^{-4} to 10^{-6} .
- Prevent human exposure to water contaminated with concentrations of non-carcinogens in excess of ARARs and having a threshold non-cancer hazard index greater than 1.0.
- Contain and control contaminated groundwater in the shallow Unit 1 groundwater aquifer to prevent further spreading and minimize the level of contaminants through mass removal.
- Restore the contaminated aquifers to concentrations below ARARs and to-be-considered guidance (TBCs) with regulator approval.

Potential human exposure to the groundwater is limited because the majority of the contamination is beneath Building 502 (as shown on Figure 10, vinyl chloride concentrations in groundwater extend just beyond the Building 502 perimeter). As discussed, shallow groundwater does not flow horizontally off Site I, but does migrate slowly down to the Unit 3 aquifer where it is contained by the TGRS. There are no users of the shallow groundwater within the Site I boundaries, and implementation of groundwater use controls would further protect against the risk of human exposure. Pumping the shallow groundwater would have potentially sped up the cleanup process if it had worked; however, analytical data indicates that natural attenuation is occurring in the shallow aquifer resulting in decreasing concentrations of chemicals of concern. The remediation has an assumed 30 year (plus) time frame for achieving ARARs whether the aquifer is pumped (especially at a rate of 1 gph) or not.

Therefore, the groundwater extraction component of the remedy will be removed. The other components of the remedy shall continue including shallow groundwater monitoring to ensure that contaminated groundwater does not migrate horizontally off Site without warning. Additionally, continued operation of the TGRS in the vicinity of Site I will guarantee that any contaminated

groundwater that migrates down to Unit 3 will be captured and treated. Groundwater use controls will also be implemented to prohibit use or access to contaminated groundwater.

4.1 Comparative Analysis

The amended remedy as presented in this ROD Amendment is nearly the same as the No Action alternative (Alternative 1) presented and discussed in the 1997 OU2 ROD. Based on the engineering data presented in this document, all of the technical advantages cited for the alternatives (Alternatives 2-4) that considered groundwater extraction/treatment as a key element are no longer viewed as implementable, effective, or able to achieve reduction in toxicity, mobility or volume. This has been demonstrated through findings that groundwater extraction is not technically feasible at Site I, primarily due to geologic conditions.

A brief comparison of the amended alternative and the original alternative, based on the information obtained from the studies completed since the 1997 OU2 ROD was signed, against the nine evaluation criteria is presented below:

Overall Protection of Human Health and the Environment

The amended remedy is protective of human health and the environment due to continued groundwater monitoring, the lack of a completed exposure pathway (prevented through LUCs), and continued operation of the TGRS in the vicinity of Site I. While the affected groundwater is not actively removed, its presence will not harm human health or further damage environmental media. The original remedy would have been no more protective than the amended remedy.

Compliance with ARARs

Because contaminants of concern would remain above cleanup levels in the Site I shallow groundwater within the foreseeable future, the amended remedy will take longer to comply with ARARs. However, the time frame to achieve ARARs is not expected to be appreciably different between the proposed remedy and the originally selected remedy given the technical constraints on groundwater extraction. Given the migration of contaminants to the Unit 3 aquifer, where treatment occurs, cleanup levels will be achieved eventually. It is doubtful that the original remedy would have achieved ARARs within a much shorter time frame. Pump and treat remedies are typically expected to require more than 30 years before cleanup levels are met. Their goal is to contain the plume and remove mass. With the new remedy, the groundwater is naturally contained by the depression in the Unit 2 clay and groundwater that migrates to the Unit 3 aquifer is contained by the TGRS, where mass is removed.

Long-Term Effectiveness

The amended remedy is effective at horizontally containing the shallow groundwater plume, and removing and treating, through the TGRS, contaminants that migrate to the Unit 3 aquifer. Removal and treatment of the contaminants by the TGRS is a permanent process. Also, contaminants that breakdown through the natural attenuation process are permanently altered. These same processes would have occurred under the original remedy. The DPVE pilot study proved that shallow groundwater extraction at Site I is not effective. However, the implementation of LUCs will prohibit the potential but unlikely human use of contaminated groundwater in the long term.

Reduction of Toxicity, Mobility, or Volume

The original remedy was expected to reduce the mobility and volume of contaminants by pumping contaminated groundwater from the shallow aquifer. However, pumping groundwater from the Site I shallow aquifer is not feasible because of the geology. This was the only advantage that the original remedy was expected to have over the amended remedy. The volume of contaminants will be reduced somewhat through the removal of contaminants by the TGRS.

Short-Term Effectiveness

Given that there are fewer components to implement with the amended remedy, there are fewer risks and a greater short-term effectiveness for the amended remedy than there was for the original remedy.

Implementability

A groundwater monitoring program is in place and the Units 1 and 2 characterization is complete. The requirement by the original remedy for extraction of contaminated groundwater is not technically feasible at Site I; as such, the amended remedy is more implementable than the original remedy. There will be some administrative effort to implement LUCs.

Cost

Obviously, the amended remedy will have a lower cost than the original remedy. The capital cost of constructing the pumping and piping system to extract the shallow groundwater is removed from the remedy. The costs to operate and maintain the pumping system and to discharge to the POTW for 30 years are also removed from the original remedy. There will be some administrative costs to implement LUCs. The only remaining cost is ongoing groundwater monitoring, which is equivalent for either remedy.

State Acceptance

The State has been consulted throughout this process and concurs with the selected alternative.

Community Acceptance

Compliance with the public participation requirements of Section 113(k)(2)(i-v) of CERCLA/SARA has been achieved for the New Brighton/Arden Hills Superfund Site by the following activities for this ROD Amendment:

- The Army has prepared an update to the Administration Record. The Administrative Record is located at 470 W. Highway 96, Suite 100, Shoreview, MN 55126.
- The Army placed a formal advertisement in the Minnesota Star Tribune on June 8, 2008 and in the Arden Hills/New Brighton Bulletin, and the Shoreview-Arden Hills Bulletin on June 11, 2008, and the Fridley Focus on June 12, 2008 announcing the availability of the Proposed Plan.
- Public comment on the Proposed Plan was solicited during a formal public comment period extending from June 11, 2008 to July 11, 2008.
- A public meeting was held on June 24, 2008 at Ramsey County Public Works/Partners Facility. Representatives of the Army, the EPA, and the MPCA were at the meeting to answer questions about the site and the changes to and additional remedial alternatives.
- Two members of the public attended the public meeting.

- No comments were received regarding the Amendment #2 for Site I during the public comment period.

4.2 Results of Comparison Using the Nine Criteria

Both alternatives meet the threshold criterion of providing protection of human health and the environment. Also both alternatives require 30 or more years to meet the ARARs.

The amended remedy is preferred by the balancing criteria. The amended remedy has a superior short-term effectiveness, is easier to implement, and has a lower cost. Given the technical infeasibility of groundwater extraction at Site I, both alternatives have equivalent long-term effectiveness and permanence, and reduction of toxicity, mobility, or volume.

4.3 Site I Amended Remedy

Therefore, the components of the amended selected remedy for Site I are:

- Groundwater monitoring – Groundwater monitoring for Site I will continue to be reported on and evaluated annually in the TCAAP Annual Performance Report.
- Additional characterization of the Unit 1 and Unit 2 soil and groundwater. This has already been completed and reported in the *Predesign Investigation Work Plan – Site I*.
- Implement LUCs to prohibit water supply wells within the plume.
- Implement LUCs to protect the groundwater monitoring infrastructure, and
- Implement LUCs to prevent human exposure to the contaminated soils that remain beneath Building 502.

5.0 STATUTORY DETERMINATIONS

This section discusses how the amended remedy for Site I meets the five statutory requirements established by Section 121 of CERCLA.

5.1 Protection of Human Health and the Environment

The amended remedy for Site I is protective of human health and the environment due to continued groundwater monitoring and the lack of a completed exposure pathway (ensured through LUCs). The contaminated groundwater is contained by a natural depression in the Unit 2 till. Groundwater that migrates to the Unit 3 aquifer is contained and treated by the TGRS.

5.2 Compliance with ARARs

Because COCs will remain above cleanup levels in the Site I shallow groundwater within the foreseeable future, the amended remedy will take longer, but not significantly longer to comply with ARARs. The DPVE pilot study concluded that it is technically infeasible to extract the contaminated groundwater from the Site I shallow aquifer.

5.3 Cost-Effectiveness

Section 300.430(f)(ii)(D) of the NCP requires evaluation of cost effectiveness. The only remaining cost to implementing the amended remedy is ongoing groundwater monitoring. The amended remedy is lower in cost because the capital cost of constructing the pumping and piping system to extract the shallow groundwater and operation and maintenance costs for the pumping system are eliminated from the remedy.

5.4 Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Possible


Because extraction of shallow groundwater at the Site is not feasible due to the Site geology, the solution proposed in the 1997 OU2 ROD became impractical.

5.5 Preference for Treatment as a Principal Element

Shallow groundwater from Site I that migrates to the Unit 3 aquifer is treated by the deep groundwater TGRS system. Studies have concluded that extracting shallow groundwater from Site I is not feasible; therefore, further treatment is not practical. Furthermore, active groundwater treatment is not necessary to provide protection of human health and the environment.

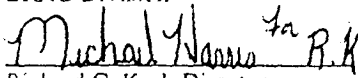
5.6 Five-Year Review Requirements

Because the remedy for the Site I will result in hazardous substances, pollutants, or contaminants remaining on site above levels that allow for unlimited use and unrestricted exposure, 5-year reviews under Section 121(c) of CERCLA and Section 300.430(f)(4)(ii) of the NCP are required.



Jeffrey Willis, Chief
Operational Army and Medical Branch
BRAC Division

9/22/2005
Date

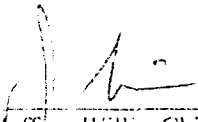


Richard C. Karl, Director
Superfund Division
U.S. Environmental Protection Agency, Region V

5/01/2009
Date

Kathryn Sather, Director
Remediation Division
Minnesota Pollution Control Agency

Date

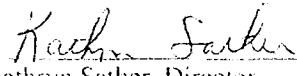


Jeffrey Willis, Chief
Operational Army and Medical Branch
BRAC Division

9/22/2008
Date

Richard C. Karl, Director
Superfund Division
U.S. Environmental Protection Agency, Region V

Date



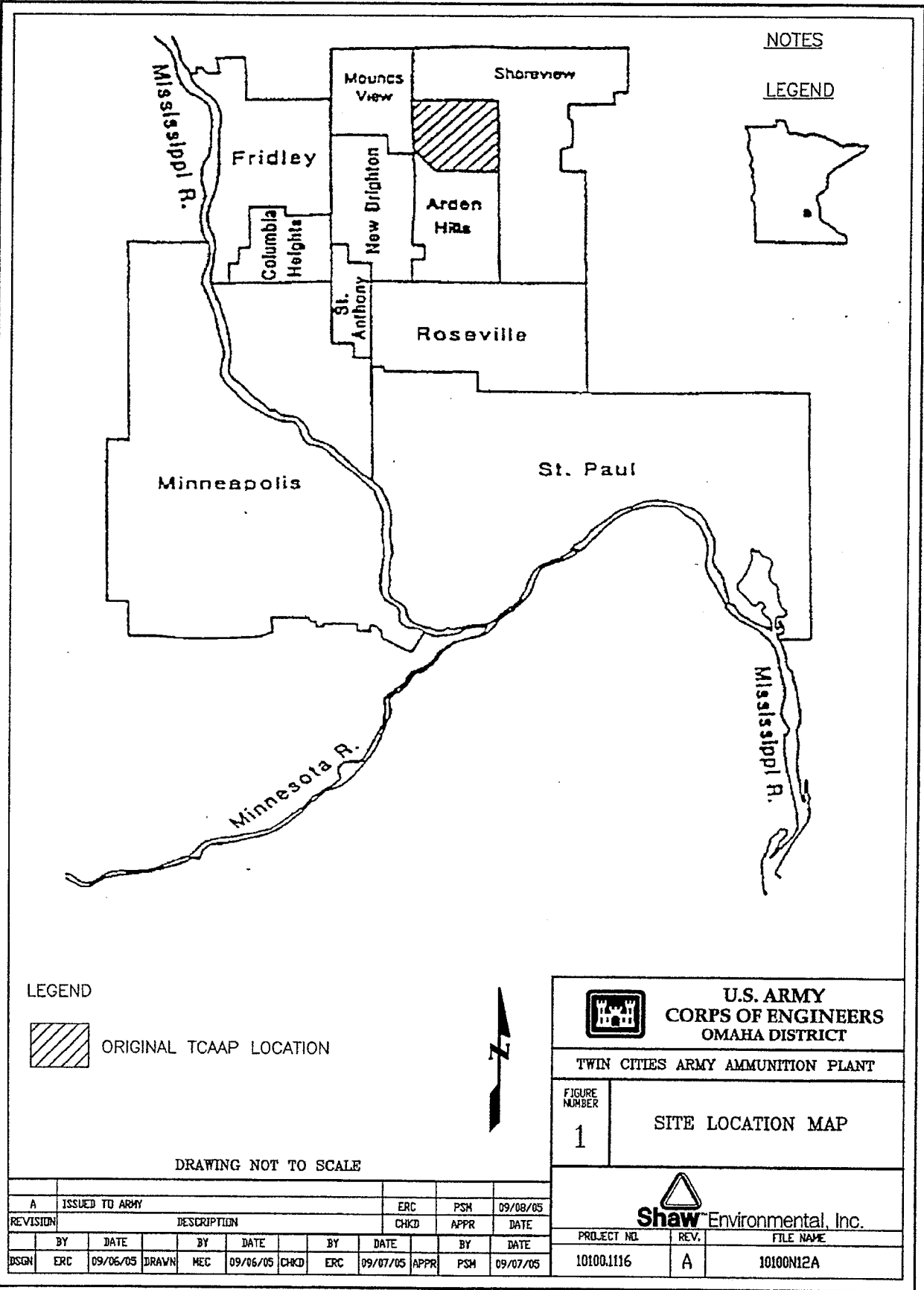
Kathryn Sather, Director
Remediation Division
Minnesota Pollution Control Agency

3/20/09
Date

FIGURES

FIGURES

FRI, SEP 15, 2005 09:27 A MEC O:\TCAAP\10100.1116\REV-A\10100N12A.DWG



NOTES

LEGEND



LEGEND



ORIGINAL TCAAP LOCATION



DRAWING NOT TO SCALE



**U.S. ARMY
CORPS OF ENGINEERS
OMAHA DISTRICT**

TWIN CITIES ARMY AMMUNITION PLANT

FIGURE
NUMBER

1

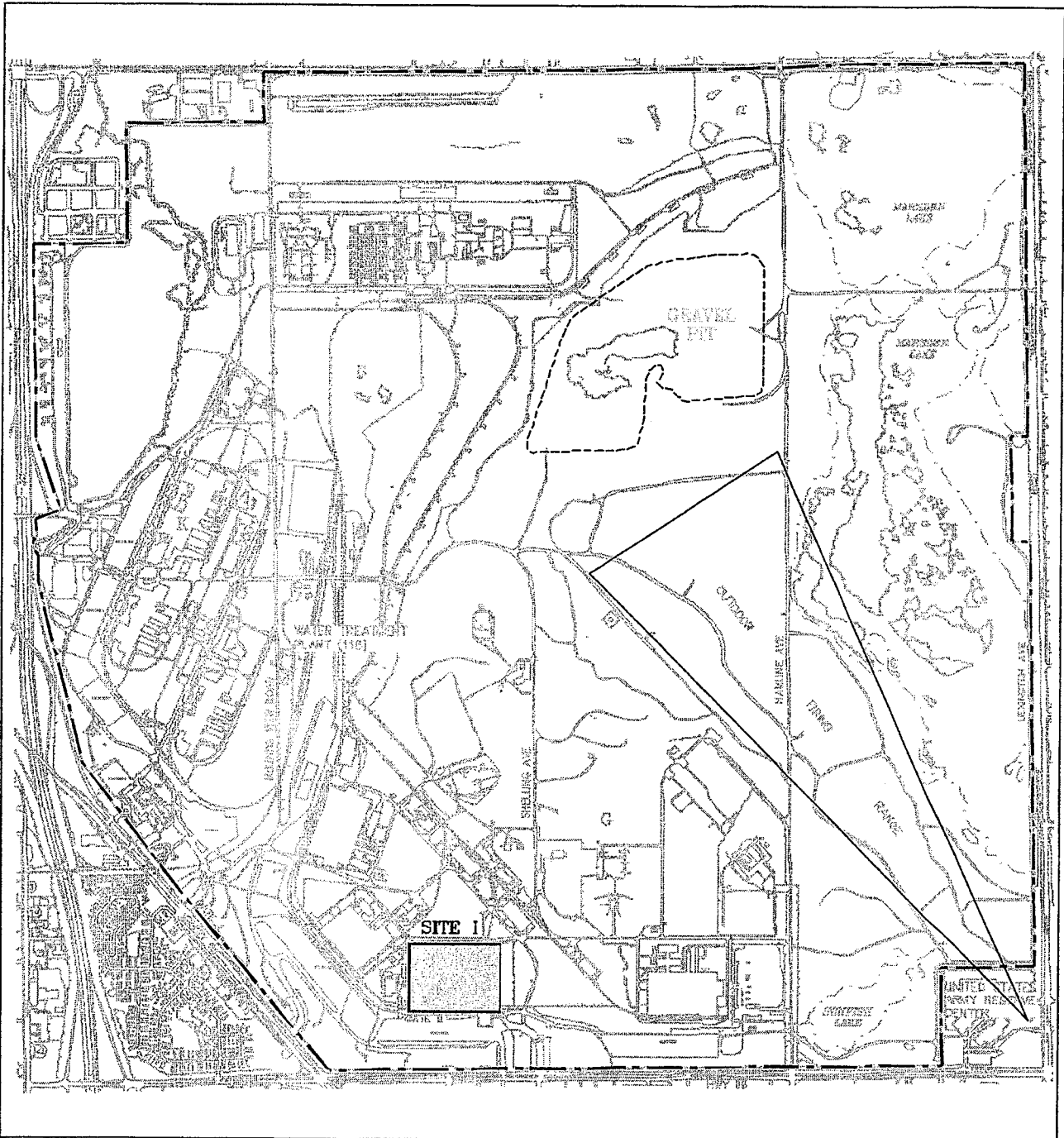
SITE LOCATION MAP

Shaw Environmental, Inc.

REVISION	BY	DATE	DESCRIPTION	BY	DATE	CHKD	APPR	DATE
A			ISSUED TO ARMY			ERC	PSM	09/08/05
DSGN	ERC	09/06/05	DRAWN	MEC	09/06/05	CHKD	ERC	09/07/05
							APPR	PSM
								09/07/05

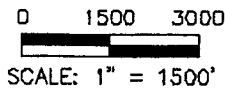
PROJECT NO.	REV.	FILE NAME
10100.1116	A	10100N12A

FRI, JAN 20, 2006 10:03 A MEC G:\TCAAP\Y10100.1504\REV-A\10100Y01A.DWG



LEGEND

- FORMER TCAAP BOUNDARY
- REMEDIATION SITES



**U.S. ARMY
CORPS OF ENGINEERS
OMAHA DISTRICT**

TWIN CITIES ARMY AMMUNITION PLANT

FIGURE
NUMBER

2

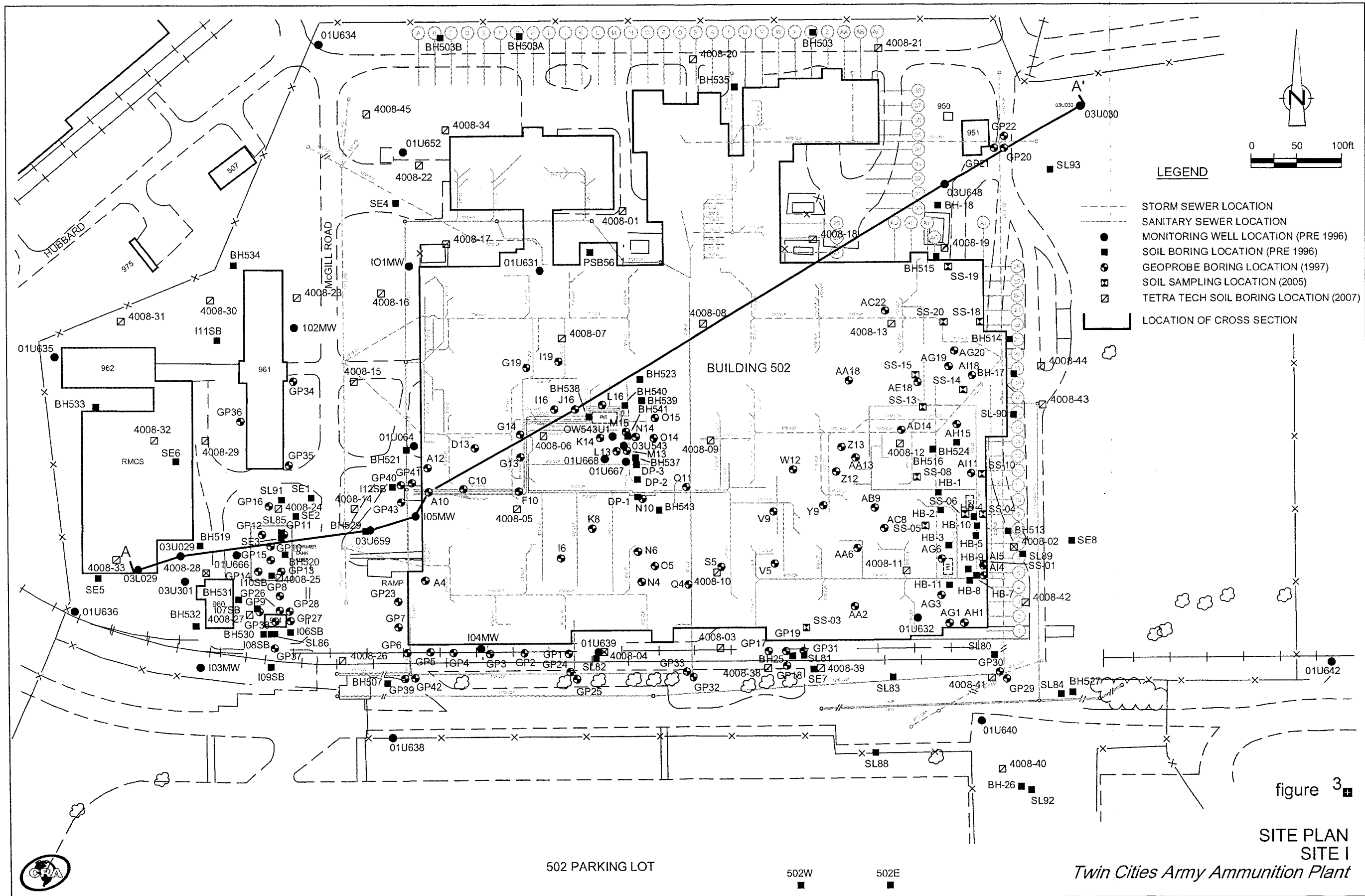
TCAAP SITE LAYOUT

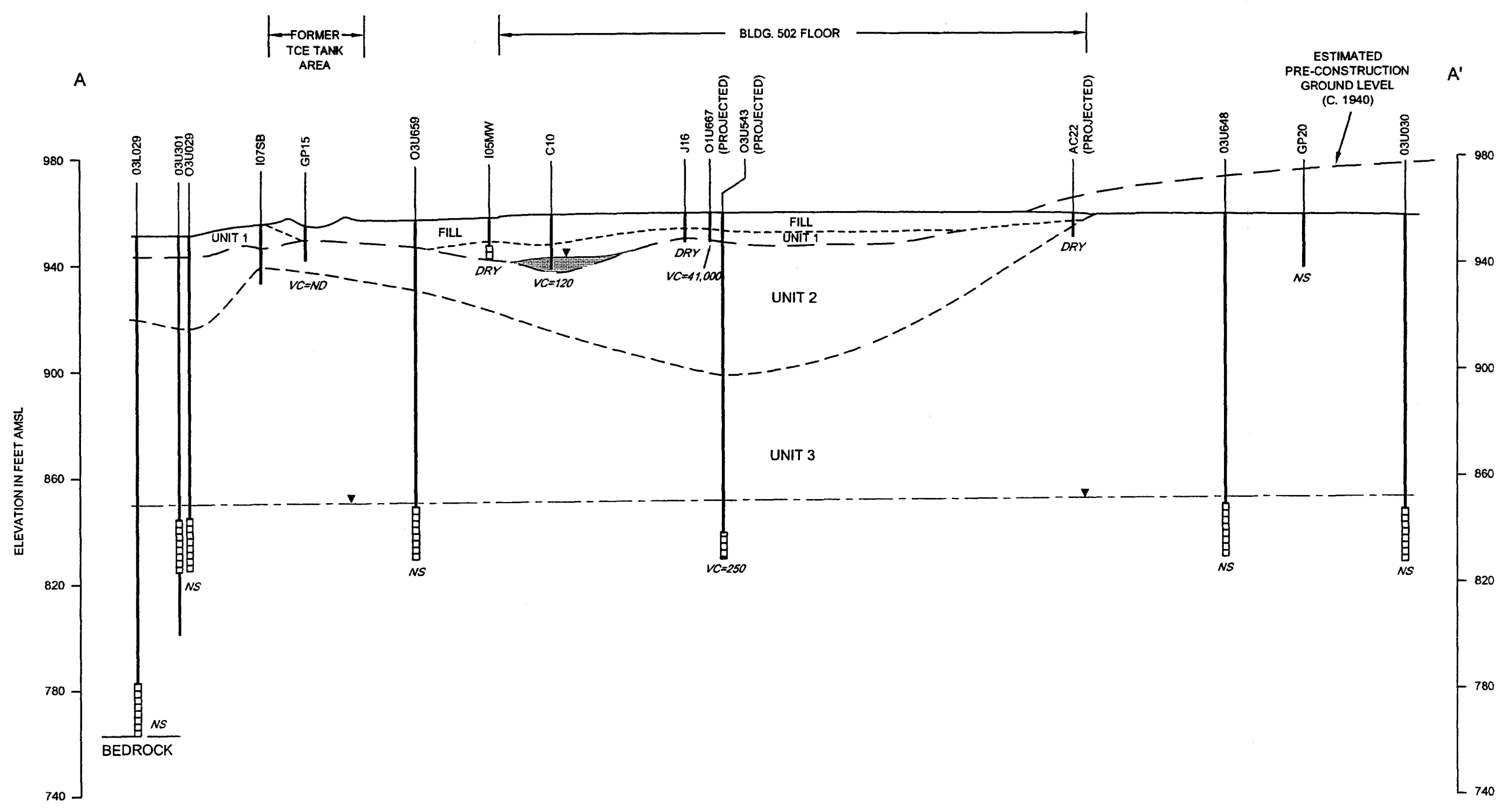


Shaw Environmental, Inc.

REVISION	BY	DATE	DESCRIPTION	CHKD	APPR	DATE	DPM	KR	DATE		
B			ISSUE TO ARMY						12/03/07		
A			ISSUE TO ARMY				ERC	PSM	01/20/08		
DSGN	ERC	01/20/08	DRAWN	MEC	01/20/08	CHKD	ERC	01/20/08	APPR	PSM	01/20/08

PROJECT NO.	REV.	FILE NAME
10100.1504	B	10100Y01B





- LEGEND**
- VC VINYL CHLORIDE CONCENTRATION (ug/L)
 - NS NOT SAMPLED AS PART OF SOURCE INVESTIGATION
 - ND NOT DETECTED
 - ▼ WATER LEVEL

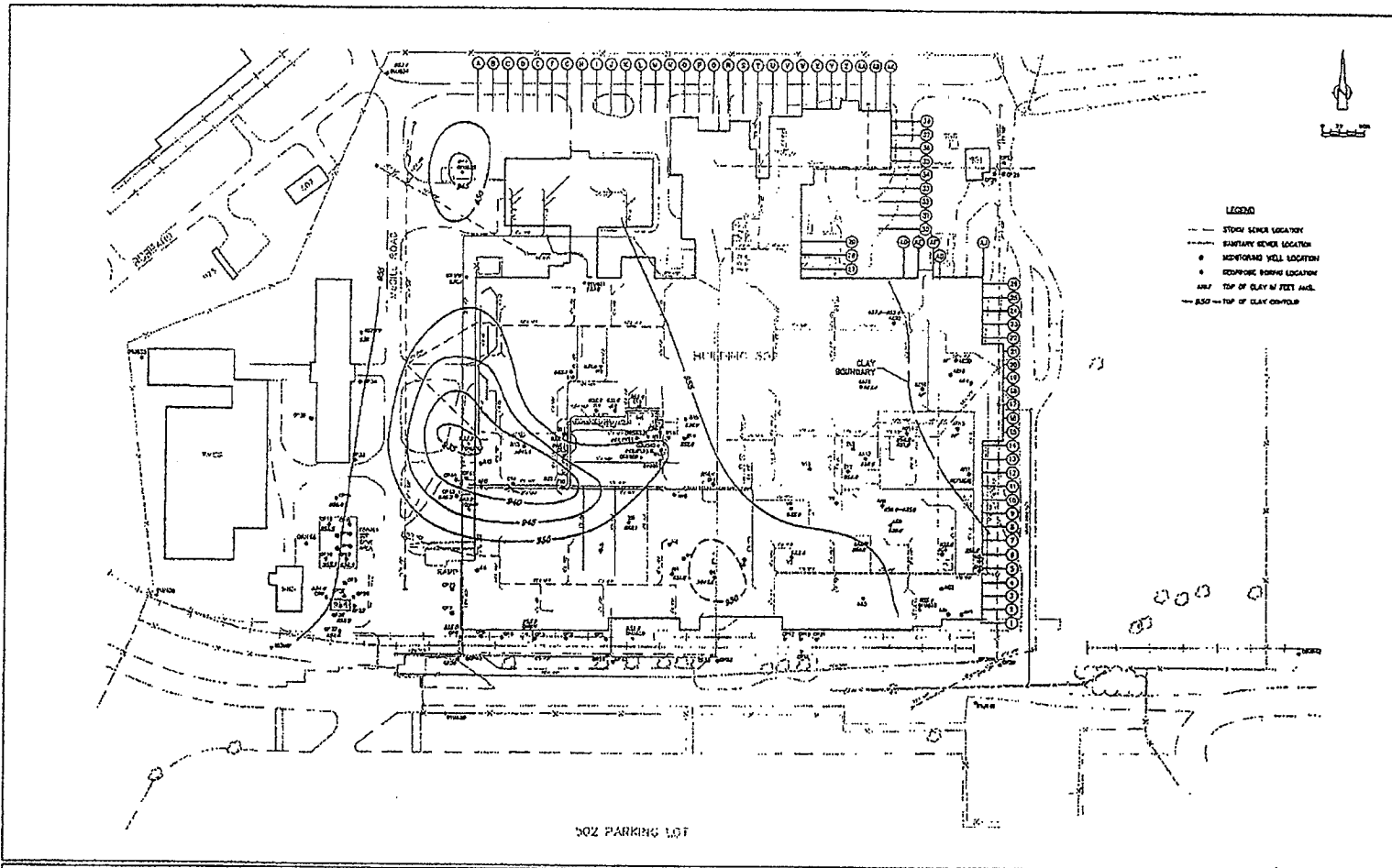
SCALE: 1"=100' HOR., 1"=40' VER.

FROM 1997 BUILDING 502 SOURCE INVESTIGATION

figure 4

GEOLOGIC CROSS SECTION A-A'
SITE I
Twin Cities Army Ammunition Plant





**SITE 1
TWIN CITIES ARMY AMMUNITION PLANT**

FIGURE 5

TOP OF UNIT 2 ELEVATIONS

Scale	Sheet	File No.	Proj. No.	Date	Drawn By
				Sheet No.	Total Sheets
				64304-00	1

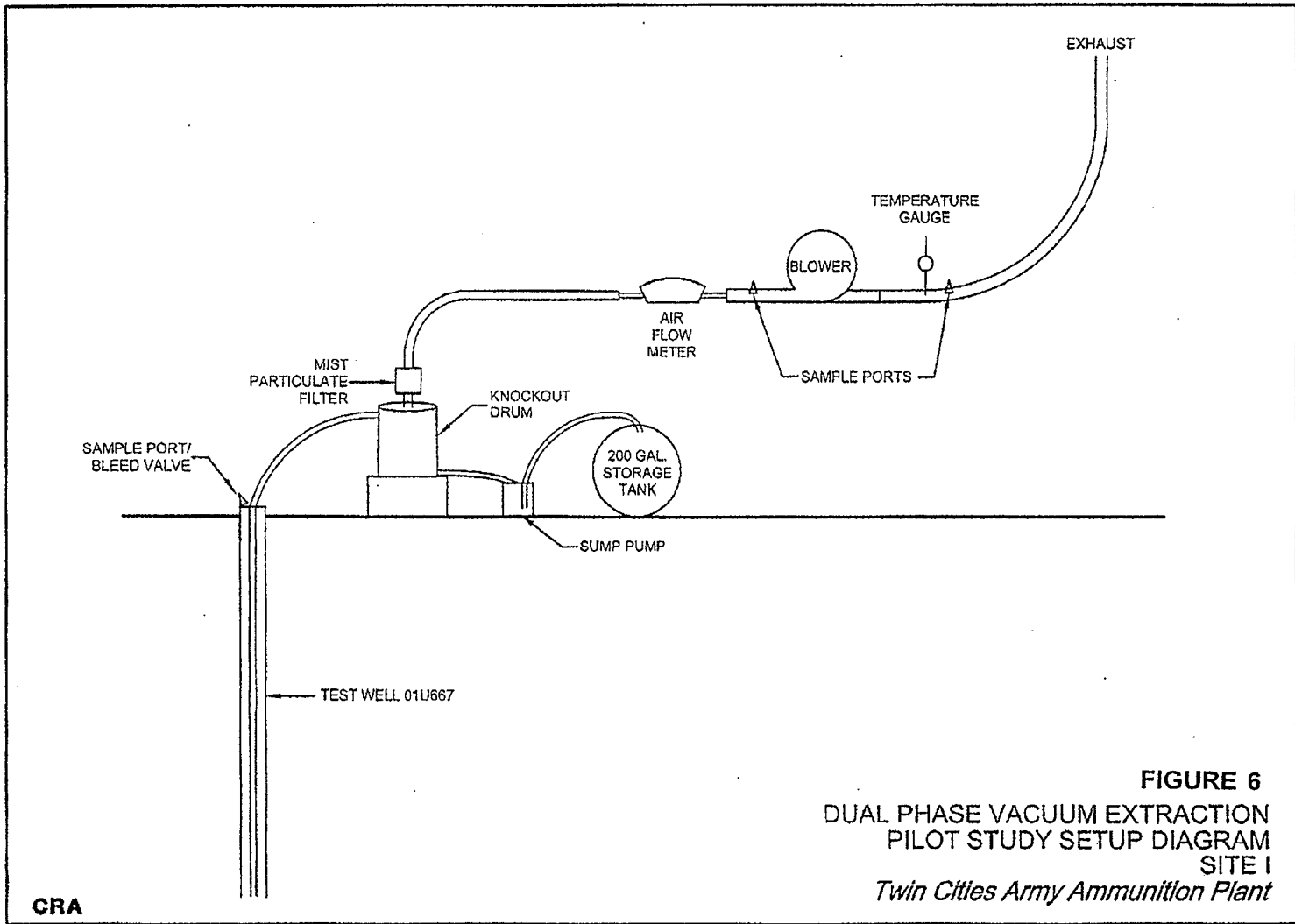
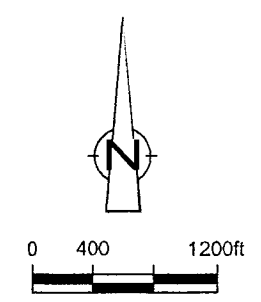
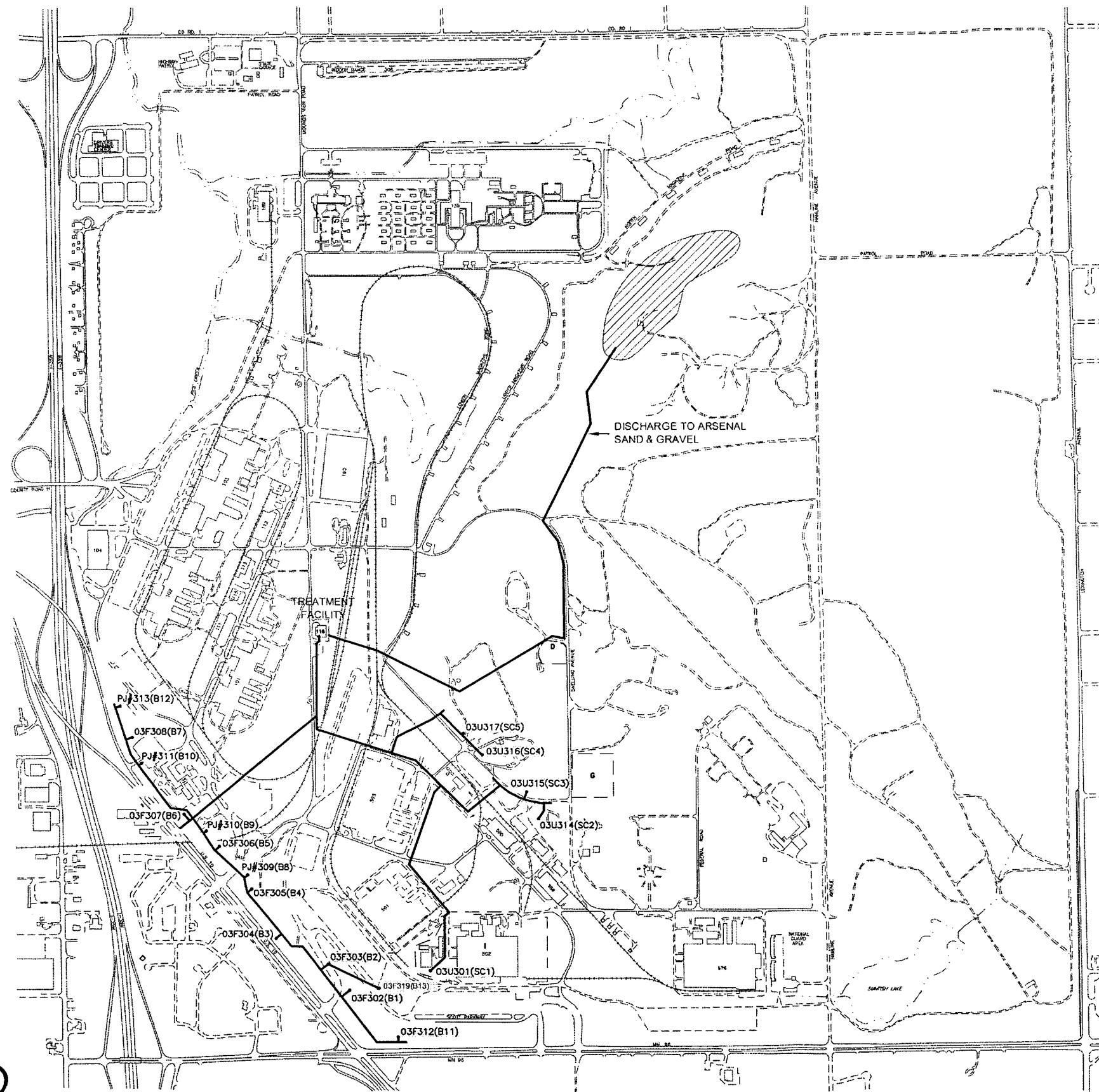


FIGURE 6
 DUAL PHASE VACUUM EXTRACTION
 PILOT STUDY SETUP DIAGRAM
 SITE I
Twin Cities Army Ammunition Plant

CRA



- LEGEND**
- ==== PRIMARY ROAD
 - SECONDARY ROAD
 - RAILROAD
 - DRAINAGE
 - ▭ BUILDING
 - ▭ BUILDING REMOVED
 - [- - -] SOURCE AREA
 - WELL LOCATION

EXTRACTION WELL NAME CROSS REFERENCE

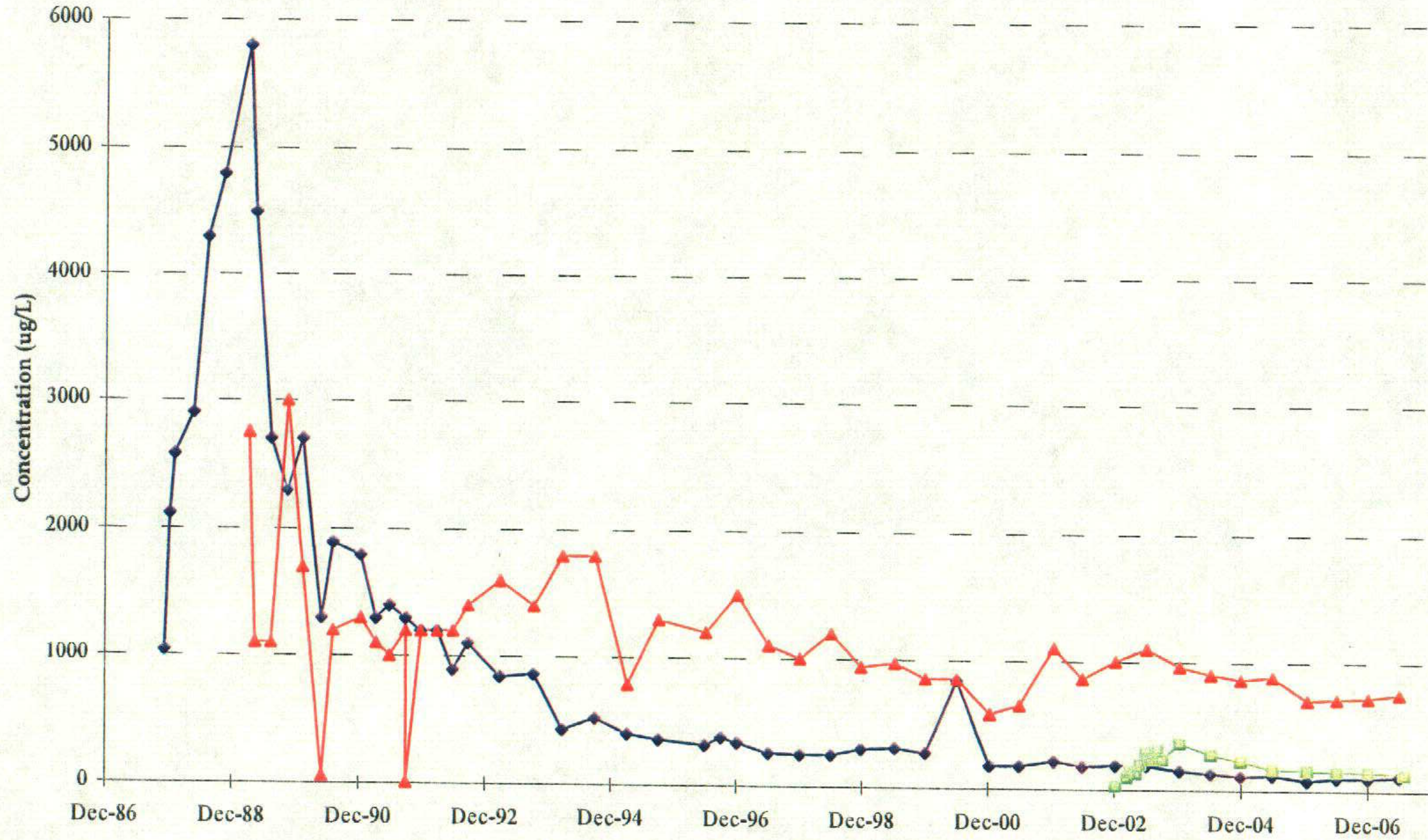
B1	03F302
B2	03F303
B3	03F304
B4	03F305
B5	03F306
B6	03F307
B7	03F308
B8	PJ#309
B9	PJ#310
B10	PJ#311
B11	03F312
B12	PJ#313
B13	03F319
SC1	03U301
SC2	03U314
SC3	03U315
SC4	03U316
SC5	03U317

figure 7

TGRS LAYOUT
 TWIN CITIES ARMY AMMUNITION PLANT
 Arden Hills, Minnesota



TCE VS. TIME



LEGEND

- ◆— B1
- B13
- ▲— SC1

figure 8

HISTORICAL TCE CONCENTRATIONS IN SELECT UNIT 3 WELLS

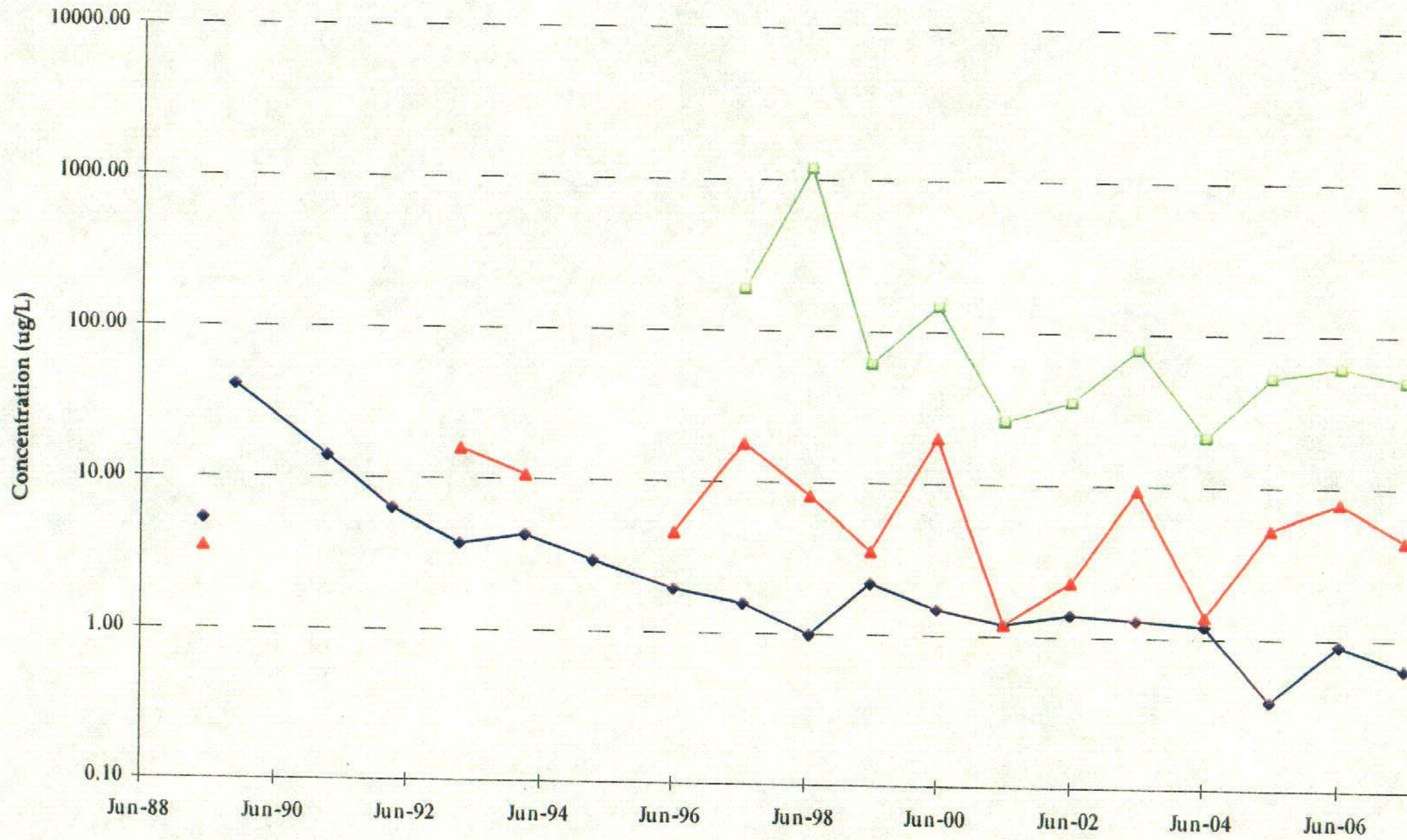
SITE I

TWIN CITIES ARMY AMMUNITION PLANT

Arden Hills, Minnesota



COCs VS. TIME



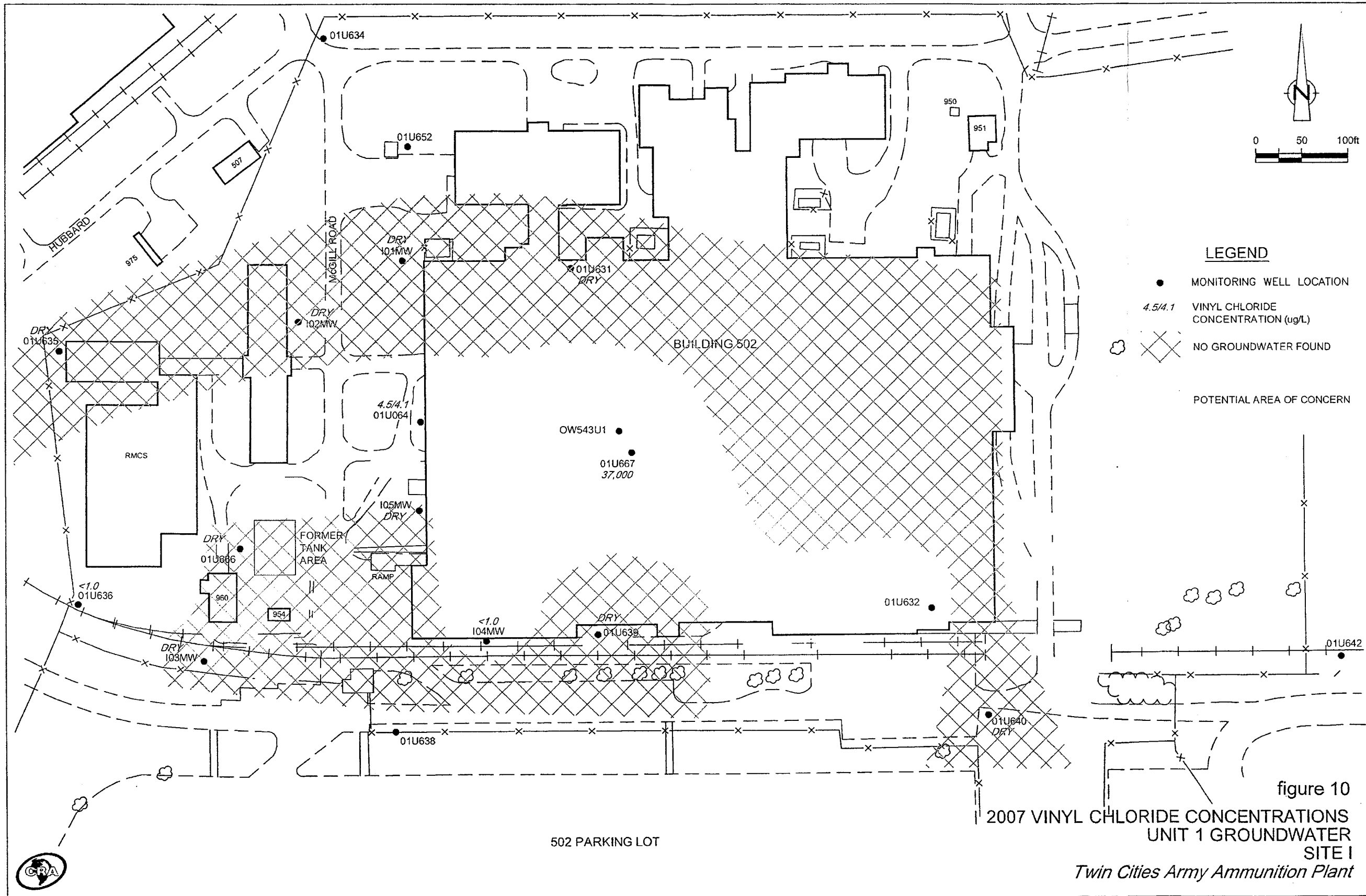
LEGEND

- ◆— TRICHLOROETHENE
- CIS-1,2,-DICHLOROETHENE
- ▲— VINYL CHLORIDE

figure 9

WELL 01U064 COC CONCENTRATIONS
SITE I
TWIN CITIES ARMY AMMUNITION PLANT
Arden Hills, Minnesota





APPENDIX A

APPENDIX A
RESPONSIVENESS SUMMARY

**RESPONSIVENESS SUMMARY
FOR
RECORD OF DECISION AMENDMENT #2
OPERABLE UNIT 2 – SITE I
NEW BRIGHTON/ARDEN HILLS SUPERFUND SITE
ARDEN HILLS, MINNESOTA**

OVERVIEW

This Responsiveness Summary was prepared to document and respond to issues and comments raised by the public regarding the Proposed Plan for Site I within Operable Unit 2 (OU2) of the New Brighton/Arden Hills Superfund Site. The preferred alternatives and the remedies selected in the Record of Decision (ROD) Amendment #2 are listed below:

- The removal of the “shallow groundwater extraction and discharge to a POTW” elements of the 1997 OU2 ROD for Site I shallow groundwater,
- Implement Land Use Controls (LUCs) to prohibit water supply wells within the plume,
- Implement LUCs to protect the groundwater monitoring infrastructure, and
- Implement LUCs to prevent human exposure to the contaminated soils that remain beneath Building 502.

A public meeting was held on June 24, 2008 at 7:00 p.m. at the Ramsey County Public Works/Partners Facility in Arden Hills, Minnesota to present the preferred alternatives to the public. No comments were received regarding the Amendment #2 for Site I during the public comment period, which began on June 11, 2008 and ended on July 11, 2008.

This Responsiveness Summary documents includes the following sections:

- Background on recent community involvement,
- Summary of comments received during the public comment period and response, and
- Remaining concerns.

BACKGROUND ON RECENT COMMUNITY INVOLVEMENT

The TCAAP Restoration Advisory Board (RAB) has been involved with the discussions regarding remedies for Site I since 1996.

Compliance with the public participation requirements of Section 113(k)(2)(i-v) of CERCLA/SARA has been achieved for the New Brighton/Arden Hills Superfund Site by the following activities for this ROD Amendment:

- The Army has prepared an update to the Administration Record. The Administrative Record is located at 470 W. Highway 96, Suite 100, Shoreview, MN 55126.
- The Army placed a formal advertisement in the Minnesota Star Tribune on June 8, 2008 and in the Arden Hills/New Brighton Bulletin, and the Shoreview-Arden Hills Bulletin on

June 11, 2008, and the Fridley Focus on June 12, 2008 announcing the availability of the Proposed Plan.

- Public comment on the Proposed Plan was solicited during a formal public comment period extending from June 11, 2008 to July 11, 2008.
- A public meeting was held on June 24, 2008 at Ramsey County Public Works/Partners Facility. Representatives of the Army, the EPA, and the MPCA were at the meeting to answer questions about the site and the changes to and additional remedial alternatives.
- Two members of the public attended the public meeting.
- No comments were received regarding the Amendment #2 for Site I during the public comment period.

The Proposed Plan for amended remedies at OU2 was published on June 16, 2008 and describes the preferred alternatives for Site I. Based upon consideration of the National Oil and Hazardous Substance Pollution Contingency Plan (NCP) criteria, the appropriate remedy for Site I is listed as follow:

- The removal of the “shallow groundwater extraction and discharge to a POTW” elements of the 1997 OU2 ROD for Site I shallow groundwater,
- Implement Land Use Controls (LUCs) to prohibit water supply wells within the plume,
- Implement LUCs to protect the groundwater monitoring infrastructure, and
- Implement LUCs to prevent human exposure to the contaminated soils that remain beneath Building 502.

SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND RESPONSE

No written comments were received regarding the Amendment #2 for Site I during the comment period.

REMAINING CONCERNS

There are no outstanding issues associated with implementation of the proposed remedial actions.

APPENDIX B

APPENDIX B
REFERENCES

REFERENCES

- Conestoga-Rovers & Associates (CRA). 1997. *Predesign Investigation Work Plan – Site I*.
- Conestoga-Rovers & Associates (CRA). 2001. *Dual Phase Vacuum Extraction Pilot Study, Predesign Investigation Report for Site I*. March 2001.
- Minnesota Pollution Control Agency (MPCA). 2001. Web site for Risk Based Guidance for Evaluating the Soil Leaching Pathway located at <http://files.pca.state.mn.us/pub/cleanup/slv.xls>.
- Montgomery Watson (MW). 1996. *Twin Cities Army Ammunition Plant Operable Unit 2 Feasibility Study Supplemental Data Report*. Prepared for U.S. Army Environmental Center. June 1996.
- Montgomery Watson and Conestoga Rovers Associates (MW). 1997. *Operable Unit 2 Feasibility Study, Final Report, Twin Cities Army Ammunition Plant, Arden Hills, Minnesota*. Prepared for U.S. Army Environmental Center and Alliant Techsystems, Inc. March 1997.
- U.S. Army Environmental Center, Environmental Restoration Division (USAEC). 1997. *Twin Cities Army Ammunition Plant, New Brighton/Arden Hills, Superfund Site, Operable Unit 2 Record of Decision*. December 1997.
- Wenck Associates, Inc. (Wenck). 2006. *Closeout Report: Removal of Contaminated Sediment at the 135 Primer/Tracer Area Stormwater Outfall*. Prepared for Twin Cities Army Ammunition Plant. January 2006.