

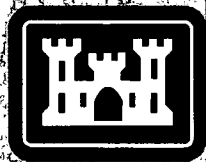
**Draft-Final  
Remedial Design/Remedial Action Plan**

**354 Area Solvent Detections  
(Operable Unit 005)**

At  
Main Post  
Fort Riley, Kansas

March 5, 2007

Prepared for



U.S. Army Corps of Engineers  
Kansas City District

Prepared by

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**List of Acronyms and Abbreviations**

1	354 Site (OU 005)	354 Area Solvent Detections (Operational Unit 005)
2		
3	ARAR	Applicable or Relevant and Appropriate Requirement
4		
5	BLRA	Baseline Risk Assessment
6	BMcD	Burns & McDonnell Engineering Company, Inc.
7	BRAC	Base Realignment and Closure
8		
9	CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
10	COC	Chemical of Concern
11	COPC	Chemical of Potential Concern
12		
13	DA	Department of the Army
14	DCE	cis-1,2-Dichloroethene
15	DCP	Data Collection Platform
16	DERA	Defense Environmental Restoration Account
17	DPW	Directorate of Public Works
18	DSR	Data Summary Report
19		
20	EAEST	EA Engineering, Science, and Technology, Inc.
21	EDG	Environmental Data Groupings
22		
23	Fe <sup>+2</sup>	Ferrous Iron
24	FFA	Federal Facility Agreement
25	FS	Feasibility Study
26	ft	Foot/feet
27		
28	HRS	Hazard Ranking System
29		
30	ISL	Identified Site List
31	IWSA	Installation-Wide Site Assessment
32		
33	KDHE	Kansas Department of Health and Environment
34		
35	LBA	Louis Berger & Associates
36		
37	MCL	Maximum Contaminant Level
38	MNA	Monitored Natural Attenuation
39	MP	Malcolm Pirnie
40	MPEO	Master Plan Environmental Overlay
41		
42	NCP	National Oil and Hazardous Substances Pollution Contingency Plan
43	NPL	National Priorities List
44		
45	O&M	Operation and Maintenance
46	OU	Operable Unit
47		
48		

**List of Acronyms and Abbreviations**

1	PCE	Tetrachloroethene (or Perchloroethene)
2	POL	Petroleum, Oil, and Lubricants
3	PWE	Directorate of Public Works – Environmental Division
4	QCSR	Quality Control Summary Report
5		
6	RA	Remedial Action
7	RAB	Restoration Advisory Board
8	RCRA	Resource Conservation and Recovery Act
9	RD	Remedial Design
10	RI	Remedial Investigation
11	ROD	Record of Decision
12	RPM	Remedial Project Manager
13	RPMP	Fort Riley Real Property Master Plan
14		
15	SOP	Standard Operating Procedure
16		
17	TCE	Trichloroethene
18	TCL	Target Compound List
19		
20	UPRR	Union Pacific Railroad
21	USACE	United States Army Corps of Engineers
22	USEPA	United States Environmental Protection Agency
23	UST	Underground Storage Tank
24		
25	VOC	Volatile Organic Compound
26		
27	µg/L	Micrograms per Liter
28		

## 1.0 INTRODUCTION

### 1.1 PURPOSE

The purpose of this Remedial Design (RD)/Remedial Action (RA) Plan for the 354 Area Solvent Detections (354 Site) (Operating Unit [OU] 005) at Fort Riley, Kansas is to present the remedial actions necessary to restore the site to a non-restricted use. While it is stated in the Record of Decision (ROD) in Section 2.8 page 2-25, that the United States Environmental Protection Agency's (USEPA's) policy is "...to return useable groundwaters to their beneficial uses wherever practicable...", it is also clearly stated on that same page, "As identified in the risk assessment, groundwater at the 354 Site (OU005) is not currently used as a drinking water source, nor is such use anticipated in the foreseeable future." Fort Riley possesses sufficient excess capacity from the existing supply wells to provide potable water for any foreseeable expansion on the post. Additionally, the evaluation of environmental risk concluded that there is no detrimental exposure to environmental receptors at the site." The principal threat at the 354 Site (OU 005) pertains to the hypothetical future use of site-impacted groundwater. This plan presents the procedures to implement monitored natural attenuation (MNA) with institutional controls in accordance with the ROD and Applicable or Relevant and Appropriate Requirements (ARARs).

### 1.2 BACKGROUND

The 354 Site (OU 005) is located at the Main Post cantonment area of the Fort Riley Military Installation, which is located in Geary County, near Junction City. Main Post is in the southern region of Fort Riley, north of the Kansas River (Figures 1-1 and 1-2).

The 354 Site (OU 005) currently encompasses portions of the Main Post as far north as Godfrey Avenue, and virtually the entire point bar south of the Union Pacific Railroad (UPRR) grade and east of the Henry Drive Bridge. This point bar and an ancient alluvial terrace dominate the topography across this area. The point bar is part of the active floodplain and consists of approximately 60 feet (ft) of alluvial sediments overlying shale or limestone bedrock. The terrace, located to the north of the railroad grade, also consists of alluvial sediments deposited on shale and limestone bedrock; however, this area is topographically higher than the floodplain and the unconsolidated terrace deposits vary in thickness from nine to 64 ft.

The former Building 354 was constructed in 1935 as a gasoline service station. In addition to gasoline and diesel fuel, it may have been subsequently used as a storage site for solvents and road oil. Two 10,000-gallon steel underground storage tanks (USTs), one 12,800-gallon steel UST, and one 8,500-gallon steel

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---

1 UST were installed at the 354 Site (OU 005) circa 1935 (United States Army Corps of Engineers  
2 [USACE], 1995), and were used for gasoline and diesel storage. Two 10,000-gallon steel USTs were  
3 installed at the 354 Site (OU 005) in 1980 and were used for diesel storage (Dames & Moore, 1995). The  
4 USACE indicated that the USTs at this site were also used to store road oil, and may have been used to  
5 store solvents (USACE, 1996). A drawing dated June 1982, obtained from the Fort Riley Directorate of  
6 Public Works (DPW), indicated plans to replace the pump on a solvent tank located approximately 15 ft  
7 southeast of former Building 354. The drawing does not indicate if the tank was an UST or an above-  
8 ground tank.

9  
10 Five of the six USTs, shown on historical drawings of the 354 Site (OU 005), were removed in 1990 and  
11 1991. The sixth tank, a 8,500-gallon steel UST, reportedly used for diesel storage, was not found (Dames  
12 & Moore, 1995). Fort Riley Real Property records of the DPW Compound indicate that five USTs were  
13 located at this site, which corresponds to the number removed in 1990 and 1991.

14  
15 The RI study area encompasses a large amount of area that historically has had a wide variety of land uses.  
16 The nature of industrial activities on the post can be directly related to periods of development. Main Post  
17 was the first part of the installation developed in the mid-nineteenth century. The post, prior to World War  
18 I, evolved from a frontier outpost to a military training post. Limited industrial facilities included a few  
19 simple shops, such as blacksmith operations and storehouses for supplies. Military practice ranges were  
20 located near the barracks area in the lowlands along the Kansas River valley bluffs. During World War I,  
21 Fort Riley underwent significant expansion in support of the war effort. Much of this expansion took place  
22 at locations in the Kansas River alluvial valley, both upstream and downstream from Main Post. More  
23 industrial infrastructure was put in place as motor pools and auto repair facilities replaced stables and  
24 blacksmith shops. Landfill areas were established on the floodplain to the south of Main Post.

25  
26 Greatly-expanded, industrial infrastructure was put in place to support Army forces training for World War  
27 II. Motor pool activities increased at Main Post. Additional rail capacity was built along the UPRR,  
28 including a petroleum off-loading facility and pipeline, and an asphalt batch plant. Following World War  
29 II, shops for maintaining tactical equipment were moved to Custer Hill.

30  
31 Today, that portion of the study area located within Main Post, to the north and west of the UPRR right-of-  
32 way, is used for vehicle maintenance and storage, office blocks, warehouses, barracks, and some  
33 residential housing units. Much of this area is covered with either concrete or asphalt, and has a high

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1 density of buried utilities, including water, sewer, electricity, gas, telephone, and fiber-optic cable. Much  
2 of the area to the south and east of the UPRR grade, which is located on the Kansas River floodplain, is in  
3 a natural or semi-natural state, with large tracts of deciduous forest. Much of the forest area along the  
4 Kansas River is conserved as critical habitat for a transient population of bald eagles. There are some  
5 structures in this area, mainly along the UPRR grade, which are used for warehouses and as administrative  
6 offices. Underground utilities are present, but not as dense as in the Main Post area.

7  
8 Environmental investigations and sampling events were performed at Fort Riley during the 1970s and  
9 1980s. These investigations identified activities and facilities where hazardous substances had been  
10 released or had the potential to be released to the environment. Potential sources of contamination  
11 included landfills; printing, dry cleaning, and furniture shops; and pesticide storage facilities (Burns &  
12 McDonnell Engineering Company, Inc. [BMcD], 2003a).

13  
14 Hazard Ranking System (HRS) ranking was performed in 1988 by the USEPA based on the aggregation of  
15 two individual areas of the Fort Riley Superfund site, the Southwest Funston Landfill and the Pesticide  
16 Storage Facility. It was noted that other potentially contaminated areas exist at Fort Riley (e.g., burn pits,  
17 fire training areas, and dry cleaner operations). These sites received a comprehensive score of 33.79. As a  
18 result, on July 14, 1989, the USEPA proposed inclusion of Fort Riley on the National Oil and Hazardous  
19 Substances Pollution Contingency Plan (NCP) pursuant to Comprehensive Environmental Response,  
20 Compensation, and Liability Act (CERCLA). Effective June 1991, the Department of the Army (DA)  
21 entered into a Federal Facility Agreement (FFA), Docket No. VII-90-F-0015, with the Kansas Department  
22 of Health and Environment (KDHE) and USEPA, Region VII to address environmental pollution subject  
23 to CERCLA, the NCP, and/or the Resource Conservation and Recovery Act (RCRA) (USEPA, 1991).  
24 Pursuant to the FFA, Fort Riley conducted an Installation-Wide Site Assessment (IWSA) in 1992 (Louis  
25 Berger & Associates [LBA], 1992) to identify sites having the potential to release hazardous substances to  
26 the environment. The IWSA did not specifically identify the 354 Site (OU 005) as a potential area of  
27 concern requiring further evaluation. It did address petroleum, oil, and lubricant (POL) facilities  
28 (including the 354 Site [OU 005]) as sites which might be evaluated under the UST programs and would  
29 normally be excluded from CERCLA which was not intended to cover sites impacted exclusively by  
30 petroleum contamination. However, following the removal of the USTs at the 354 Site (OU 005),  
31 investigation of soil and groundwater revealed the presence of chlorinated solvent contamination. As a  
32 result, during January 1997, the 354 Site (OU 005) was formally designated an OU.



1 In 1998, the Army began a remedial investigation (RI)/feasibility study (FS) to identify the types,  
2 quantities, and locations of the contaminants at the 354 Site (OU 005) and to develop a plan to address the  
3 contamination problem. The RI report provided the basis for the FS report, which presented the  
4 alternatives available to address potential risks identified in the RI report. The USEPA and KDHE  
5 approved of the RI and FS reports in 2003 and 2005, respectively (BMcD, 2003a and 2004a).

6  
7 A pilot study for soil remediation was performed at the Building 367 location during 2004. This  
8 remediation effort was successful in treating and removing approximately 1,000 cubic yards of soil that  
9 were contaminated with chlorinated solvents. This effectively eliminated the source of groundwater  
10 contamination, which should result in continuing decreases in future groundwater concentrations. Pilot  
11 study results are reported in the *Pilot Study Report, Pilot Study for Soil Remediation, 354 Area Solvent*  
12 *Detections (Operable Unit 005) at Main Post, Fort Riley, Kansas* (BMcD, 2005c).

13  
14 The monitoring wells associated with the 354 Site (OU 005) have been sampled as part of the groundwater  
15 monitoring program at Fort Riley. The results of these sampling events are provided in the Data Summary  
16 Reports (DSRs) for each event (Dames & Moore, 1995 and BMcD, 1999, 2000a, 2000b, 2000c, 2001a,  
17 2001b, 2002a, 2002b, 2002c, 2003b, 2004b, 2004c, 2005a, and 2005d).

18  
19 The *Proposed Plan, 354 Area Solvent Detections (Operable Unit 005) at Main Post, Fort Riley, Kansas*  
20 (BMcD, 2005b), was issued to inform the public of Fort Riley's, USEPA's, and KDHE's preferred remedy  
21 based on information included in the Administrative Record. The intention was to solicit public comments  
22 pertaining to the remedial alternatives evaluated, including the preferred alternative. Submitted on May  
23 18, 2005, the Draft Final Proposed Plan was accepted by the KDHE and USEPA with no comments, as  
24 presented in the Responsiveness Summary (Section 3.0 of this document). Having received no objections  
25 to the preferred remedy, the selected remedy for the 354 Site (OU 005) was then documented in a ROD  
26 which was signed by the USEPA on July 3, 2006 (BMcD, 2006).

### 27 28 **1.3 MONITORING WELL NETWORK**

29 The monitoring wells which have been sampled to support the investigations at the 354 Site (OU 005)  
30 were installed under a number of different environmental programs (CERCLA, RCRA, and independent  
31 Army investigations). The monitoring wells and piezometers which will constitute the monitoring well  
32 network for the 354 Site (OU 005) are listed in Table 1-1. Information presented includes surface  
33 elevation, TOC elevation, total depth, screened interval, and well coordinates.

## 1.4 ANALYTICAL RESULTS

Details regarding the historical sampling events are provided in the RI report (BMcD, 2003a) and quality control summary reports (QCSRs) for each event.

## 1.5 ACTIONS TO ADDRESS MAJOR COMPONENTS OF THE SELECTED REMEDY

Fort Riley, as lead agency under the FFA, has established a course of action to accomplish each of the components of the selected remedy for the 354 Site (OU 005). The following key elements of the selected remedy will be implemented:

- Periodic sampling of the wells as listed in Table 3-1,
- Conducting annual inspections and periodic maintenance and repair of the monitoring wells listed in Table 1-1,
- Restricting site access and the installation and use of groundwater wells at and downgradient of the 354 Site (OU 005), as outlined in Section 2.0,
- Conducting a review in accordance with Section 121(c) of CERCLA no less often than every five years after initiation. The first five-year review of the selected remedy will include consideration of the following factors:
  - the performance of MNA in achieving clean-up levels (Maximum Contaminant Levels [MCLs]),
  - use of the property above the groundwater plume to ensure that groundwater with contamination above clean-up levels (MCLs) is not used, and
  - if no wells exceed groundwater clean-up levels (MCLs) for the chemicals of concern (COC) for three consecutive years, a recommendation for discontinuing sampling and site close out will be made as part of the five-year review. Otherwise, sampling will continue as discussed in this RD/RA Plan.

There are no risks as there are no complete exposure pathways as stated in the RI and the only ARAR in the ROD was the Anti-Degradation clause of the Kansas Surface Water Quality Standards. Based on the EPA, Region VII letter dated March 8, 1999 that stated that as long as the aquifer is not degraded any further, the Anti-Degradation clause does not apply. The Remedial Action Objectives are met at this time. The water quality is not degrading and, in fact, under the influence of natural attenuation that is

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1 functioning at the site, the levels of contaminants of concerns are an order of magnitude below the MCLs.

2 A demonstrable trend of decreasing contaminant concentrations is apparent.

3  
4 Based on the current levels of contaminants at the site and established contract and oversight values, the  
5 following are the projected costs:

6

Action	Cost
2007 Ground-Water Sampling & Operation & Maintenance (O&M) & Data Collection Platforms (DCPs)	\$83,000
2008 Ground-Water Sampling & O&M & DCPs	\$83,000
2009 Ground-Water Sampling & O&M & DCPs	\$83,000

7  
8 Fort Riley is the lead agency in this work and the USEPA's RPM "approval" constitutes an authorization  
9 to proceed.

10  
11 **1.6 BASIS FOR MNA WITH INSTITUTIONAL CONTROLS**

12 The DA, USEPA, and KDHE have determined that MNA with institutional controls meets the  
13 requirements of CERCLA, and, to the extent practical, the NCP. This remedy was chosen over the other  
14 alternatives because it provides risk reduction through degradation of contaminants in the groundwater and  
15 provides measures to prevent future exposure to currently contaminated groundwater. Based on the  
16 information available at this time, the DA, USEPA, and KDHE believe the selected remedy will be  
17 protective of human health and the environment, will comply with ARARs, will be cost-effective, and will  
18 utilize permanent solutions to the maximum extent practicable (BMcD, 2005b). Although MNA with  
19 institutional controls does not involve engineered treatment, it does rely on natural degradation processes  
20 already occurring at the 354 Site (OU 005) to further reduce contaminant concentrations to levels below  
21 the MCLs. Evidence of natural degradation processes at the 354 Site (OU 005), as per the USEPA MNA  
22 guidance document (USEPA, 1999) includes 1) decreasing contaminant concentration trend, and 2)  
23 supporting geochemical data measurements. Natural attenuation/degradation of the volatile organic  
24 compounds (VOCs) plume(s) is effectively reducing the contamination based on available data. The  
25 selection of MNA as the selected remedy is based upon current and reasonably projected land use and  
26 exposures (BMcD, 2006). However, hazardous substances, pollutants, or contaminants may remain at the  
27 354 Site (OU 005) above levels that would allow for unlimited use and unrestricted exposure. The  
28 rationale for choosing this remedy is based on the fact that no source materials (such as liquids, areas

Introduction

1 contaminated with high concentrations of toxic compounds, or highly mobile materials) that require further  
2 treatment constituting principal threat wastes likely exist at the 354 Site (OU 005).

3  
4 The chemicals of concern that remain at the site are in the ground water (at depths of 25'-50') and are  
5 TCE, PCE, cis-1,2-DCE and benzene. The concentrations of contaminants above the MCLs are in the  
6 upper terrace or the transition zone as defined in the RI which has been incorporate by reference. There  
7 are no contaminants above the MCLs in the Kansas River alluvium. Section 2.10 of the ROD is the  
8 Summary of Comparative Analysis of Alternatives and Tables 2-12 through 2-36 contain the detailed  
9 explanation of the process for the selection. That data is found in the FS and the PP as well. Section  
10 2.12.1 on page 2-44 of the ROD is the Summary of the Rationale for the Selected Remedy and consists of  
11 seven bullets supporting the rationale. They are:

- 12  
13 • Soil contamination was reduced through a pilot study treatment to below levels determined by the  
14 KDHE to prevent further leaching to groundwater.
- 15 • Current monitoring data indicates no evidence of principal threat waste.
- 16 • Natural attenuation combined with soil remediation treatment has resulted in a continuing  
17 decrease in contaminant concentrations in groundwater.
- 18 • The selected remedy is expected to continue to provide risk reduction through degradation of  
19 contaminants in the groundwater.
- 20 • The selected remedy provides measures to prevent future exposure to currently contaminated  
21 groundwater.
- 22 • The selected remedy provides the best balance of tradeoffs with respect to the balancing and  
23 modifying criteria.
- 24 • DA, USEPA, KDHE, and the public believe the selected remedy would be protective of human  
25 health and the environment, would comply with ARARs, would be cost effective, and would  
26 utilize permanent solutions to the maximum extent practicable.

1 **1.7 PLAN EVALUATION**

2 This plan will be updated, if needed and appropriate, based upon evaluations of new chemical data and  
3 groundwater flow characteristics. On an annual basis, trends in constituent concentrations will be  
4 reviewed and groundwater flow patterns will be analyzed to determine if the concentrations of constituents  
5 are increasing and moving toward potential receptor locations. Additionally, the site access and land use  
6 restrictions will be reviewed to ensure that the institutional controls remain relevant and appropriate for site  
7 conditions. As a result of those evaluations, possible recommended adjustments to this RD/RA Plan might  
8 include:

- 9
- 10 • Addition or deletion of monitoring wells to be sampled.
  - 11 • An increase or decrease in the frequency of sampling events.
  - 12 • Changes in the specific chemical constituents to be analyzed and/or changes in the analytical  
13 method.
  - 14 • Modifications in sampling, analysis, and evaluation methods.
  - 15 • Additions to or deletions of institutional controls for site access and land use restrictions.
- 16

17 \*\*\*\*\*

## 2.0 INSTITUTIONAL CONTROLS

The inclusion of institutional controls, such as groundwater use restrictions, will reduce the potential for human ingestion, inhalation, or dermal contact with contaminated groundwater at the 354 Site (OU 005). Institutional controls for the 354 Site (OU 005) include the restriction of land use and site access.

### 2.1 PURPOSE

The purpose of institutional controls for the 354 Site (OU 005) is to restrict the use of groundwater in accordance with the ROD and ARARs. The principal threat at the 354 Site (OU 005) pertains to the hypothetical future use of site-impacted groundwater. While it is stated in the ROD in Section 2.8 page 2-25, that the USEPA's policy is "...to return useable groundwaters to their beneficial uses wherever practicable...", it is also clearly stated on that same page, "As identified in the risk assessment, groundwater at the 354 Site (OU005) is not currently used as a drinking water source, nor is such use anticipated in the foreseeable future."

### 2.2 INSTITUTIONAL CONTROLS

USEPA guidance for institutional controls states that the local authority for regulating and enforcing institutional controls at an active military base is the Commanding Officer and that the regulators should work through the installation personnel to incorporate restrictions (USEPA, 2000). The primary control for the 354 Site (OU 005) will be to restrict land use through the environmental overlay of the Fort Riley Real Property Master Plan (RPMP). Master planning for Army installations is required by Army Regulation 210-20, which establishes a relationship between environmental planning and real property master planning to ensure that environmental factors are included in planning decisions and land use.

The long-range component of the RPMP consists of narratives and supporting graphics that include a Master Plan Environmental Overlay (MPEO) to reflect operational and environmental constraints. Operational and environmental constraints are reflected in the MPEO and in the land-use analysis narrative. The institutional controls are cited in all the previous documents as well as the RD/RAP as residing in the RPMP. There is no action except groundwater sampling that is covered by the existing plans incorporated by reference so there are no existing constraints. The monitoring wells are locked, painted, and have concrete-filled bollards to serve as protection from damage. The MPEO is in the hands of all personnel that might perform actions that would have the potential to impact the monitoring system.

Institutional Controls

1 Figure 1-2 covers the graphic representation. The purpose of the environmental overlay is to graphically  
2 depict the environmental data groupings (EDGs) which include:

- 3 • Surface/aerial limiting factors, for example, noise and flood plains,
- 4 • Underground hazards/limiters, for example, groundwater and Defense Environmental Restoration  
5 Account (DERA) issues, and
- 6 • Surface hazardous and toxic materials / waste issues.

7  
8 The MPEO will illustrate 354 Site (OU 005) features including:

- 9 • Site boundaries and
- 10 • Monitoring well locations.

11 The 354 Site (OU 005) will be designated as restricted land use in the RPMP. The category directs the  
12 RPMP user to the MPEO that subsequently identifies the restrictions. Restrictions will limit exposure at  
13 the 354 Site (OU 005) by:

- 14 • Restricting use to non-residential
- 15 • Limiting public access
- 16 • Prohibiting installation of drinking water wells and groundwater use in the area
- 17 • Involving Directorate of Public Works – Environmental Division (PWE) personnel in proposed  
18 future plans for the 354 Site (OU 005)

19

20 In addition, land use at a portion of the 354 Site (OU 005) is restricted because of its proximity to the  
21 floodplain (Executive Order 11988, Flood Plain Management Construction Criteria for Army Facilities).

22

23 Numerous federal laws and regulations control the transfer and sale of government property. These laws  
24 and regulations address the requirements for disposition of contaminated property. Should Fort Riley be  
25 considered for transfer or sale, the provisions of these shall be followed. At a minimum, full disclosure of  
26 the Base Realignment and Closure (BRAC) conditions and specifications of maintenance and land-use  
27 controls will be included in the provisions of the sale or transfer.

28

29 Proprietary and governmental controls cannot be applied at active military bases. The federal ownership of  
30 an active military base limits the layering of other proprietary or government controls. Besides the RPMP,  
31 controls that will be implemented at the 354 Site (OU 005) are informational controls such as the KDHE  
32 Identified Site List [ISL] and community awareness through the Restoration Advisory Board [RAB]). The  
33 KDHE ISL is accessible through the Internet and provides basic information about the site, including site

*Institutional Controls*

1 location, contaminants at the site, a narrative of activities, and a point of contact at the KDHE. The ISL  
2 database is not used for enforcement and does not place restrictions on site usage. The ISL database  
3 allows the public to conduct a web-based search to find contaminated sites within a specific community or  
4 area. State registries like this KDHE ISL are useful in providing information to the public.

5

6

\*\*\*\*\*

7



**3.0 MONITORED NATURAL ATTENUATION PROGRAM**

**3.1 OBJECTIVES**

The objectives of the MNA program are to:

- Monitor groundwater contaminant concentrations and reduce contaminant levels, to the extent practicable and appropriate, through natural attenuation processes, and
- Monitor geochemical parameters to determine if conditions favorable to MNA are present.

**3.2 CHEMICALS OF CONCERN**

As part of the baseline risk assessment (BLRA), chemicals of potential concern (COPCs) were identified. However, the BLRA indicated that the estimated risks to human health and the environment were within or below the USEPA acceptable levels. Four site-related contaminants, present in the terrace aquifer at levels exceeding drinking water standards (MCLs, identified as an ARAR), were selected as the chemicals of concern (COCs) for the 354 Site (OU 005). These four contaminants were identified in the FS (BMcD, 2004a) and their respective MCLs are presented below:

<u>COCs</u>	<u>MCL (micrograms per liter [ug/L])</u>
Tetrachloroethene (PCE)	5
Trichloroethene (TCE)	5
cis-1,2-Dichloroethene (DCE)	70
Benzene	5

**3.3 GROUNDWATER MONITORING PROGRAM**

**3.3.1 Monitoring Well Sampling**

The groundwater monitoring program for the site is based on more than 10 years of groundwater sampling, evaluation, and trend analyses. The wells selected for long-term monitoring will be sampled annually according to the schedule presented below.

Action	Cost
2007 Ground-Water Sampling & O&M & DCPs	\$83,000
2008 Ground-Water Sampling & O&M & DCPS	\$83,000
2009 Ground-Water Sampling & O&M & DCPs	\$83,000

1 The rationale for individual wells to be sampled is discussed below:

- 2 • Monitoring Wells B354-99-09, B354-01-24, B354-01-25, PSF92-01, PSF92-05, MW95-04,  
3 TS0292-01, and TS0292-02 will be used to monitor the VOC concentrations in the shallow zone.
- 4 • Monitoring Wells B354-00-10, B354-99-12c, B354-99-13c, B354-01-26, B354-01-27, B354-01-  
5 28, B354-01-30c, and B354-01-31c will be used to monitor the VOC concentrations in the deep  
6 zone.

7 Sampling will be conducted in accordance with the standard operating procedures (SOPs) in the  
8 *Installation-Wide Sampling and Analysis Plan for Environmental Investigations at Fort Riley, Kansas,*  
9 *Volume I – Field Sampling Plan* (Malcolm Pirnie [MP]-BMcD, 2004a) and *Site Specific Plans for*  
10 *Groundwater Monitoring Activities, 354 Site, Fort Riley, Kansas* (EA Engineering, Science, and  
11 Technology, Inc. [EAEST, 2006]). Annual inspections and periodic maintenance and repair will be  
12 conducted on the monitoring wells, which are depicted on Figure 1-2 and discussed below in Section 3.3.3.

### 13 **3.3.2 Chemical Analysis of Monitoring Well Samples**

14 The COCs (PCE, TCE, cis-1,2-DCE, and benzene) have been detected above MCLs, so they were  
15 included in the long-term monitoring program. Samples obtained from the monitoring wells outlined in  
16 Section 3.3.1 will be sampled for Target Compound List (TCL) VOCs, naphthalene, natural attenuation  
17 parameters (methane, ethane, ethene, alkalinity, total organic carbon, nitrate, nitrite, sulfide, sulfate,  
18 dissolved oxygen, oxidation-reduction potential, and iron II [Fe<sup>+2</sup>]), and general water quality parameters  
19 (temperature, pH, turbidity, and specific conductivity), as shown on Tables 3-1 and Table 3-2.

### 20 **3.3.3 Groundwater Level Measurements**

21 The water level in all monitoring wells will be measured and recorded during a 24-hour period  
22 immediately prior to the commencement of sampling operations as presented in Table 3-1. Water levels  
23 will again be measured immediately prior to and immediately after sampling each well. Water levels will  
24 be measured in accordance with the SOP in the *Installation-Wide Sampling and Analysis Plan for*  
25 *Environmental Investigations at Fort Riley, Kansas, Volume I – Field Sampling Plan* (MP-BMcD, 2004a).

26 During the collection of water level measurements, field personnel will assess each monitoring well. This  
27 assessment will include the condition of the well pad, bumper post, protective cover, well cap, and stickup,  
28 as applicable. This information will be logged in the field logbook.

29 \*\*\*\*\*

## 4.0 DATA EVALUATION AND REPORTING

### 4.1 DATA EVALUATION

#### 4.1.1 Adherence to Installation Basic Documents

All work conducted under this RD/RA Plan must adhere to the following basic documents (or updated versions if available at the time of the work):

- *Installation-Wide Sampling and Analysis Plan for Environmental Investigations at Fort Riley, Kansas, Volume I – Field Sampling Plan (MP-BMcD, 2004a),*
- *Installation-Wide Sampling and Analysis Plan for Environmental Investigations at Fort Riley, Kansas, Volume II – Quality Assurance Project Plan (MP-BMcD, 2004b),*
- *Installation-Wide Site Safety and Health Plan for Environmental Investigations at Fort Riley, Kansas (MP-BMcD, 2004c), and*
- *Installation-Wide Investigative Derived Waste Management Plan for Environmental Investigations at Fort Riley, Kansas (BMcD, 2003c).*
- *Site Specific Plans for Groundwater Monitoring Activities, 354 Site, Fort Riley, Kansas (EAEST, 2006).*

#### 4.1.2 Hydrogeologic

The hydrogeologic system at the 354 Site (OU 005) involves the interaction of the alluvial terrace aquifer and the Kansas River. The water level data acquired during each sampling event combined with stage data on the Kansas River will be used to develop potentiometric surface maps of the 354 Site (OU 005) area. The maps will provide valuable insight into groundwater flow directions as well as vertical and hydraulic gradients at the time the samples were taken.

#### 4.1.3 Chemical Data Significance

The objectives of the MNA program are to monitor the reduction of groundwater contaminant concentrations through natural attenuation processes to the extent practicable and appropriate and monitor geochemical parameters to determine if conditions favorable to MNA are present.

1 **4.2 REPORTS**

2 **4.2.1 Quality Control Summary Reports**

3 A QCSR will be prepared within 30 days following the receipt of the laboratory data. The QCSR will  
4 include a summary of the data validation procedures conducted to evaluate the usability of the groundwater  
5 monitoring data. Data validation includes an evaluation of the following:

- 6 • field/sampling information,
- 7 • chain-of-custody,
- 8 • completion of requested analyses,
- 9 • holding times,
- 10 • sample preservation,
- 11 • method requirements,
- 12 • laboratory method blanks,
- 13 • trip blanks,
- 14 • surrogates,
- 15 • laboratory control samples,
- 16 • matrix spike/matrix spike duplicates,
- 17 • field duplicates,
- 18 • reporting limits, and
- 19 • field and analytical completeness.

20  
21 **4.2.2 Annual Sampling Reports**

22 An Annual Sampling Report will be prepared and submitted within 60 days following receipt of laboratory  
23 data from the Spring sampling event. The Annual Sampling Report will include a brief description of  
24 sampling activities, a summary of the data, a comparative evaluation of the data with the results from  
25 previous sampling events, evaluation of a groundwater potentiometric surface map developed from water  
26 level measurements taken during the sampling event, and presentation of quality control information. A  
27 summary of maintenance or repairs on the monitoring wells will also be included.

28  
29 **4.3 OVERALL DATA EVALUATION**

30 Following the submittal of the Annual Sampling Report, the data will be evaluated to determine if further  
31 sampling is necessary. If no wells contain COCs exceeding groundwater cleanup levels (i.e., MCLs) for

1 three consecutive years, a recommendation for discontinuing sampling and site close out will be made.  
2 Otherwise, sampling will continue as discussed in this RD/RA Plan.

3

#### 4 **4.4 DOCUMENT DISTRIBUTION**

5 A distribution list is included as Table 4-1. The list will serve as a guide for the distribution of documents  
6 to be prepared in support of the requirements of this Plan. (The list will need to be updated if changes in  
7 key agencies and/or document distribution occur).

8

9

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## 5.0 STATUTORY (FIVE-YEAR) REVIEWS

### 5.1 PURPOSE

Five-year reviews are performed to evaluate whether the response action remains protective of human health and the environment. The focus depends on the original goal of the response action. At the 354 Site (OU 005), protectiveness is assured through degradation by natural attenuation processes and exposure protection – MNA and institutional controls. Therefore, the five-year review at the 354 Site (OU 005) will focus on whether monitoring indicates that natural attenuation is occurring and whether the controls remain in place to prevent exposure.

### 5.2 LEGAL AND REGULATORY REQUIREMENTS AND ADMINISTRATIVE GUIDANCE

When planning and performing a five-year review, the requirements and guidance in place at the time of the review shall be consulted and used, as appropriate for the 354 Site (OU 005). The following laws, regulations, and administrative guidance documents contain requirements and guidance for the performing five-year reviews:

- Section 121(c) of the CERCLA, as amended, requires performance of “review ...no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented.”
- Section 300.430(f)(4)(ii) of the NCP states “If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after initiation of the selected remedial action.”
- Executive Order 12580 delegates responsibility for five-year reviews “...[to] the departments of ...Defense”
- EPA OSWER Directive 9355.7-03B-P, Structure and Components of Five-Year Reviews, June 2001 which “focuses primarily on the implementation of five-year reviews and issues associated with implementation.”
- EPA OSWER Directive 9355.7-02A, Supplemental Five-Year Review Guidance, July 26, 1994, which “clarifies responsibility for conduct of five-year reviews at federal facilities”

### 5.3 GENERAL CHARACTERISTICS OF FIVE-YEAR REVIEWS

The following general characteristics are drawn from the above EPA OSWER guidance:

- The five-year review covers all OUs for which the RODs specify a five-year review.
- The five-year review is triggered by the first OU giving rise to a five-year review (i.e. at Fort Riley, it is the Southwest Funston Landfill). Discussions of subsequent remedies or OUs should be incorporated into the first five-year review conducted or in future reviews, as appropriate. The USEPA general requirements with respect to five-year reviews are applicable to all federal facilities on the National Priority List (NPL). See CERCLA section 120(a)(2).
- Federal agencies are responsible for the costs of all five-year reviews at their facilities.
- Federal agencies are responsible for annually reporting to Congress the reviews conducted at their own facilities, and actions recommended as a result of such reviews.

The following elements are included in a five-year review:

- Document Review
- Standards or ARAR Review
- Site Visit
- Report
- Public Notice

### 5.4 354 SITE (OU 005) FIVE-YEAR REVIEWS

Because this RA will result in hazardous substances, pollutants, or contaminants remaining at the 354 Site (OU 005) above levels that allow for unlimited use and unrestricted exposure, a review in accordance with the NCP will be conducted no less often than every five years after initiation of the remedial action to ensure that the action is, or will be, protective of human health and the environment. The five-year reviews of the selected remedy will include consideration of the following factors:

- the performance of MNA in achieving cleanup levels (MCLs),
- the continued absence of groundwater use on property above the plume to ensure that groundwater with contamination above cleanup levels (MCLs) is not used, and
- if no wells have contained COCs exceeding groundwater cleanup levels (MCLs) for three consecutive years, a recommendation for discontinuing sampling and for site closeout will be made. Otherwise, sampling will continue as discussed in this RD/RA Plan.

Statutory (Five-Year) Reviews

- 1 Five-year reviews at the 354 Site (OU 005) are initially planned for fiscal years 2007 and 2012.
- 2 Performance of the reviews may be suspended or extended based upon the results of reviews. Generally,
- 3 reviews are discontinued when levels of COCs are at levels that would allow unlimited use and
- 4 unrestricted exposure.

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6.0 REFERENCES

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BMcD, 2003a. *Draft Final Remedial Investigation Report, 354 Area Solvent Detections (Operable Unit 005) at Main Post, Fort Riley, Kansas.*

References

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2 *(Operable Unit 005) at Main Post, Fort Riley, Kansas.*  
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- 4 BMcD, 2003c. *Installation-Wide Investigative Derived Waste Management Plan for Environmental*  
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- 7 BMcD, 2004a. *Draft Final Feasibility Study Report, 354 Area Solvent Detections (Operable Unit 005) at*  
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- 10 BMcD, 2004b. *Data Summary Report, September/October 2003 Sampling Event, 354 Area Solvent*  
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20 *Post, Fort Riley, Kansas.*  
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33

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- 4 Louis Berger & Associates (LBA), 1992. *Installation Wide Site Assessment for the Fort Riley, Kansas.*  
5 December 7.  
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30 *Institutional Controls at Superfund and RCRA Corrective Action Cleanups.* EPA 540-F-00-005,  
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32

33 \*\*\*\*\*

## TABLES

**Table 1-1**  
**Monitoring Well and Piezometer Data**  
*354 Area Solvent Detections Remedial Design/Remedial Action Plan*  
*Fort Riley, Kansas*

Well Number	Ground Surface Elevation (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Screened Interval (ft bgs)	Well Coordinates	
					Northing	Easting
TS0292-01	NA	1084.00	29.9	19.8 - 29.8	267711.01	1659529.71
TS0292-02	NA	1066.02	17.4	7.0 - 17.0	267587.39	1659600.05
MW95-04	NM	1062.19	33.6	18.5 - 33.5	267538.18	1659877.95
B354-99-09	1088.7	1091.12	34.6	22.1 - 33.1	267920.42	1659316.70
B354-00-10	1120.9	1123.66	81.1	68.1 - 78.0	269203.64	1659250.18
B354-99-12c	1059.2	1061.29	44.3	36.3 - 41.3	266585.10	1659838.98
B354-99-13c	1059.7	1061.79	51.0	43.0 - 48.0	265822.05	1660215.51
B354-00-PZ14c	1054.8	1057.71	45.6	35.1-45.3	265298.94	1659464.81
B354-00-PZ16	1049.2	1051.96	22.6	7.0-22.4	268038.45	1662102.83
B354-01-PZ20	1051.1	1053.95	22.6	7.0-22.4	266108.17	1661579.01
B354-01-24	1077.0	1079.83	34.5	24.2 - 33.9	267937.52	1659140.08
B354-01-25	1067.4	1069.83	26.0	11.8 - 21.6	267495.63	1659309.58
B354-01-26	1128.3	1130.79	70.8	60.4 - 70.2	270289.58	1659165.19
B354-01-27	1113.6	1116.38	57.3	47.0 - 56.7	268855.01	1659441.78
B354-01-28	1124.1	1126.68	65.3	55.0 - 64.7	270639.43	1659096.50
B354-01-29c	1065.1	1067.84	44.6	33.5-43.2	267242.64	1659697.17
B354-01-30c	1049.3	1051.76	43.3	33.0 - 42.8	265348.04	1660735.40
B354-01-31c	1051.5	1054.56	40.4	29.9 - 40.1	267401.10	1662047.98
PSF92-01	1089.0	1090.78	NM	NA	268876.76	1660075.46
PSF92-02	1078.5	1080.42	28.0	NA	268520.45	1660325.13
PSF92-03	1077.9	1080.80	28.0	NA	268446.35	1660347.34
PSF92-04	1079.1	1080.58	29.5	NA	268334.22	1660346.18
PSF92-05	1062.3	1063.77	28.0	NA	268252.64	1660473.48

**Notes:**

Elevations are presented in feet above mean sea level

The well coordinates are provided in Kansas State Plane north zone. Units are in feet.

The projection is polyconic, based on the 1983 North American Datum (NAD83).

bgs - below ground surface

ft - feet

NA - not available

NM - not measured

TOC - top of casing

**Table 3-1**  
**Monitored Natural Attenuation Program Sample Summary**  
*354 Area Solvent Detections Remedial Design/Remedial Action Plan*  
*Fort Riley, Kansas*

	Analytical Laboratory											Field Measured				
	GW Level	TCL Volatiles	Naphthalene	Methane	Ethane	Ethene	Alkalinity	TOC	Nitrate	Nitrite	Sulfide	Sulfate	DO	ORP	Iron (II)	Temperature, pH, Turbidity, & Specific Conductivity
<b>Wells</b>																
B354-99-09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B354-00-10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B354-99-12c	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B354-99-13c	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B354-00-PZ14c	0															
B354-00-PZ16	0															
B354-01-PZ20	0															
B354-01-24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B354-01-25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B354-01-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B354-01-27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B354-01-28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B354-01-29c	0															
B354-01-30c	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
B354-01-31c	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PSF92-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PSF92-02	0															
PSF92-03	0															
PSF92-04	0															
PSF92-05	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MW95-04	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TS0292-01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TS0292-02	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
<b>Totals</b>	23	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16

0 - Sample and/or measurement is planned.  
DO - Dissolved oxygen  
GW - Groundwater  
ORP - Oxidation reduction potential  
TCL - Target compound list  
TOC - Total organic carbon

**Table 3-2**  
**Analytical Methods**  
*354 Area Solvent Detections Remedial Design/Remedial Action Plan*  
*Fort Riley, Kansas*

Parameter	Analytical Method	Holding Time	
		Extraction	Analysis
<b>Organics</b>			
VOC w/ Naphthalene	SW-846 Method 8260B	NA	14 Days
Methane, Ethane, Ethene	SW-846 8015B (M)	NA	14 Days
<b>Natural Attenuation Parameters</b>			
Alkalinity	EPA 310.1	NA	14 Days
Nitrite	EPA Method 300.0	NA	48 Hours
Nitrate as nitrogen	EPA Method 300.0	NA	48 Hours
Sulfide	EPA Method 376.2	NA	7 Days
Sulfate	EPA Method 300.0	NA	28 Days
Total Organic Carbon (TOC)	SW-846 Method 9060	NA	28 Days

Notes:

EPA = United States Environmental Protection Agency

NA = Not Applicable

SW-846 = Test Method for Evaluating Solid Waste

VOC = Volatile Organic Compounds

**Table 4-1**  
**Document Distribution List**  
*354 Area Solvent Detections Remedial Design/Remedial Action Plan*  
*Fort Riley, Kansas*

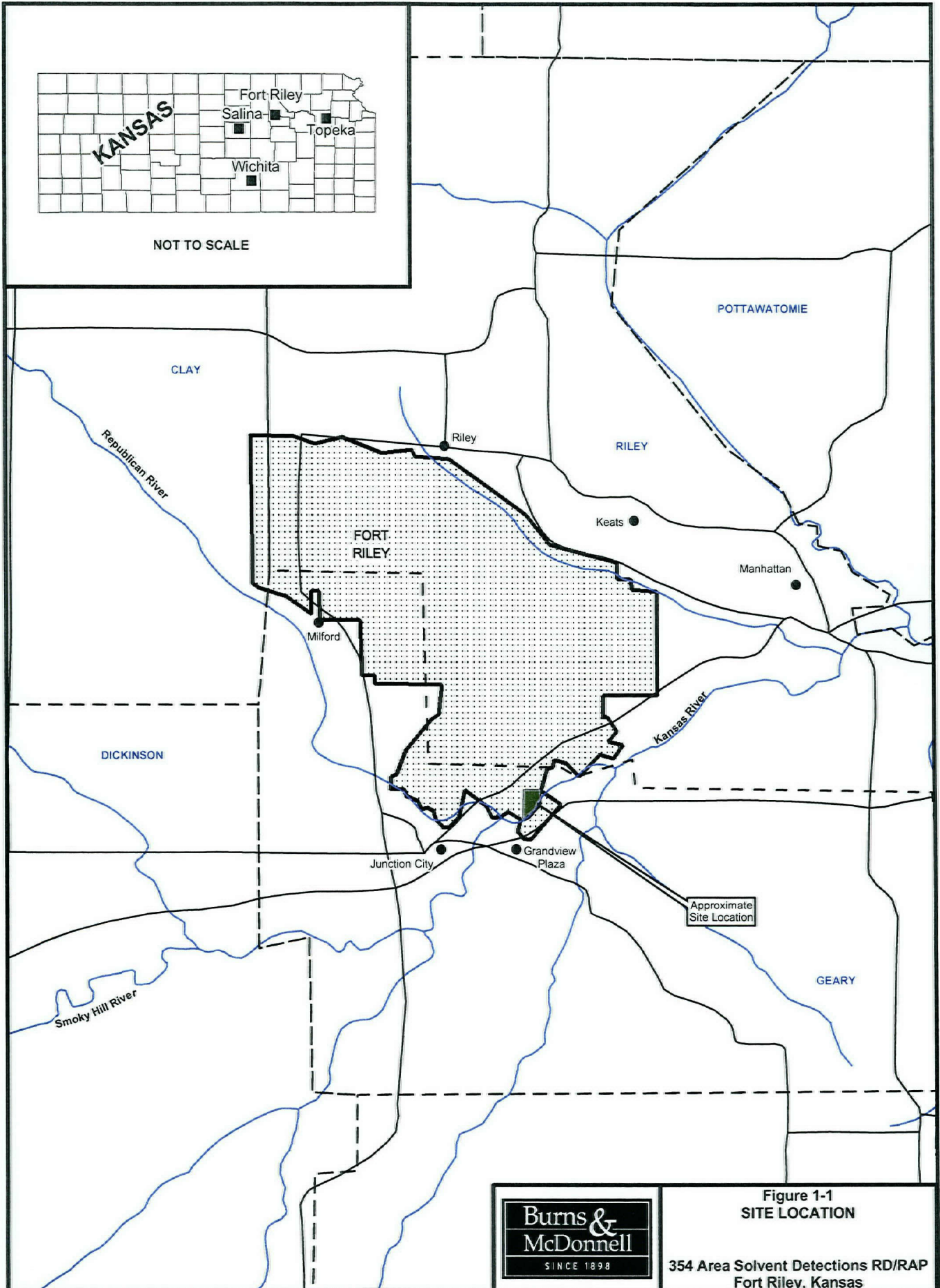
ADDRESSEE	NUMBER OF COPIES (1)							
	DISTRIBUTION DESIGNATION							
	A - Working Draft Plan/Report	B - Draft Plan /Report	C - Draft Final Plan/Report	D - QCSR	E - Daily Quality Control Report	F - Working Draft Weeekly Report	G - Final Weekly Report	H - Electronic Copies of Data
Commander USACE, Kansas City District ATTN: CENWK-PM-ED (R. Van Saun) 601 East 12th Street Kansas City, Missouri 64106-2896	5	5	1/1	2	1	1	1	1
Directorate of Public Works ATTN: Dick Shields Building 407, Pershing Court Fort Riley, Kansas 66442-6016	2/1	2/1	2/2	2	1	1	1	1
Amer Safadi, Remedial Project Manager U.S Environmental Protection Agency, Region VII SUPR/FFSE 901 North 5th Street Kansas City, Kansas 66101		2	2	2			1	
Travis Danke, Project Manager Curtis State Office Building 1000 SW Jackson Street, Suite 410 Topeka, Kansas 66612-1367		1	1	1			1	
Mr. Peter Rissell U.S. Army Environmental Center ATTN: SFIM-AEC-CDN Bldg E4480, Edgewood Area Aberdeen Proving Ground, MD 21010-5401		2	2	2			1	

(1) Hard Copy/PDF File on CD



**FIGURES**

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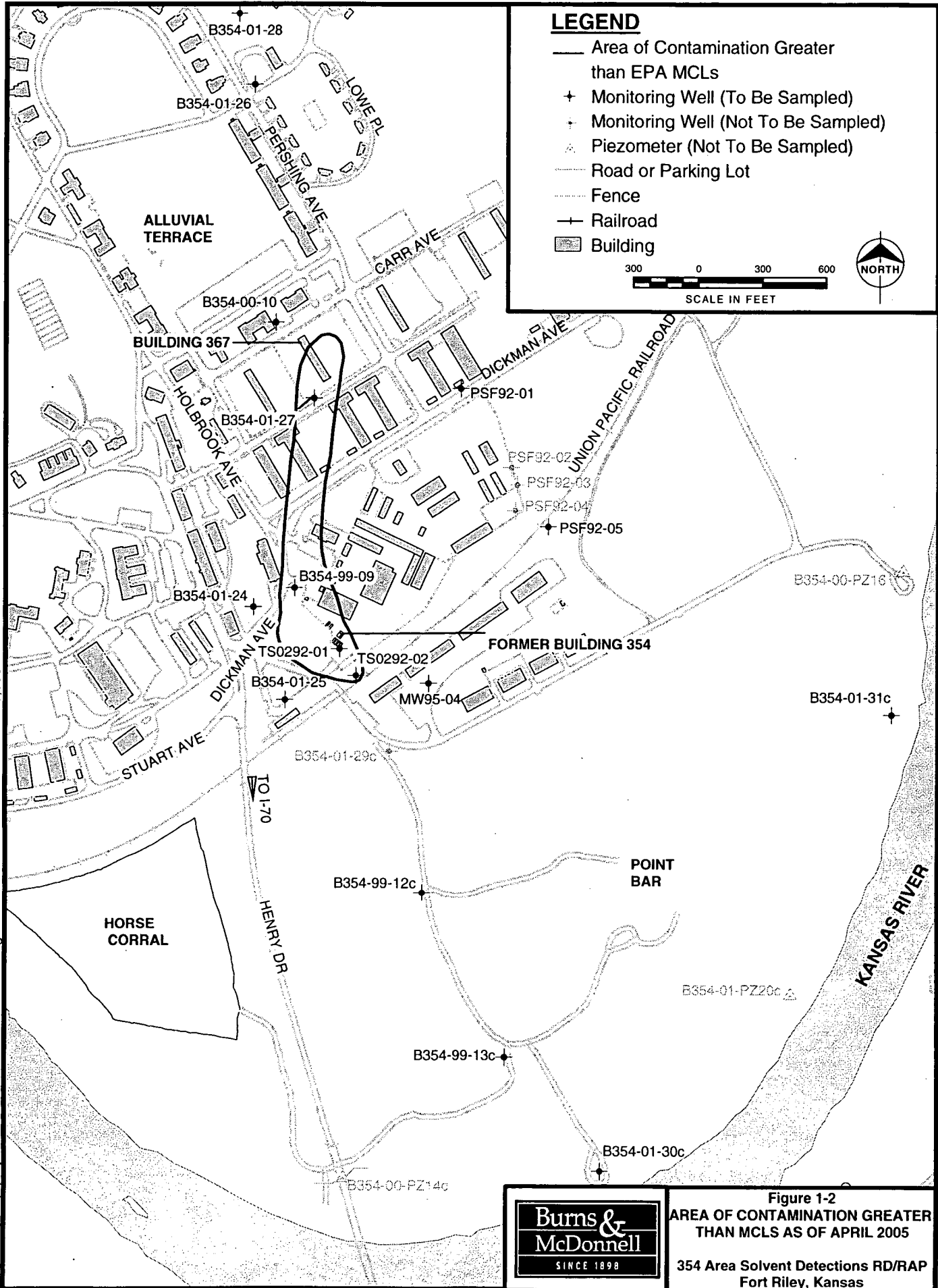
u:/armycorp/projects/b354/arc/arcdocs/RDRAP/fig1-2.mxd 11/13/06 sos mrb el 1:10,000

**LEGEND**

- Area of Contamination Greater than EPA MCLs
- + Monitoring Well (To Be Sampled)
- Monitoring Well (Not To Be Sampled)
- △ Piezometer (Not To Be Sampled)
- Road or Parking Lot
- - - Fence
- + Railroad
- ▭ Building

300 0 300 600  
SCALE IN FEET

NORTH



**Figure 1-2**  
**AREA OF CONTAMINATION GREATER THAN MCLs AS OF APRIL 2005**  
 354 Area Solvent Detections RD/RAP  
 Fort Riley, Kansas

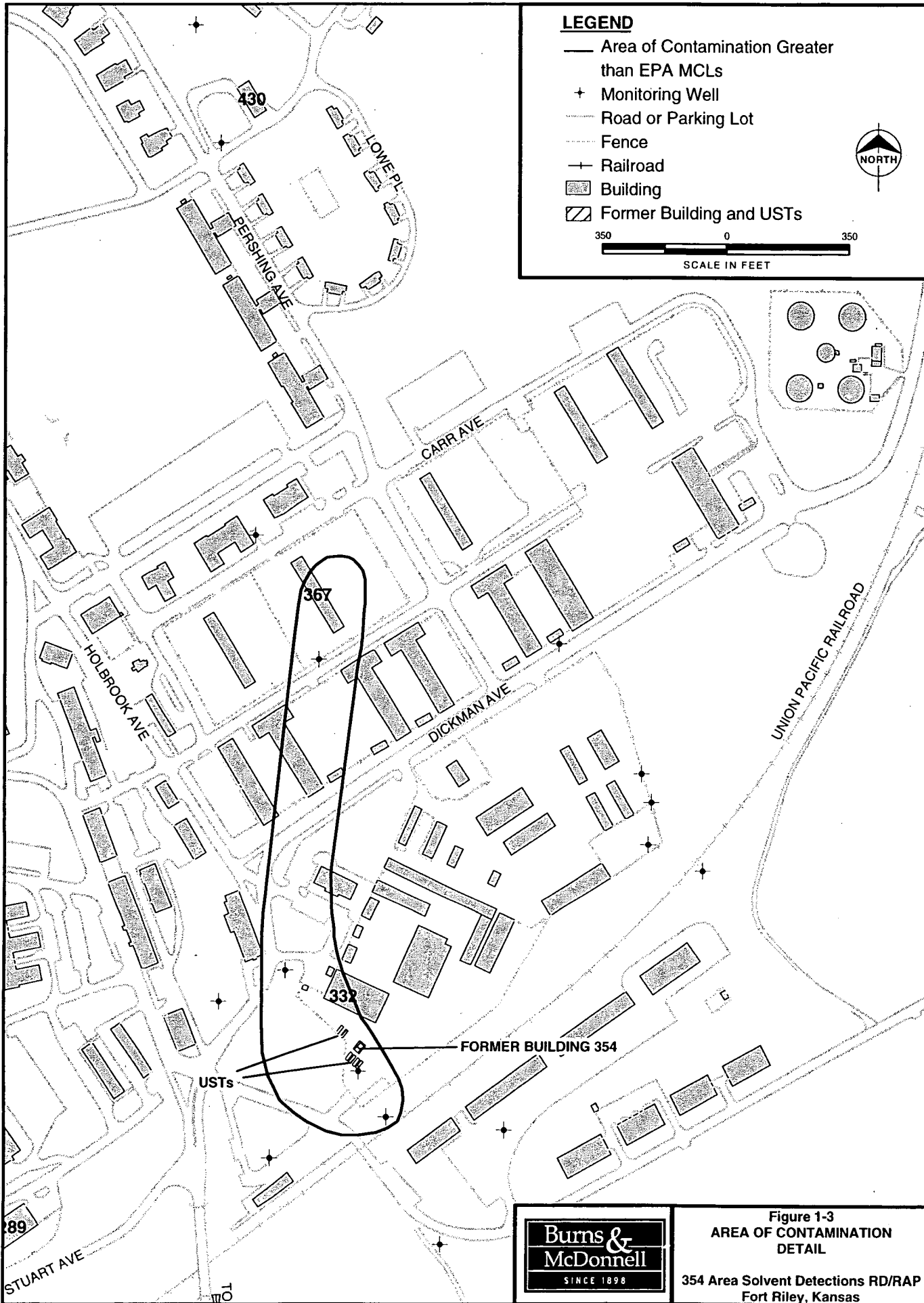
**LEGEND**

- Area of Contamination Greater than EPA MCLs
- + Monitoring Well
- Road or Parking Lot
- - - Fence
- + Railroad
- Building
- ▨ Former Building and USTs



350 0 350

SCALE IN FEET



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14,200 mb el 08/30/06



Figure 1-3  
AREA OF CONTAMINATION  
DETAIL

354 Area Solvent Detections RD/RAP  
Fort Riley, Kansas