

Remedial Design/Remedial Action Plan

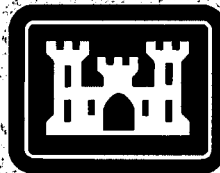
**Dry Cleaning Facilities Study Area
(Operable Unit 003)**

at

**Main Post
Fort Riley, Kansas**

June 26, 2008

Prepared for



**U.S. Army Corps of Engineers
Kansas City District**

Prepared By



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List of Acronyms and Abbreviations

1	(OU 003)	Dry Cleaning Facilities Area (Operable Unit 003)
2		
3	AOC	Area of Concern
4	ARAR	Applicable or Relevant and Appropriate Requirement
5		
6	bgs	Below Ground Surface
7	BLRA	Baseline Risk Assessment
8	BMcD	Burns & McDonnell Engineering Company, Inc.
9	BRAC	Base Realignment and Closure
10		
11	CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
12	CERCLIS	Comprehensive Environmental Response, Compensation, and Liability
13		Information System
14	COC	Chemical of Concern
15	COPC	Chemical of Potential Concern
16		
17	DA	Department of the Army
18	DCE	cis-1,2-Dichloroethene
19	DCFA	Dry Cleaning Facility Area
20	DCP	Data Collection Platform
21	DERA	Defense Environmental Restoration Account
22	DSR	Data Summary Report
23		
24	EAB	Enhanced Anaerobic Bioremediation
25	EDG	Environmental Data Groupings
26		
27	Fe ⁺²	Ferrous Iron
28	FFA	Federal Facility Agreement
29	FS	Feasibility Study
30	FSA	Feasibility Study Addendum
31	ft	Foot/feet
32		
33	HRS	Hazard Ranking System
34	HPGL	High Pressure Gas Line
35		
36	IRP	Installation Restoration Program
37	ISL	Identified Site List
38		
39	KDHE	Kansas Department of Health and Environment
40		
41	LAW	Law Environmental
42	LBA	Louis Berger & Associates
43		
44	MCL	Maximum Contaminant Level
45	MH	Manhole
46	MNA	Monitored Natural Attenuation
47	MP	Malcolm Pirnie
48	MPEO	Master Plan Environmental Overlay

List of Acronyms and Abbreviations

1	NCP	National Oil and Hazardous Substances Pollution Contingency Plan
2	NPL	National Priorities List
3		
4	O&M	Operation and Maintenance
5	OU	Operable Unit
6		
7	PA	Preliminary Assessment
8	PCE	Tetrachloroethene (or Perchloroethene)
9	PSR	Pilot Study Report
10	PWE	Directorate of Public Works – Environmental Division
11		
12	QCSR	Quality Control Summary Report
13		
14	RA	Remedial Action
15	RCRA	Resource Conservation and Recovery Act
16	RD	Remedial Design
17	RI	Remedial Investigation
18	RIAMER	Remedial Investigation Addendum Monitoring Expansion Report
19	RIA	Remedial Investigation Addendum
20	ROD	Record of Decision
21	RPM	Remedial Project Manager
22	RPMP	Fort Riley Real Property Master Plan
23		
24	SI	Site Investigation
25	SOP	Standard Operating Procedure
26		
27	TA2	Training Area 2
28	TCE	Trichloroethene
29	TCL	Target Compound List
30		
31	UPRR	Union Pacific Railroad
32	USACE	United States Army Corps of Engineers
33	USEPA	United States Environmental Protection Agency
34		
35	VOC	Volatile Organic Compound
36	VC	Vinyl Chloride
37		
38	µg/L	Micrograms per Liter
39		

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this Remedial Design (RD)/Remedial Action (RA) Plan for the Dry Cleaning Facilities (DCF) Site (Operable Unit [OU] 003) 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 2-26, 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 DCF Site (OU 003) 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 DCF Site (OU 003) 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 Fort Riley, Kansas, DCF Study Area is located in the Main Post cantonment area of the Fort Riley Military Installation, located in Geary and Riley Counties, near Junction City, Kansas. Main Post is in the southern region of Fort Riley, north of the Kansas River (Figure 1-1). The term "DCF Study Area" is used in this report to refer to the entire DCF Site (OU 003).

Fort Riley is identified by the USEPA as Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) site KS6214020756. This document is issued by the Department of the Army (DA), the lead agency for the activities at Fort Riley, in consultation with the USEPA and Kansas Department of Health and Environment (KDHE), the support agencies. Remediation work at the DCF Study Area has been funded by the DA (Fort Riley) through the Installation Restoration Program (IRP).

The DCF Study Area is situated both north and south of the Kansas River and consists of five main investigative areas (Figure 1-2). The original area of investigation was the location of the former dry cleaning operation buildings. During the investigative period, four additional areas were added to the

original area. These five areas are described as follows (Burns & McDonnell Engineering Company, Inc. [BMcD], 2004b):

The **Dry Cleaning Facilities Area (DCFA) (original study area)** consists of two areas located on an alluvial terrace: the former Buildings 180/181 Area and the former Buildings 183/184 Area. Dry cleaning operations were conducted at both of these locations. Geology of the alluvial terraces consists of clays, sands, and silts overlying Permian-age sedimentary rock composed of alternating sequences of shale and limestone. A bedrock erosional channel underlies the eastern portion of former Building 181. The axis of the channel runs northeast/southwest, slopes to the southwest, and extends through the Transition Zone into the Island. Sand is present at depth within the bedrock erosional channel.

The **Transition Zone** separates the DCFA terraces from the Island and the Horse Corral river alluvial deposits. The Transition Zone is where the geology “transitions” from the upper terrace system beneath the DCFA to the point bars of the alluvial system of the Island and the Horse Corral. The Transition Zone is composed of Kansas River alluvium interspersed with erosional deposits from the upland and terrace areas. Soil in the Transition Zone is composed primarily of alluvial sediment deposited by the Kansas River. The subsurface lithology within the Transition Zone consists of an upward-fining sequence of medium to coarse sand with traces of gravel present above the bedrock fining upwards into a fine sand with an upper layer of silty clay/clayey silt present in places. The Union Pacific Railroad (UPRR) tracks lie within the Transition Zone.

The **Island** consists of a point bar formed by the Kansas River. This area is located between the DCFA and the Kansas River. The Island consists of approximately 40 heavily-wooded acres that are undeveloped and currently serve as a winter roosting area for bald eagles. The Island is a U.S. Fish and Wildlife Service designated critical habitat for Bald and Golden Eagles (16 U.S.C. 668-668d) and is under the protection of federal and state protected species laws. The Island is underlain by Kansas River alluvium. The Kansas River alluvium is composed of Kansas River flood deposits and erosional deposits from the upland and terrace areas. Subsurface lithologies in this area represent an upward-fining sequence typical of alluvial point bar and floodplain sediments.

The **Horse Corral** is the western portion of a point bar located downstream of the Island, and is located southeast of the DCF Study Area. This area is located immediately west and is adjacent to the 354 Area Solvent Detections Site (OU 005). The Horse Corral is bounded by Henry Drive to the east, the Kansas

River to the west and south, and the UPRR tracks to the north. The point bar is currently used for pasturing and training of Fort Riley's horses. Portions of the Horse Corral are also designated as a critical habitat for Bald and Golden Eagles and are under the federal and state protected species law. The Horse Corral is underlain by Kansas River alluvium. The Kansas River alluvium is composed of Kansas River flood deposits and erosional deposits from the upland and terrace area. Subsurface lithologies in this areas represents an upward-fining sequence typical of alluvial point bar and floodplain sediments.

Training Area 2 (TA2) consists of the Kansas River floodplain located along the south side of the Kansas River directly across from the Island. TA2 is heavily wooded and is used by Fort Riley for military exercises. It is undeveloped and is also a winter roosting area for bald eagles. Portions of the TA2 area are also designated as a critical habitat for Bald and Golden Eagles and are under the protection of federal and state protected species law. The TA2 area is underlain by Kansas River alluvium. The Kansas River alluvium is composed of Kansas River flood deposits. Subsurface lithologies in this areas represents an upward-fining sequence typical of alluvial point bar and floodplain sediments.

DCF Study Area History and Current Site Configuration

The original investigation area (DCFA) contained the former dry cleaning operations and support buildings (Figure 1-2). The former Buildings 180/181 Area was located south of Custer Road. Buildings 180/181 were the location of the original dry cleaning (1930 to 1983) and laundry (1915 to 1983) operations before these operations were transferred to Building 183. Building 182 was a storage building. Buildings 180/181 and 182, and the surrounding parking lots and sidewalks were demolished in the summer 2000. Buildings 183 and 184 were located north of Custer Road. The former Building 183 contained the more recent dry cleaning operations that consisted of dry cleaning (1983 to 2002) and laundry facilities (1941 to 2002). A steam generating plant was present at Building 184. Buildings 183 and 184, and most surrounding structures were demolished in fall 2002. The locations where Buildings 180/181, 182, 183, and 184 once stood are now empty grassy lots.

The Transition Zone is a moderately-wooded area that contains the UPRR. The Island and TA2 are heavily-wooded undeveloped areas. The Horse Corral area is a moderately-wooded area that contains a few barns and inner corral fencing for housing, pasturing, and training horses.

Site Enforcement Activities

Environmental investigations and sampling events were performed at Fort Riley during the 1970s and 1980s. These investigations identified activities and facilities where hazardous substances had been released or had the potential to be released to the environment. Potential sources of contamination included landfills; printing, dry cleaning, furniture shops; and pesticide storage facilities (BMcD, 2004b).

Effective June 1991, the DA entered into a FFA, Docket No. VII-90-F-0015, with the State of Kansas KDHE and USEPA Region VII to address environmental pollution subject to Comprehensive Environmental Response Compensation and Liability Act (CERCLA), the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), and/or the Resource Conservation and Recovery Act (RCRA) (USEPA, 1991). The Hazard Ranking System (HRS) ranking was performed in 1988 by the USEPA based on the aggregation of two individual areas of the Fort Riley Superfund site, the Southwest Funston Landfill and the Pesticide Storage Facility. It was noted that other potentially contaminated areas exist at Fort Riley (e.g. burn pits, fire training areas, and dry cleaner operations). These sites received a comprehensive score of 33.79. As a result, on July 14, 1989, the USEPA proposed inclusion of Fort Riley on the National Priorities List (NPL) pursuant to CERCLA.

The FFA specifically required that a preliminary assessment (PA) be performed for the DCF Study Area. Site investigation field activities began in October 1991. A Draft PA/Site Investigation (SI) was finalized with USEPA, KDHE, and Army comments attached to the PA/SI document in October 1992 (Law Environmental (Law), 1992). In accordance with the NCP, a remedial investigation (RI) was subsequently performed for the DCF Study Area. The Draft Final RI Report (Louis Berger & Associates (LBA), 1995) was submitted in March 1995 to the USEPA and KDHE for review and acceptance. Based upon the results of the RI, a Draft Feasibility Study (FS) was prepared and submitted to KDHE and USEPA in April 1995. The Draft FS was not finalized due to comments from KDHE requesting that further information be obtained with regard to the groundwater contamination on the Island. As a result, the *Work Plan for Monitoring Network Expansion Including Additional Characterization of the Island* (LBA, 1996a) was prepared in May 1996. Conditional upon completion of the additional groundwater sampling and analysis in the Work Plan, KDHE approved the RI in April 1996. After the planned work was completed, the *Remedial Investigation Addendum Monitoring Expansion Report* (RIAMER) (LBA, 1998a) was prepared and submitted in March 1998. KDHE approved the RIAMER in April 1998. The *Revised Feasibility Study for the Dry Cleaning Facilities Study Area, Fort Riley, Kansas* (LBA, 1998b) was submitted to

USEPA and KDHE for review in March 1998. KDHE approved the Revised FS in April 1998. During this time, groundwater monitoring was continued at the DCF Study Area.

In 2000, the USEPA conducted a review of the removal actions conducted at the DCF Study Area. The results of the review were transmitted to Fort Riley in a letter dated April 26, 2000 entitled *Technical Review of Removal Action Activities at the Former Dry Cleaning Facility Operable Unit No.3, Fort Riley, Kansas* (USEPA, 2000a). The USEPA review had determined that the soil vapor extraction contaminant removal action/pilot study, conducted in the latter part of 1994 and early 1995, "had no effect on the significantly higher concentrations of chlorinated compounds observed in well DCF93-13. Additional source area(s) appear to be present." Based upon this correspondence, Fort Riley voluntarily conducted an additional source screening in October 2000. The results of the Potential Source Area Investigation were presented in the *Technical Memorandum Report, Potential Source Area and Sewer Line Field Screening, Dry Cleaning Facilities Area (OU 003) at Fort Riley, Kansas* (BMcD, 2002c). Based upon the results of the technical report, Fort Riley decided to conduct additional field investigations at the DCF Study Area and to present the findings as an addendum to the original RI Report. The *Remedial Investigation/Feasibility Study Addendum Work Plan for the Dry Cleaning Facilities Area (Operable Unit 003) at Fort Riley* (BMcD, 2002b) was submitted to USEPA and KDHE in March 2002. Following approval by these agencies, field investigation activities for the RI Addendum began in April 2002. Based on the results of groundwater screening on the Island during this investigation, the *Technical Memorandum for the Monitoring Well Placement, Dry Cleaning Facilities Area (Operable Unit 003) at Fort Riley, Kansas*, (BMcD, 2003a) was presented by Fort Riley to the USEPA and KDHE for approval of monitoring well locations on the Island and the Transition Zone. Following agency approval, field investigation activities for the RI Addendum resumed in September 2002 and continued throughout 2003. After demolition of Buildings 183 and 184, it was decided that surface soil sampling was needed in the area of these former buildings. KDHE also requested that an additional well cluster was needed along the Kansas River in the northern portion of TA2. This additional work was detailed in the *Work Plan Addendum for the Dry Cleaning Study Area at Fort Riley, Kansas* (BMcD, 2003d). The surface soil at former Building 183 was sampled and Monitoring Well Cluster DCF03-50a/c was installed at TA2 in the summer 2003 (see Figure 1-2).

The results for the field work conducted in support of the RI Addendum was reported in the *Remedial Investigation Addendum (RIA) for the Dry Cleaning Facilities Area (Operable Unit 003) at Fort Riley Kansas* (BMcD, 2004b) and was submitted and approved by KDHE and USEPA in April 2004. The

Feasibility Study Addendum (FSA) for the Dry Cleaning Facilities Area (Operable Unit 003) Fort Riley, Kansas (BMcD, 2005b) was submitted and approved by KDHE and USEPA in March 2005. Following completion of the FSA, Fort Riley implemented a removal action/pilot study to address soil and groundwater contamination at the DCF Study Area. The removal action/pilot study incorporated the engineered portions of the remedial alternatives selected for each area of concern (AOC) that were approved for the FSA by the KDHE and USEPA. The *Work Plan Pilot Study for Soil and Groundwater Remediation DCF Study Area (Operable Unit 003) Main Post, Fort Riley, Kansas* (BMcD, 2005c) was approved by Fort Riley in August 2005 with concurrence from KDHE and USEPA. The main areas addressed by the removal action/pilot study included surface soil, subsurface soil, and utility corridors at AOC 1 located at the former DCFA Buildings 180/181, groundwater at AOC 2 located at the former DCFA Buildings 180/181, and soil and groundwater at AOC 3 which included portions of the Transition Zone and the Island (Figure 1-3). Additional removal action/pilot study activities were also conducted on the Island and the Horse Corral and were identified as "Other Areas" on Figure 1-3. Field work in support of the removal action/pilot study commenced in November 2005 and was concluded in September 2007. Following completion of the removal action/pilot study field work, the results of the removal action/pilot study were presented to Fort Riley in the *Pilot Study Report (PSR) for the Dry Cleaning Facility Study Area (Operable Unit 003) Main Post, Fort Riley, Kansas* (ECC/BMcD, 2008) in January 2008.

The monitoring wells associated with the DCF Study Area have been sampled as part of the groundwater monitoring program at Fort Riley. The results of these sampling events are provided in the Data Summary Report (DSRs) for each event (LBA, 1996b, 1998c, and 1999; and BMcD, 1999a, 1999b, 1999c, 2000, 2001a, 2001b, 2001c, 2002a, 2002d, 2002e, 2003b, 2003e, 2003f, 2004a, 2004c, 2005a, 2006a) and the Quality Control Summary Reports (QCSRs) for the PSR (ECC/BMcD 2006a, 2006b, and 2007).

The *Proposed Plan for the Dry Cleaning Facilities Area (Operable Unit 003) at Main Post, Fort Riley, Kansas* (BMcD, 2007) was issued in October 2007 to inform the public of Fort Riley's, USEPA's, and KDHE's preferred remedy based on information included in the Administrative Record. The intention was to solicit public comments pertaining to the remedial alternatives evaluated, including the preferred alternative. Submitted on October 11, 2007, the Draft Final Proposed Plan was accepted by the KDHE and USEPA, as presented in the Responsiveness Summary (Section 3.0 of this document). The *Record of Decision, Dry Cleaning Facilities Study Area (Operable Unit 003) at Main Post, Fort Riley, Kansas* (BMcD, 2008b) was submitted on January 16, 2008 and accepted by KDHE and USEPA.

1.3 MONITORING WELL NETWORK

Monitoring wells have been installed during investigation activities at the DCF Study Area. The monitoring wells that will constitute the monitoring well network for the DCF Study Area are listed in Table 1-1. Information presented includes well number, formation screened, TOC elevation (feet [ft]), bottom of screen elevation (ft), and screened intervals (ft below ground surface [bgs]).

1.4 ANALYTICAL RESULTS

Details regarding the historical sampling events are provided in the RIA report (BMcD, 2004c), the PSR, (ECC/BMcD, 2008), DSRs (LBA, 1996b, 1998c, and 1999; and BMcD, 1999a, 1999b, 1999c, 2000, 2001a, 2001b, 2001c, 2002a, 2002d, 2002e, 2003b, 2003e, 2003f, 2004a, 2004c, 2005a, 2006a), and QCSRs (ECC/BMcD 2006a, 2006b, and 2007) for each event.

1.5 ACTIONS TO ADDRESS MAJOR COMPONENTS OF THE SELECTED REMEDY

Fort Riley, as lead agency under the Federal Facility Agreement (FFA), has established a course of action to accomplish each of the components of the selected remedy for the DCF Study Area. The following key elements of the selected remedy will be implemented:

- Periodic sampling of the 25 monitoring wells as listed in Table 1-1,
- Conducting annual inspections and periodic maintenance and repair of the 25 monitoring wells listed in Table 1-1,
- Restricting site access and the installation and use of groundwater wells at and downgradient of the DCF Study Area (OU 003), 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 Island alluvial wells exceed groundwater clean-up levels (MCLs) for the chemicals of concern (COC) at the end of the three year's of sampling (2008, 2009, 2010) or during 5-year review sampling, 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.

As presented in the RIA and the Proposed Plan, the human health risks for the DCFA Study Area were below the USEPA's acceptable risk range of up to 1.0×10^{-4} to 1.0×10^{-6} and the ecological risks were minimal for terrestrial flora and fauna inhabiting the site as well as for aquatic organisms inhabiting the Kansas River. The baseline risk assessment (BLRA) was conducted prior to the removal actions/pilot studies and can therefore be considered a very conservative estimate of current risk for the DCF Study Area. Based on groundwater data collected and reported in the PSR and the ROD, the ARAR that is driving action at the DCF Study Area is the Anti-Degradation clause of the Kansas Surface Water Quality Standards. Based on USEPA, Region VII correspondence dated March 8, 1999, as long as the aquifer is not degraded any further, the Anti-Degradation clause does not require action. The temporal trends for groundwater analytical data at the DCF Study Area as reported in the PSR have shown an order of magnitude decrease in contaminant concentrations. Based on this information, the water quality is not degrading further, therefore the Anti-Degradation clause is not triggered. However, because the MCL for tetrachloroethylene (PCE), trichloroethylene (TCE), and cis-1,2-dichloroethylene (cis-1,2-DCE) and vinyl chloride (VC) are exceeded at several Island alluvial monitoring wells within the monitoring well network, continued temporal monitoring of groundwater concentrations are warranted using an MNA approach.

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

Action	Cost
2008 Groundwater Sampling & Operation & Maintenance (O&M) & Data Collection Platforms (DCPs)	\$75,000
2009 Groundwater Sampling & O&M & DCPs	\$75,000
2010 Groundwater Sampling & O&M & DCPs	\$75,000
5 Yr Report	\$20,000

Fort Riley is the lead agency in this work and the USEPA's Remedial Project Manager's "approval" constitutes an authorization to proceed.

1.6 BASIS FOR MNA WITH INSTITUTIONAL CONTROLS

The DA, USEPA, and KDHE have determined that MNA with institutional controls meets the requirements of CERCLA, and, to the extent practical, the NCP. This remedy was chosen over the other

alternatives because it provides risk reduction through degradation of contaminants in the groundwater and provides measures to prevent future exposure to currently contaminated groundwater. Based on the information available at this time, the DA, USEPA, and KDHE believe the selected remedy will be protective of human health and the environment, will comply with ARARs, will be cost-effective, and will utilize permanent solutions to the maximum extent practicable (BMcD, 2008). MNA with institutional controls relies on natural degradation processes already occurring at the DCF Study Area to further reduce contaminant concentrations to levels below the MCLs. Evidence of natural degradation processes at the DCF Study Area, as per the USEPA MNA guidance document (USEPA, 1999) includes 1) decreasing contaminant concentration trend, and 2) supporting geochemical data measurements. Based on available data, natural attenuation/degradation of the volatile organic compounds (VOCs) plume(s) is effectively reducing the contamination. The selection of MNA is based upon current and reasonably projected land use and exposures (BMcD, 2008). Because no source materials (such as liquids, areas contaminated with high concentrations of toxic compounds, or highly mobile materials) that require further treatment constituting principal threat wastes likely exist at the DCF Study Area (OU 003), MNA is an appropriate remedy for the DCFA Study Area.

The COCs that remain at the DCF Study Area are in the groundwater at depths of 25'-50' and include TCE, PCE, cis-1,2-DCE, and VC. The concentrations of contaminants above the MCLs are in the upper terrace and the Kansas River alluvium (Figure 2-1).

The process of the remedy selection for the DCFA Study Area is presented in detail in the ROD (BMcD, 2008), the FSA (BMcD, 2005b), and the Proposed Plan (BMcD, 2007). Section 2.10 of the ROD is the Summary of Comparative Analysis of Alternatives and Tables 2-2 through 2-21 contain the detailed explanation of the process for the selection. Section 2.12.1 on page 2-43 and page 2-44 of the ROD is the Summary of the Rationale for the Selected Remedy and consists of 12 bullets supporting the rationale.

They are:

- Shallow soil contamination to a depth of 12 ft bgs (2,400 cubic yards) was excavated and removed during a pilot study conducted in 2005 through 2007. The soil was removed to levels determined by KDHE to prevent further leaching to groundwater.
- Vadose zone contamination to a depth of 30 ft bgs near Monitoring Well DCF02-42 was treated by injection of 7,400 pounds of sodium permanganate into the subsurface.
- The bedding and soil in and around the high pressure gas line corridor and the sanitary sewer lines and manholes were treated with 3,692 gallons of sodium permanganate.

- The groundwater in the buried bedrock erosional channel was treated with 8,200 pounds of CAP 18™ (a neat vegetable oil) for enhanced anaerobic bioremediation (EAB).
- The groundwater in the alluvial aquifer on the Island was treated with 21,755 pounds of potassium permanganate to reduce contaminant mass at the groundwater source area.
- The leading edge of the plume was treated with 2,680 pounds of CAP 18™ (a neat vegetable oil) for EAB.
- The Horse Corral was treated with 2,850 pounds of CAP 18™ (a neat vegetable oil) for EAB.
- Current monitoring data indicate no evidence of principal threat waste.
- Natural attenuation combined with soil and groundwater remediation treatment has resulted in a continuing decrease in contaminant concentrations in groundwater.
- The selected remedy is expected to continue to provide risk reduction through degradation of contaminants in the groundwater.
- The selected remedy provides measures to prevent future exposure to currently contaminated groundwater.
- DA, USEPA, KDHE, and the public believe the selected remedy would be protective of human health and the environment, would comply with ARARs, would be cost effective, and would utilize permanent solutions to the maximum extent practicable.

1.7 EVALUATION

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

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

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 DCF Study Area. Institutional controls for the DCF Study Area include the restriction of land use and site access.

2.1 PURPOSE

The purpose of institutional controls for the DCF Study Area is to restrict the use of groundwater in accordance with the ROD and ARARs. The principal threat at the DCF Study Area pertains to the hypothetical future use of site-impacted groundwater. While it is stated in the ROD in Section 2.8 page 2-26, that the USEPA's policy is "...to return useable groundwaters to their beneficial uses wherever practicable...", it is also stated on that same page, "As identified in the risk assessment, groundwater at the DCF Study Area (OU 003) 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, 2000b). The primary control for the DCF Study Area 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/RA Plan 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.

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

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

The MPEO will illustrate DCF Study Area features including:

- Site boundaries and
- Monitoring well locations.

The DCF Study Area will be designated as restricted land use in the RPMP. The category directs the RPMP user to the MPEO that subsequently identifies the restrictions. Restrictions will limit exposure at the DCF Study Area by:

- Restricting use to non-residential,
- Limiting public access,
- Prohibiting installation of drinking water wells and groundwater use in the area, and
- Involving Directorate of Public Works – Environmental Division (PWE) personnel in proposed future plans for the DCF Study Area.

In addition, land use for a large portion of the DCF Study Area is restricted because of its proximity to the floodplain (Executive Order 11988, Flood Plain Management Construction Criteria for Army Facilities).

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

Proprietary and governmental controls cannot be applied at active military bases. The federal ownership of an active military base limits the layering of other proprietary or government controls. Besides the RPMP controls that will be implemented at the DCF Study Area, informational controls such as the KDHE Identified Site List (ISL) and community awareness through the Restoration Advisory Board (RAB) will

be implemented. The KDHE ISL is accessible through the Internet and provides basic information about the site, including site location, contaminants at the site, a narrative of activities, and a point of contact at the KDHE. The ISL database is not used for enforcement and does not place restrictions on site usage. The ISL database allows the public to conduct a web-based search to find contaminated sites within a specific community or area. State registries like the KDHE ISL are useful in providing information to the public.

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.

The source areas have been properly characterized as part of the Remedial Investigation and remediated as part of the pilot study. The events that may trigger further action and what contingencies might be implemented based on these actions are dependent on the ARAR developed for the DCF Study Area. The ARAR driving the MNA remedy is the Anti-Degradation Policy of the Kansas Water Pollution Control Act, which requires action to prevent further degradation of water quality in the alluvial aquifer. If groundwater contamination levels in the alluvial aquifer exceed pre-1999 levels, Fort Riley will consult with the EPA and the KDHE to determine the appropriate course of action to address the new site conditions.

3.2 CHEMICALS OF CONCERN

As part of the BLRA, chemicals of potential concern (COPCs) were identified. However, the BLRA indicated that the estimated risks to human health and the environment were below the USEPA acceptable levels. Four site-related contaminants, present in the terrace and alluvial aquifer at levels which exceeded drinking water standards (MCLs, identified as an ARAR), were selected as the COCs for the DCF Study Area. These four contaminants were identified in the FSA (BMcD, 2005b). Their respective MCLs are presented below:

<u>COC</u>	<u>MCL (micrograms per liter [µg/L])</u>
PCE	5
TCE	5
cis-1,2-DCE	70
VC	2

3.3 GROUNDWATER MONITORING PROGRAM

3.3.1 Monitoring Well Sampling

The groundwater monitoring program for the DCF Study Area is based on more than 16 years of groundwater sampling, evaluation, and trend analyses. The wells selected for long-term monitoring will be sampled annually for a minimum of 3 years followed by 5-Year Review sampling as necessary. The 2008, 2009, and 2010 sampling will monitor contaminant concentrations and to ensure that the Pilot Study activities did not disrupt the natural attenuation. When the Island alluvial wells are below MCL's, the DCF Study Area will be recommended for site closeout. Five-Year Review sampling may still be required for monitoring wells installed in the alluvial aquifer. The components and cost of the monitoring program are detailed as follows:

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

- Shallow Monitoring Wells DCF92-01, DCF92-05, DCF93-13, DCF93-19, DCF93-20, DCF06-25, DCF96-27, DCF 06-40, DCF02-41, DCF02-44a, DCF02-46a, DCF02-47a, and DCF02-48a will be used to monitor the VOC concentrations in the bedrock and shallow zone of the terrace and alluvial aquifers (Figure 3-1).
- Deep Monitoring Wells DCF00-34c, DCF99-37c, DCF99-38c, DCF02-43, DCF02-44c, DCF02-46c, DCF02-47c, DCF02-48c, DCF02-49c, and DCF02-50c will be used to monitor the VOC concentrations in the deep zone of the alluvial aquifer (Figure 3-2).

Sampling will be conducted in accordance with the standard operating procedures (SOPs) in the *Installation-Wide Sampling and Analysis Plan for Environmental Investigations at Fort Riley, Kansas, Volume I – Field Sampling Plan* (Malcolm Pirnie [MP]-BMcD, 2004a). Inspections and periodic maintenance and repair, which are discussed in Section 3.3.3, will be conducted on the monitoring wells in 2008, 2009, and 2010; and during 5 year sampling events.

3.3.2 Chemical Analysis of Monitoring Well Samples

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

3.3.3 Groundwater Level Measurements

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

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

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 as 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, 2004a),
- *Installation-Wide Site Safety and Health Plan for Environmental Investigations at Fort Riley, Kansas* (MP-BMcD, 2004b), and
- *Installation-Wide Investigative Derived Waste Management Plan for Environmental Investigations at Fort Riley, Kansas* (BMcD, 2003c).

4.1.2 Hydrogeologic

The hydrogeologic system at the DCF Study Area involves the interaction of the terrace and alluvial aquifers with 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 for the DCF Study Area. The maps will provide valuable insight into groundwater flow directions as well as vertical and hydraulic gradients at the time of sample collection.

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 to monitor geochemical parameters to determine if conditions favorable to MNA are present.

4.2 REPORTS

4.2.1 Quality Control Summary Reports

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

- field/sampling information,
- chain-of-custody,
- completion of requested analyses,
- holding times,
- sample preservation,
- method requirements,
- laboratory method blanks,
- trip blanks,
- surrogates,
- laboratory control samples,
- matrix spike/matrix spike duplicates,
- field duplicates,
- reporting limits, and
- field and analytical completeness.

4.2.2 Annual Sampling Reports

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

4.3 OVERALL DATA EVALUATION

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

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

4.4 DOCUMENT DISTRIBUTION

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

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 DCF Study Area, protectiveness is assured through degradation by natural attenuation processes and exposure protection – MNA and institutional controls. Therefore, the five-year review at the DCF Study Area 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 DCF Study Area. 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 previously referenced 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 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, and
- public notice.

5.4 DCF STUDY AREA FIVE-YEAR REVIEWS

Because this RA will result in hazardous substances, pollutants, or contaminants remaining at the DCF Study Area 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 COCs are not detected in the alluvial monitoring wells at levels 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.

Five-year reviews for the DCF Study Area (OU 003) are initially planned for fiscal years 2008 and 2012. Performance of the reviews may be suspended or extended based upon the results of reviews. Generally, reviews are discontinued when levels of COCs are at levels that would allow unlimited use and unrestricted exposure.

6.0 REFERENCES

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TABLES

Table 1-1
Monitoring Well Data
Dry Cleaning Facilities Study Area Remedial Design/Remedial Action Plan
Fort Riley, Kansas

Well Number	Formation Screened	TOC Elevation (ft)	Bottom of Screen Elevation (ft bgs)	Screened Interval (ft bgs)
DCF92-01	Upper Crouse	1092.04	1043.69	38.30 - 48.35
DCF92-05	Unconsolidated	1082.73	1041.79	30.94 - 40.94
DCF93-08	Upper Crouse	1086.49	1045.49	35.75 - 41.00
DCF93-13	Unconsolidated	1082.86	1042.73	35.93 - 40.13
DCF93-19	Lower Crouse	1087.54	1026.80	50.50 - 60.74
DCF93-20	Lower Crouse	1088.98	1032.37	51.27 - 56.61
DCF06-25	Alluvial	1060.92	1030.80	20.12 - 30.12
DCF96-27	Alluvial	1060.81	1027.91	22.90 - 32.90
DCF00-34c	Alluvial	1050.13	1009.92	29.91 - 40.21
DCF99-37c	Alluvial	1065.16	1015.16	40.00 - 50.00
DCF99-38c	Alluvial	1064.17	1016.67	37.50 - 47.50
DCF06-40	Unconsolidated	1084.66	1036.60	38.06 - 48.06
DCF02-41	Alluvial	1060.16	1026.66	23.50 - 33.50
DCF02-42	Transition	1072.27	1039.07	23.17 - 33.20
DCF02-43	Alluvial	1058.51	1016.51	32.00 - 42.00
DCF02-44a	Alluvial	1061.15	1029.85	16.30 - 31.30
DCF02-44c	Alluvial	1061.01	1018.71	32.30 - 42.30
DCF02-46a	Alluvial	1067.40	1031.40	21.00 - 36.00
DCF02-46c	Alluvial	1067.10	1011.70	45.40 - 55.40
DCF02-47a	Alluvial	1063.18	1029.58	18.60 - 33.60
DCF02-47c	Alluvial	1062.86	1010.46	42.40 - 52.40
DCF02-48a	Alluvial	1059.49	1028.99	15.50 - 30.50
DCF02-48c	Alluvial	1059.44	1009.04	40.40 - 50.40
DCF02-49c	Alluvial	1051.87	1010.27	31.60 - 41.60
DCF03-50c	Alluvial	1061.87	1016.77	35.10 - 45.10

Notes:

Elevations are presented in feet above mean sea level

ft - feet

NA - not available

bgs - below ground surface

NM - not measured

TOC - top of casing

Table 3-1
Monitored Natural Attenuation Program Sample Summary
Dry Cleaning Facility Study Area 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
Wells																
DCF92-01	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF92-05	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF93-08	X															
DCF93-13	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF93-19	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF93-20	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF06-25	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF96-27	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF00-34c	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF99-37c	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF99-38c	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF06-40	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF02-41	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF02-42	X															
DCF02-43	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF02-44a	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF02-44c	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF02-46a	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF02-46c	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF02-47a	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF02-47c	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF02-48a	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF02-48c	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF02-49c	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DCF03-50c	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Totals	26	24	24	24	24	24	24	24	24	24	24	24	24	24	24	24

x - 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
Dry Cleaning Facilities Study Area Remedial Design/Remedial Action Plan
Fort Riley, Kansas**

Parameter	Analytical Method	Holding Time	
		Extraction	Analysis
Organics			
VOC	SW-846 Method 8260B	NA	14 Days
Methane, Ethane, Ethene	SW-846 8015B (M)	NA	14 Days
Natural Attenuation Parameters			
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
Dry Cleaning Facilities Study Area 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 (Dr. Richard 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: John Shimp Building 407, Pershing Court Fort Riley, Kansas 66442-6016	3	3	7/2	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	

(1) Hard Copy/PDF File on CD

FIGURES

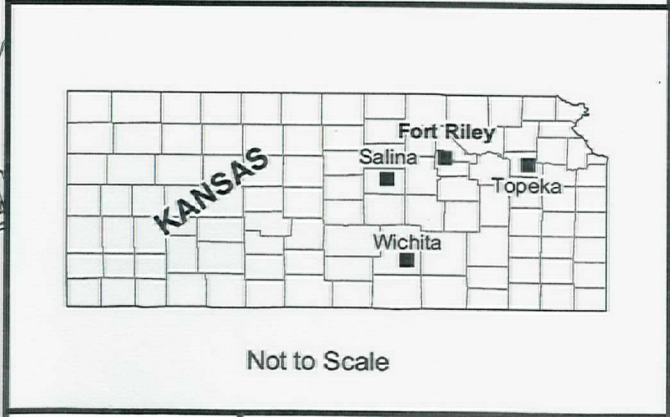
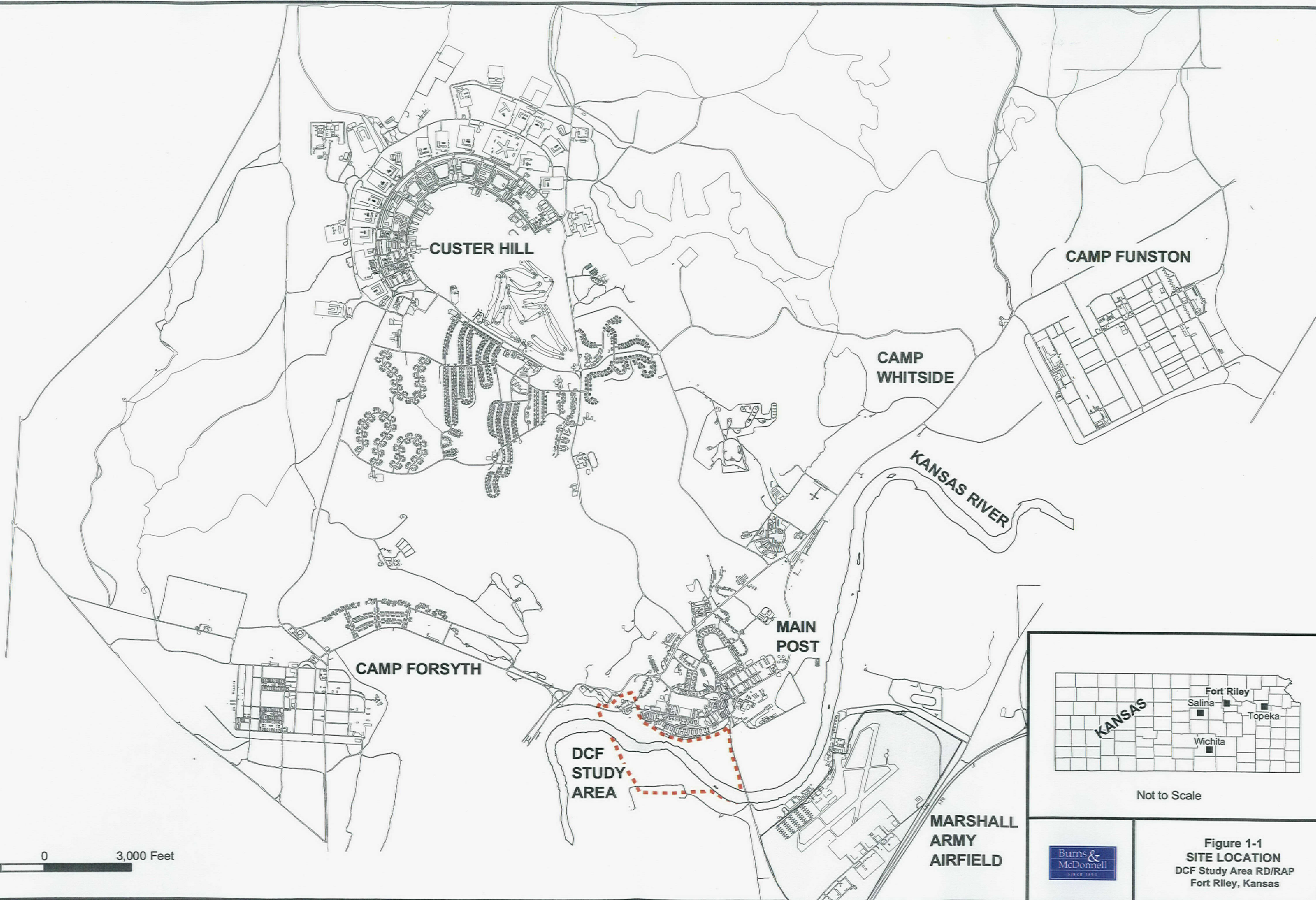
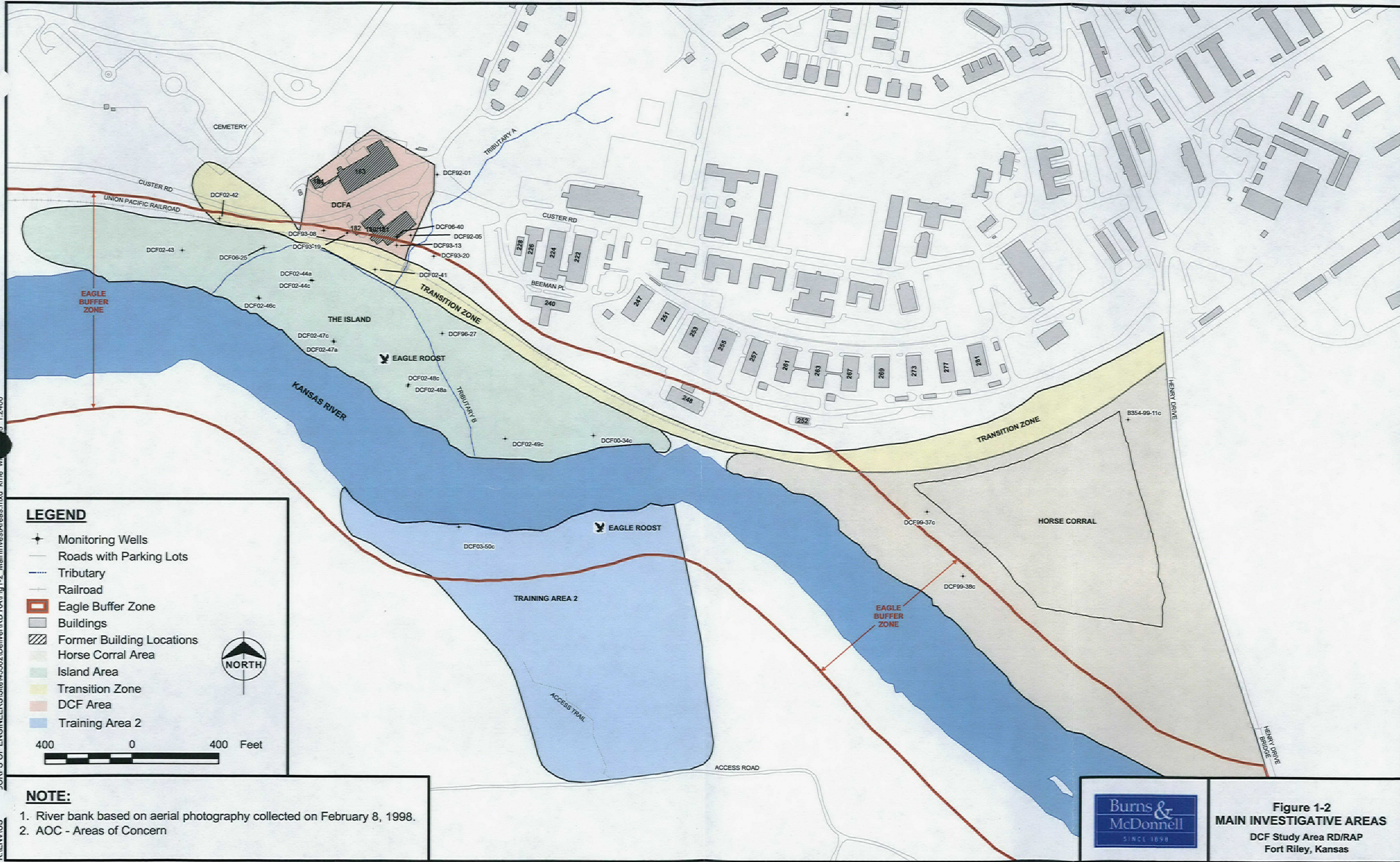


Figure 1-1
SITE LOCATION
DCF Study Area RD/RAP
Fort Riley, Kansas

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LEGEND

- ✦ Monitoring Wells
- Roads with Parking Lots
- Tributary
- Railroad
- ▭ Eagle Buffer Zone
- ▭ Buildings
- ▨ Former Building Locations
- ▭ Horse Corral Area
- ▭ Island Area
- ▭ Transition Zone
- ▭ DCF Area
- ▭ Training Area 2



400 0 400 Feet

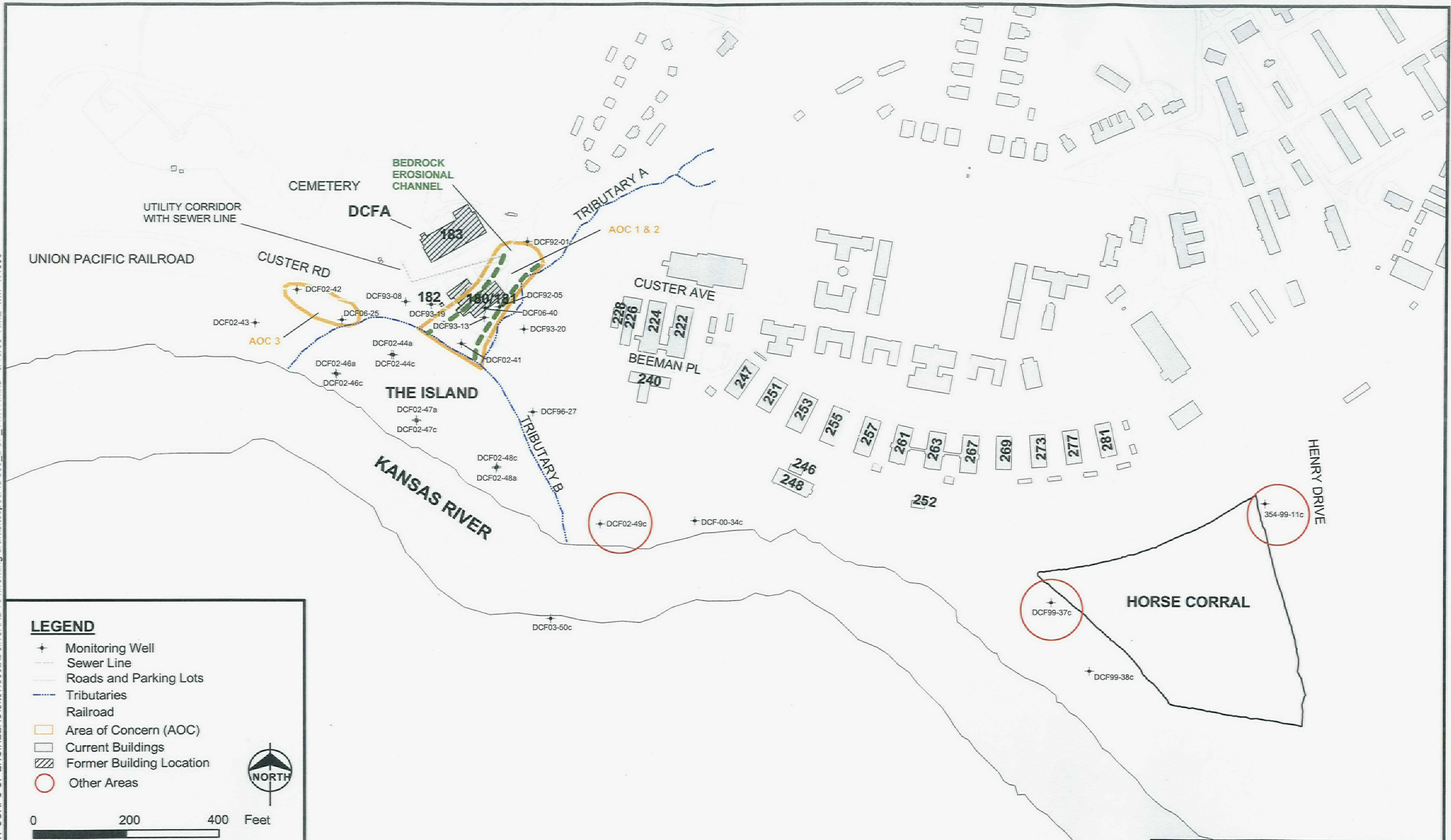
NOTE:

1. River bank based on aerial photography collected on February 8, 1998.
2. AOC - Areas of Concern



Figure 1-2
MAIN INVESTIGATIVE AREAS
 DCF Study Area RD/RAP
 Fort Riley, Kansas

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LEGEND

- + Monitoring Well
- - - Sewer Line
- Roads and Parking Lots
- Tributaries
- Railroad
- Area of Concern (AOC)
- Current Buildings
- Former Building Location
- Other Areas



0 200 400 Feet

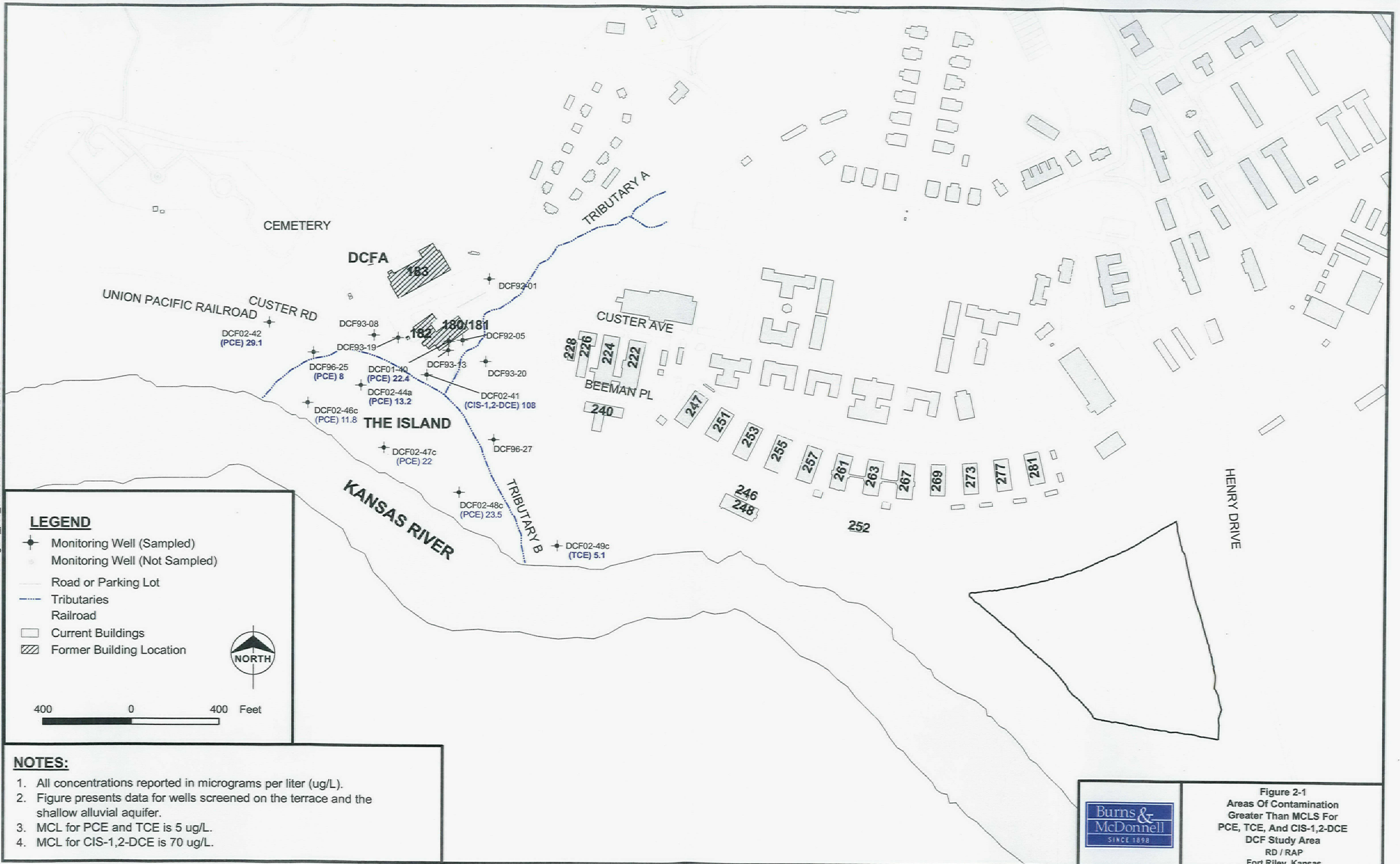
NOTES:

1. River bank based on aerial photography collected on February 8, 1998.



Figure 1-3
Areas of Concern
DCF Study Area RD/RAP
Fort Riley, Kansas

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CEMETERY

DCFA

UNION PACIFIC RAILROAD
CUSTER RD

TRIBUTARY A

CUSTER AVE

BEEMAN PL

THE ISLAND

KANSAS RIVER

TRIBUTARY B

HENRY DRIVE

DCF02-42
(PCE) 29.1

DCF93-08

DCF93-19

DCF96-25
(PCE) 8

DCF01-40
(PCE) 22.4

DCF02-44a
(PCE) 13.2

DCF02-46c
(PCE) 11.8

DCF02-47c
(PCE) 22

DCF96-27

DCF02-48c
(PCE) 23.5

DCF02-49c
(TCE) 5.1

DCF92-01

DCF92-05

DCF93-20

DCF02-41
(CIS-1,2-DCE) 108

DCF93-73

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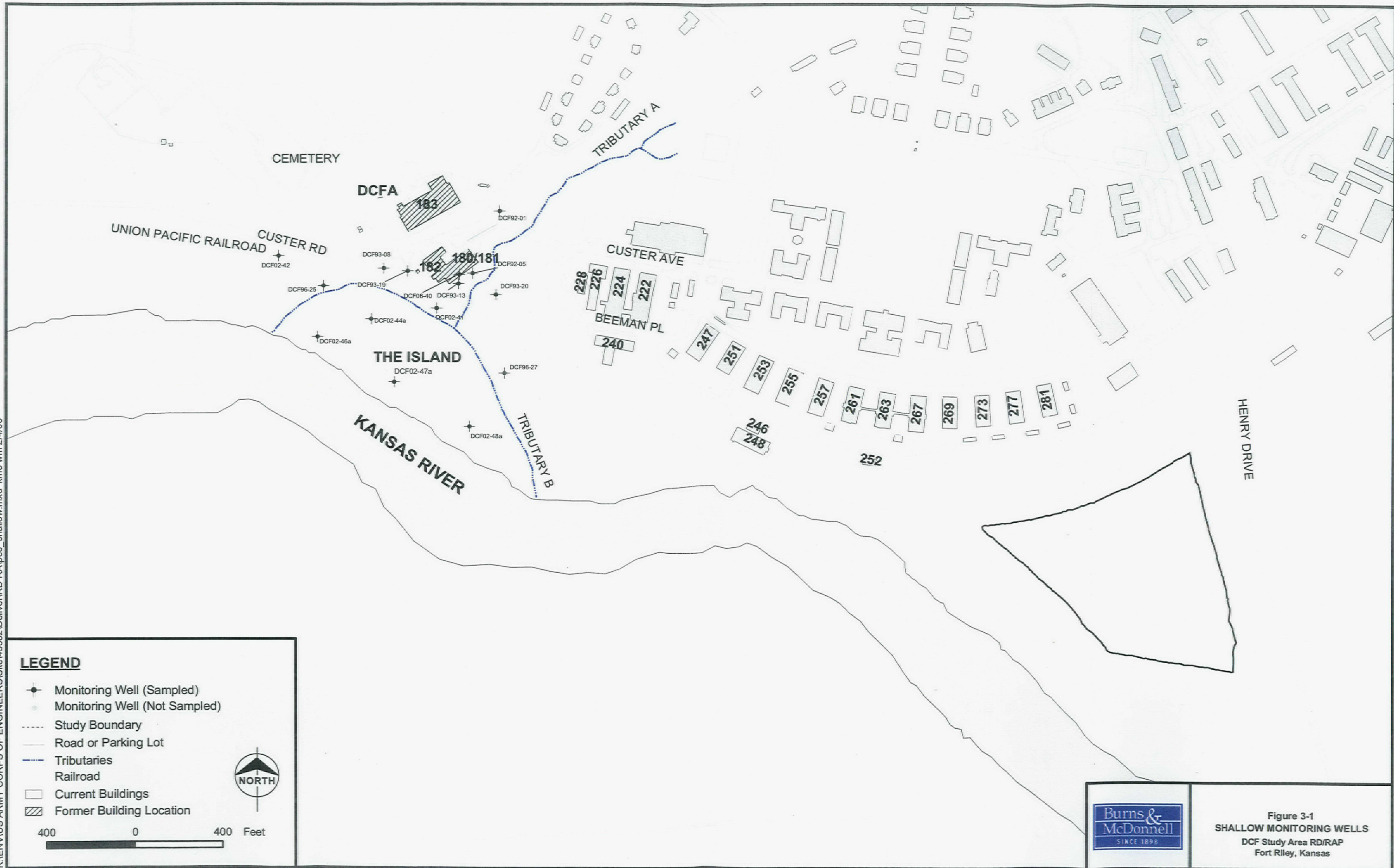
246

248

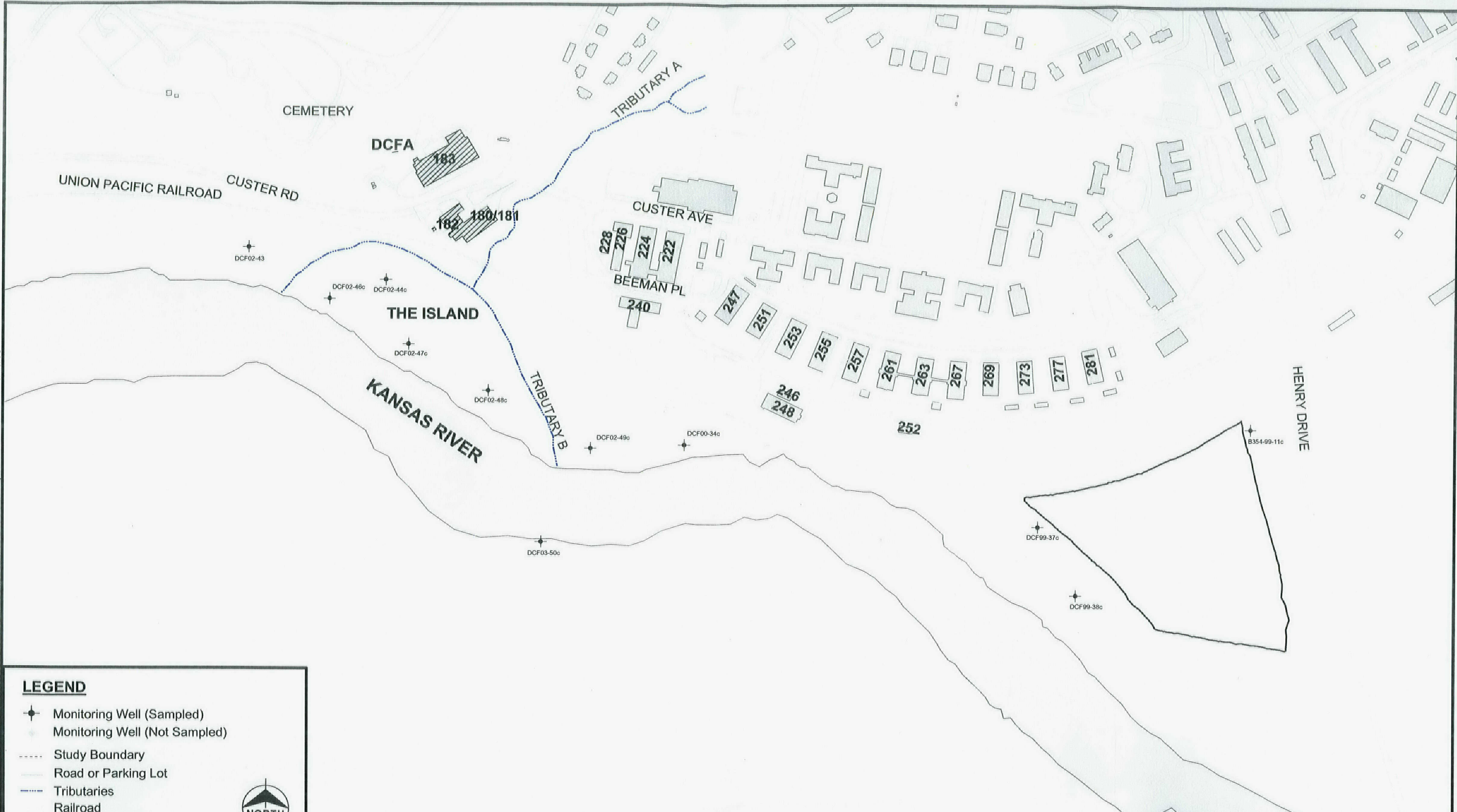
400 0 400 Feet



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LEGEND

- ◆ Monitoring Well (Sampled)
- Monitoring Well (Not Sampled)
- - - Study Boundary
- Road or Parking Lot
- - - Tributaries
- Railroad
- Current Buildings
- ▨ Former Building Location

NORTH

400 0 400 Feet



Figure 3-2
DEEP MONITORING WELLS
 DCF Study Area RD/RAP
 Fort Riley, Kansas