# FINAL
# REMEDIAL ACTION WORK PLAN
# FOR
# LHAAP-67, ABOVEGROUND STORAGE TANK FARM
# LONGHORN ARMY AMMUNITION PLANT
# KARNACK, TEXAS

**Prepared For:**


**U.S. Army Corps of Engineers**

**Prepared By:**

AECOM

**AECOM Technical Services**

**March 2013**

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**Tulsa District**

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**Contract No. W912DY-09-D-0059**

**Task Order No. DS01**

**March 2013**

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## Acronyms and Abbreviations

| | |
|---|---|
| µg/L | micrograms per liter |
| 1,1,1-TCA | 1,1,1-trichloroethane |
| 1,1,2-TCA | 1,1,2-trichloroethane |
| 1,1-DCE | 1,1-dichloroethene |
| 1,2-DCA | 1,2-dichloroethane |
| AECOM | AECOM Technical Services, Inc. |
| ARAR | applicable or relevant and appropriate requirements |
| AST | aboveground storage tank |
| bgs | below ground surface |
| CERCLA | Comprehensive, Environmental Response, Compensation, and Liability Act |
| cm/s | centimeters per second |
| COC | Chemical of Concern |
| CQCP | Contractor Quality Control Plan |
| DHC | Dehalococcoides ethenogens |
| DO | Dissolved Oxygen |
| DPT | Direct push technology |
| ECP | Environmental Condition of Property |
| ft | feet |
| HASP | Health and Safety Plan |
| IDW | Investigation Derived Waste |
| LHAAP | Longhorn Army Ammunition Plant |
| LTM | Long-term Monitoring |
| LUCs | Land Use Controls |
| MCL | Maximum Contaminant Level |
| MNA | Monitored Natural Attenuation |
| NCP | National Oil and Hazardous Substances Contingency Plan |
| NPL | National Priorities List |
| O&M | Operation and Maintenance |
| ORP | Oxidation-Reduction Potential |
| PPE | Personal Protective Equipment |
| QA/QC | Quality Assurance/Quality Control |

| | |
|---|---|
| RA | Remedial Action |
| RAOs | Remedial Action Objectives |
| RAWP | Remedial Action Work Plan |
| RD | Remedial Design |
| ROD | Record of Decision |
| SARA | Superfund Amendments and Reauthorization Act |
| TAC | Texas Administrative Code |
| TCE | Trichloroethylene |
| TCEQ | Texas Commission on Environmental Quality |
| TOC | Total Organic Carbon |
| USACE | United States Army Corps of Engineers |
| USEPA | United States Environmental Protection Agency |
| VC | Vinyl chloride |
| VOC | Volatile Organic Compounds |
| WERS | Worldwide Environmental Remediation Services |

# 1 INTRODUCTION

AECOM Technical Services, Inc. (AECOM) has been contracted by the U.S. Army Corps of Engineers (USACE), Tulsa District, to complete the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Remedial Action (RA) at the Longhorn Army Ammunition Plant (LHAAP) site LHAAP-67 (Aboveground Storage Tank Farm), located in Karnack, Texas. The LHAAP is an inactive, government-owned, formerly contractor-operated and maintained industrial facility located in central-east Texas in the northeastern corner of Harrison County. The facility occupies approximately 1,400 of its former 8,416 acres located between State Highway 43 in Karnack, Texas, and the western shore of Caddo Lake as shown in **Figure 1-1**. LHAAP was listed as a National Priorities List (NPL) site on August 9, 1990 due to threatened releases of hazardous substances, pollutants, or contaminants. The United States Environmental Protection Agency (USEPA), the Texas Water Commission (now the Texas Commission on Environmental Quality [TCEQ]), and the U.S. Army signed a Federal Facilities Agreement on December 30, 1991.

In June 2010, a combined Record of Decision (ROD) was signed covering both LHAAP-35B(37) (Chemical Laboratory) and LHAAP-67 (Aboveground Storage Tank Farm) due to similarities in site impacts, and because the remedies to be performed are similar and concurrent (U.S. Army, 2010). LHAAP-35B(37) is located west-northwest of LHAAP-67 (**Figure 1-2**). A combined Remedial Design (RD) document detailing remedial activities required under the LHAAP-35B(37) and LHAAP-67 ROD was approved by the regulatory agencies in August 2011 (U.S. Army, 2011). This RA Work Plan (RAWP) describes the plan to implement the remedial action required under the ROD and developed by the RD to address risks associated with contaminated groundwater at LHAAP-67. The RAWP for LHAAP-35(B)37 will be submitted as a separate document.

The work described in this RAWP will be managed by USACE Tulsa District under Worldwide Environmental Remediation Services (WERS) Contract No. W912DY-09-D-0059 Task Order No. DS01.

## 1.1 Organization of Work Plan

This work plan is composed of the following sections:

- Section 1: “Introduction” summarizes the site background, proposed remedy including the chemicals of concern (COCs) and their respective cleanup levels, the nature and extent of contamination, and remedial action objectives (RAOs).
- Section 2: “Land Use Controls Plan” describes the proposed scope of work including the implementation of activities associated with the Land Use Controls (LUCs) component of the remedy.
- Section 3: “Monitored Natural Attenuation” describes the plume refinement activities, groundwater and surface water sampling, health and safety procedures and quality assurance/quality control (QA/QC) procedures associated with the monitored natural attenuation (MNA) component of the remedy.

- Section 4: "Remedy Performance Evaluation and Reporting" describes the MNA performance evaluation reporting, annual long-term monitoring (LTM) reporting, and CERCLA five-year reviews to be performed for the remedy.
- Section 5: "Schedule" describes the proposed implementation schedule for the RA activities.
- Section 6: "References" provides a list of references cited in the document.

The work plan also includes Appendix A supporting the main text.

- Appendix A: Sample Annual Land Use Control Compliance Certification Documentation

Activities specified in this work plan will be conducted in accordance with the Installation-Wide Work Plan in place when field work is executed.

## 1.2 LHAAP-67 Background

The LHAAP-67 site is a former aboveground storage tank (AST) farm located at the southeast corner of 48th Street and Ignatius Avenue in the central portion of LHAAP (**Figure 1-2**). The site covers an area of approximately 1.9 acres. The site topography is relatively flat. The nearest significant surface water body to LHAAP-67 is Central Creek located approximately 870 feet (ft) southeast of the site. Central Creek eventually flows into Caddo Lake.

When operational, LHAAP-67 consisted of seven aboveground storage tanks of unknown size. The tanks were surrounded by earthen dikes designed to contain potential spills. The tanks were used for storage of No. 2 fuel oil, kerosene, and solvents. The ASTs have been removed and the only structure remaining at the site is a railroad bed (U.S. Army, 2010).

Field investigations conducted between 1998 and 2007 identified soil and groundwater contamination at LHAAP-67 and determined its nature and extent. It is believed that historic releases from the ASTs at the site contaminated the soil and then leached from the soil into the groundwater. The investigation data and the subsequent risk assessments indicated that the soil at the LHAAP-67 site does not pose a risk to the environment or to human health under an industrial exposure scenario for a future maintenance worker (U.S. Army, 2010). A relatively small area of contamination appears to be present within shallow zone groundwater which poses an unacceptable carcinogenic risk and non-carcinogenic hazard to a future maintenance worker under an industrial scenario. There is no groundwater contamination in the intermediate groundwater zone. Although there is likely interconnectivity between the shallow and intermediate zones due to the laterally and vertically discontinuous nature of channel sands, flow is predominantly horizontal in these units (U.S. Army, 2010).

The COCs identified in LHAAP-67 groundwater are trichloroethene (TCE), 1,1-dichloroethene (1,1-DCE), 1,2-dichloroethane (1,2-DCA), 1,1,1-trichloroethane (1,1,1-TCA), and 1,1,2-trichloroethane (1,1,2-TCA). The presence of these COCs in the shallow groundwater zone represents the primary driver for remedial action as there are no ecological risks at the LHAAP-67 site.

The RA to be implemented at LHAAP-67 was selected and developed in accordance with the CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986, and, to the extent practicable, the National Oil and Hazardous Substances Contingency

Plan (NCP) (40 Code of Federal Regulations 300). The selected remedy finalized in the ROD was developed based on the assumption that future land use will be as a national wildlife refuge. A notification will be recorded at the Harrison County Courthouse to indicate that the site is suitable for non-residential use.

### 1.2.1 Proposed Remedy

Under the Safe Drinking Water Act, maximum contaminant levels (MCLs) have been determined for each of LHAAP-67 COCs, and the MCLs will be used as cleanup levels.

**Table 1-1** below presents the cleanup levels for the LHAAP-67 site.

**Table 1-1: Cleanup Levels**

| Chemical of Concern (COC) | Concentration (µg/L) | Basis |
|---|---|---|
| Trichloroethylene | 5 | MCL |
| 1,1-dichloroethylene | 7 | MCL |
| 1,2-dichloroethane | 5 | MCL |
| 1,1,1-trichloroethane | 200 | MCL |
| 1,1,2-trichloroethane | 5 | MCL |

Notes and Abbreviations:
µg/L – micrograms per liter
MCL – maximum contaminant level

The remedy for the LHAAP-67 site is intended to protect human health by preventing exposure to contaminated groundwater and preventing contaminated groundwater from migrating into nearby surface water.

The remedy for the LHAAP-67 site will include the following components:

- Land Use Controls: LUCs in the impacted area will ensure protection of human health by restricting the use of groundwater exceeding cleanup levels to environmental monitoring and testing only. The LUCs will remain in effect until such time as the U.S. Army, TCEQ, and USEPA agree that the concentrations of COCs have met cleanup levels.
- Monitored Natural Attenuation: MNA constitutes a passive remedial action that relies on natural biological, chemical, and physical processes that act to reduce the mass and concentrations of groundwater COCs under favorable conditions. A program of MNA will be implemented to establish confidence in attenuation trends and verify that the plume is stable and will not migrate to nearby surface water at levels that may present an unacceptable risk to human health or the environment. Natural attenuation is expected to return groundwater to acceptable quality such that its use does not need to be restricted by the presence of COCs and, until that time, to prevent contaminated groundwater from impacting Central Creek.

The need for continued monitoring will be evaluated every five years during the CERCLA five-year review.

Long-term Monitoring/Five-Year Reviews: LTM will begin at a semiannual frequency after the first two years until the CERCLA five-year review. In subsequent years, LTM will be performed annually until the following CERCLA five-year review. The LTM associated with this remedy

will be used to track the continued effectiveness of MNA and will continue at least once every five years until the cleanup levels are achieved.

Based on previously performed groundwater modeling, MCLs would be met through natural attenuation in 17 to 66 years for TCE, 20 to 34 years for 1,1-DCE, and 21 to 43 years for 1,2-DCA. While the modeling predicts that 1,1,1-TCA and 1,1,2-TCA would attain their respective MCLs in 22 and 20 years, these two volatile organic compounds (VOCs) have not exceeded their MCLs at LHAAP-67 in recent groundwater monitoring events (U.S. Army, 2010).

### 1.2.2 Nature and Extent of Contamination

The center of mass of the VOC plume in the shallow groundwater is in proximity of shallow monitoring well 67WW01. The most recent available data (December 2006) indicates only one well (67WW01) exhibited concentrations of TCE (5.99 µg/L), 1,1-DCE (179 µg/L), and 1,2-DCA (6.1 µg/L). Vinyl chloride (VC), a degradation product of TCE not listed separately as a COC in the ROD or final RD, has also been detected in this well in excess of its MCL. During the 2006 sampling event and the event prior (2004), 1,1,1-TCA and 1,1,2-TCA were detected at concentrations less than their respective MCLs.

**Figure 1-3** depicts the estimated plume boundaries for TCE, 1,1-DCE, and 1,2-DCA based on December 2006 groundwater data, as defined by their respective MCLs.

Currently, there are no shallow wells to the southeast of well 67WW01 and the closest downgradient well (67WW07) to the east of 67WW01 is approximately 270 ft.

The evaluation of historical VOC trends at LHAAP-67 provides strong evidence that natural attenuation processes are contributing to a significant reduction in COC concentrations and mitigating plume migration. The data also suggests that natural attenuation mechanisms other than biodegradation, such as dilution, dispersion, sorption, and volatilization, are likely the primary contributors to the COC reductions (U.S. Army, 2010).

### 1.2.3 Site Geology and Hydrogeology

Across LHAAP-67, below the unconsolidated fluvial materials, the silty clay of the Wilcox Group is encountered, ranging in thickness from approximately two feet to fifteen feet. The clay grades into fine-grained silty sand with increasing thickness towards the east-southeast. Depth to groundwater at the site is approximately 17 to 20 feet below ground surface (bgs) and groundwater flow is generally to the east-southeast. Groundwater elevation contours for the shallow zone from data collected in December 2007 are included in **Figure 1-3**. There is likely limited interconnectivity between the shallow and intermediate zones because of the laterally and vertically discontinuous nature of the channel sands; however, flow is predominantly horizontal through these units (U.S. Army, 2011).

For the shallow groundwater zone, hydraulic conductivity values for the sand units range from $1.2 \times 10^{-5}$ centimeters per second (cm/s) to $1.0 \times 10^{-2}$ cm/s (U.S. Army, 2011). The average groundwater velocity is 14.7 feet per day for LHAAP-67, based on the average hydraulic conductivity (U.S. Army, 2008), hydraulic gradient and effective porosity (Shaw, 2007).

The shallow groundwater potentiometric surface indicates groundwater from LHAAP-67 has an easterly and southeasterly flow and may discharge into Central Creek if a sufficiently high groundwater elevation is achieved; however, current conditions do not support release to Central

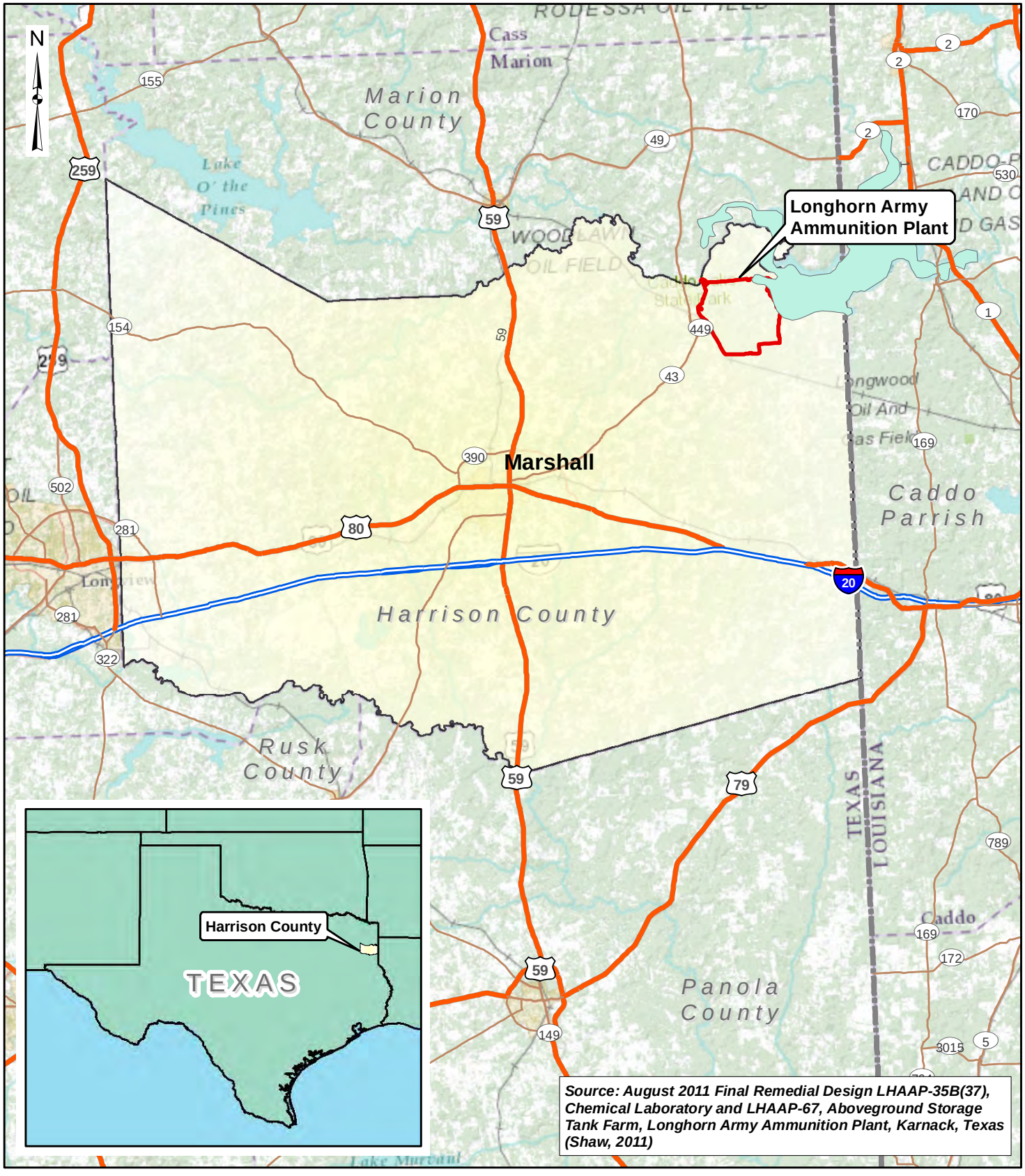
Creek. Data indicates that the shallow zone water table is several feet below the Central Creek bed surveyed at 168.54 feet above mean sea level (U.S. Army, 2010). Due to uncertainties regarding the seasonal variations in the water table elevations, shallow groundwater is presumed to discharge into the Central Creek when the water table elevations are high enough (U.S. Army, 2010).

### 1.2.4 Remedial Action Objectives

The RA at the LHAAP-67 site must protect human health and meet applicable or relevant and appropriate requirements (ARARs). There are no ecological risks at the LHAAP-67 site (U.S. Army, 2010). The proposed RA addresses human health risks for a future maintenance worker in an industrial scenario.

The RAOs for the LHAAP-67 site, consistent with the reasonably anticipated future use as a national wildlife refuge, are:

- Ensure protection of human health by preventing exposure to the contaminated groundwater;
- Ensure protection of human health and the environment by preventing contaminated groundwater from migrating into nearby surface water; and,
- Ensure return of groundwater to its potential beneficial use as drinking water, wherever practicable.




***Source: August 2011 Final Remedial Design LHAAP-35B(37), Chemical Laboratory and LHAAP-67, Aboveground Storage Tank Farm, Longhorn Army Ammunition Plant, Karnack, Texas (Shaw, 2011)***

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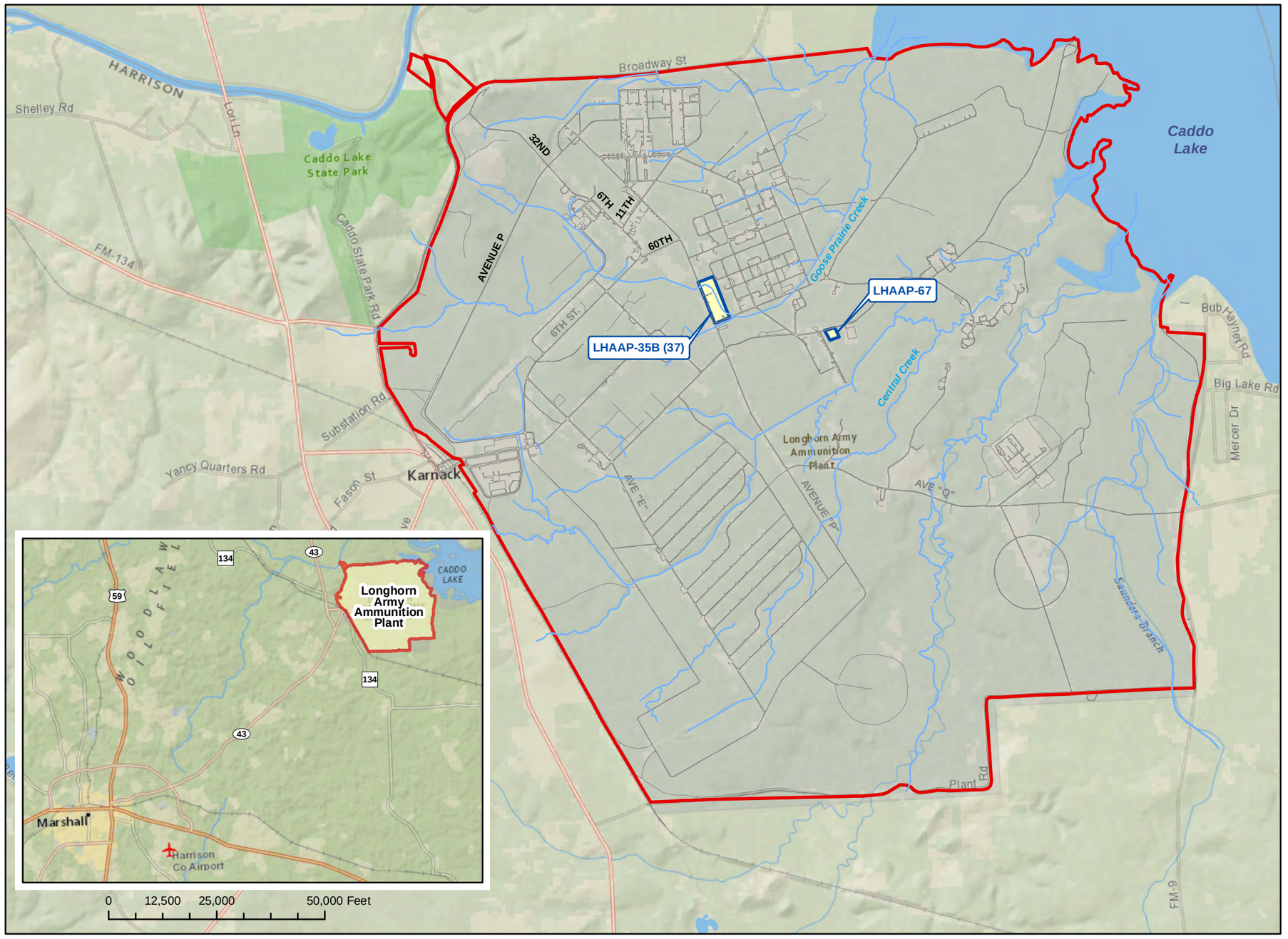
Figure 1-1
Site Area Map
Remedial Action Work Plan
LHAAP-67
Longhorn Army Ammunition Plant
Karnack, Texas

60256135

September 2012




**Legend**

- Streams
- Roads
- LHAAP Boundary
- Site
- Lake/Pond

***Source: August 2011 Final Remedial Design LHAAP-35B(37), Chemical Laboratory and LHAAP-67, Aboveground Storage Tank Farm, Longhorn Army Ammunition Plant, Karnack, Texas (Shaw, 2011)***

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Figure 1-2
Site Location Map
Remedial Action Work Plan
LHAAP-67
Longhorn Army Ammunition Plant
Karnack, Texas

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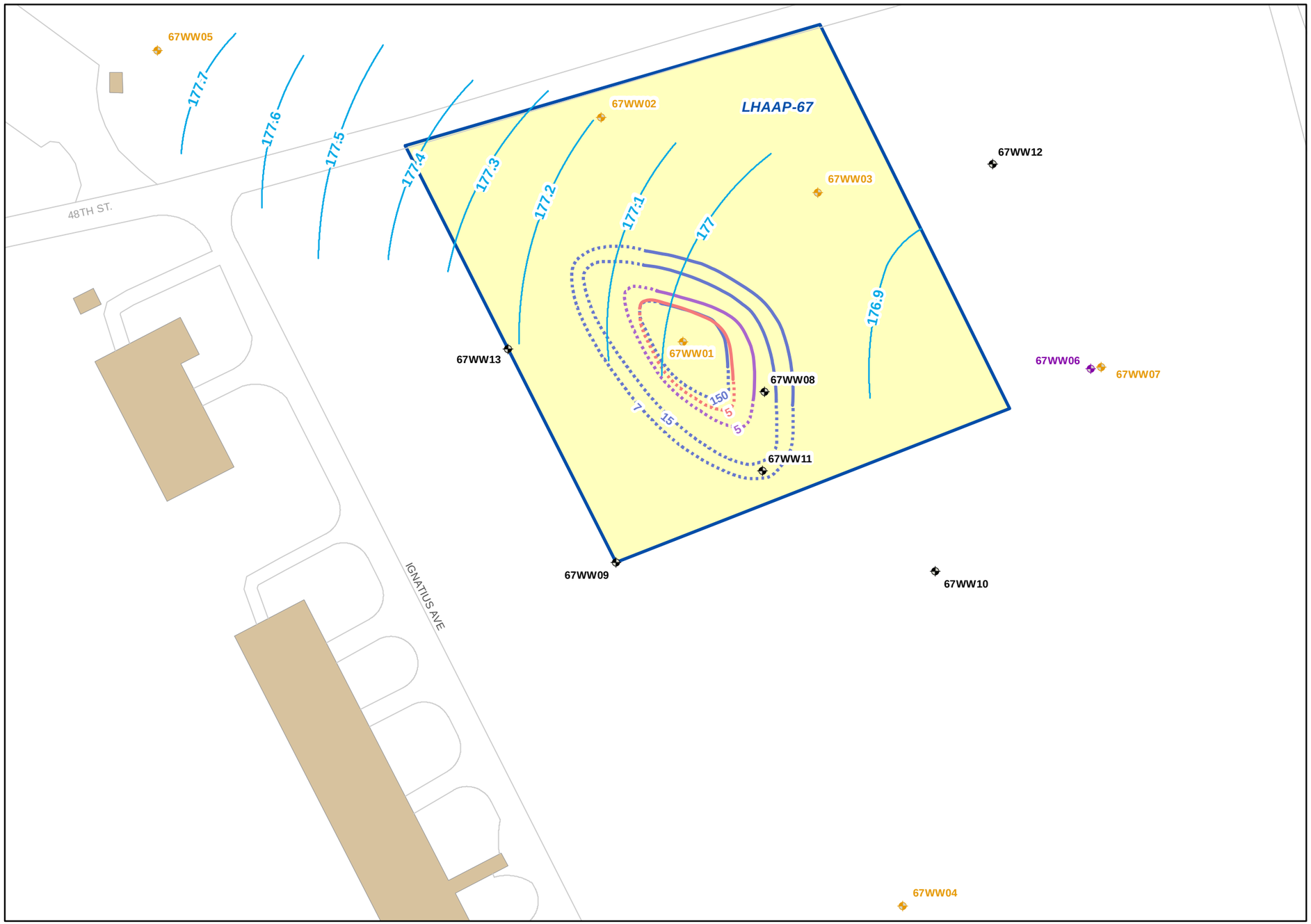


**Legend**

- Existing Intermediate Well
- Existing Shallow Monitoring Well
- Proposed Shallow Well Location
- 176.9 — Groundwater Elevation Contour December 2007 (ft msl)
- 1,1-DCE Concentration Contour (Dashed Where Inferred)
- 1,2-DCA Concentration Contour (Dashed Where Inferred)
- TCE Concentration Contour (Dashed Where Inferred)
- Roads
- Buildings
- LHAAP-67 Site Boundary

***Source: August 2011 Final Remedial Design LHAAP-35B(37), Chemical Laboratory and LHAAP-67, Aboveground Storage Tank Farm, Longhorn Army Ammunition Plant, Karnack, Texas (Shaw, 2011)***

0 37.5 75 150 Feet

Note:
1. Reporting limit (<5 µg/L) results were considered not detected to develop contours.
2. Concentrations reported in µg/L.
3. Concentration contours are based on December 2006 sampling event data.
4. µg/L = micrograms per liter.
5. LUC = Land Use Control.
6. ft msl = feet above mean sea level.
7. Groundwater Elevation Contours are based on December 2007 Water Level Measurement Data.

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Figure 1-3
Contaminant Plumes in Shallow Groundwater
Remedial Action Work Plan
LHAAP-67
Longhorn Army Ammunition Plant
Karnack, Texas

60256135 September 2012

# 2 LAND USE CONTROLS PLAN

The U.S. Army or its representatives will be responsible for LUC implementation and certification, reporting and enforcement. The U.S. Army will address LUC problems within its control that are likely to impact remedy integrity and shall address problems as soon as practicable. The following sections provide a detailed scope of work for the LUCs component of the RA.

## 2.1 Land Use Controls Implementation

The objectives of LUCs at LHAAP-67 are to prevent human exposure to groundwater contamination presenting an unacceptable risk to a future maintenance worker and ensure that there is no withdrawal or use of groundwater from the site for anything other than environmental monitoring and testing until the cleanup levels are attained. Notification of the groundwater use restriction will accompany all transfer documents and will be recorded at the Harrison County Courthouse in accordance with the Texas Administrative Code (TAC) Title 30, §335.566.

The LUCs address the area of the LHAAP-67 site containing VOC plumes in the shallow groundwater zone. The U.S. Army is responsible for implementing, maintaining, monitoring, reporting on, and enforcing the LUCs. As a condition of property transfer, the U.S. Army may require the transferee to assume responsibility for various implementation actions, as indicated below. Although the U.S. Army may transfer responsibility for various implementation actions, the U.S. Army will retain its responsibility for remedy integrity. This means that the U.S. Army is responsible for addressing substantive violations of performance objectives that would undermine the U.S. Army's CERCLA remedy. The U.S. Army will also be responsible for incorporating RD information and outlining the transferee's LUC obligations into property transfer documentation.

The U.S. Army will undertake the following actions to implement the groundwater restriction LUC for LHAAP-67:

- **Define the Area of the Groundwater Use Restriction**

  The estimated LUC boundary is depicted in **Figure 2-1**. The LUC boundary will be finalized after collecting first round of groundwater sampling data as part of MNA evaluation. A buffer may be provided to address uncertainty in the exact location of the plume boundary at all points.

- **Survey the LUC Boundary**

  The proposed LUC boundary will be finalized only after the proposed well installations are complete and all wells are sampled (one round of monitoring data). The proposed boundary will be coordinated with the USEPA and TCEQ, and the LUC boundary will be surveyed by a State-licensed surveyor. A legal description of the surveyed area will be appended to the survey plat.

- **Record the LUC in Harrison County**

  The LUC plat, legal description and groundwater use restriction language will be recorded in the Harrison County Courthouse in accordance with the TAC Title 30, §335.566.

- **Notify the Texas Department of Licensing and Regulation of the LUC**

  The Texas Department of Licensing and Regulation will be notified of the groundwater restriction which includes the prohibition of water well installation for any purpose other than environmental monitoring and testing without prior approval from the U.S. Army, USEPA, and the TCEQ. The survey plat, legal boundary, and description of the groundwater restriction, in conjunction with a locator map, will be provided in hard and electronic copy.

  The U.S. Army and regulators will consult to determine appropriate enforcement actions should there be a failure of a LUC objective at the site after it has been transferred.

## 2.2 Site Certification and Reporting

The annual inspections/certifications will be completed in compliance with the LUC objectives. The U.S. Army or the transferee after the transfer will retain the annual LUC inspection/certification documents (Appendix A of this document) in the project files for incorporation into the CERCLA five-year review reports, and these reports will be made available to the USEPA and TCEQ upon request. If any violations are found during the annual certification, the U.S. Army will provide the USEPA and TCEQ a separate written explanation indicating the specific violations found and what efforts or measures have or will be taken to correct the violations. Upon transfer, such responsibilities may shift to the transferee via appropriate provisions placed in the Environmental Condition of Property (ECP) or other environmental transfer document. The need to continue annual inspections/certifications will be revisited during CERCLA five-year reviews.

## 2.3 Notice of Planned Property Conveyances

The U.S. Army will provide notice to the USEPA and TCEQ when conveying the LHAAP-67 site acreage. The notice will describe the mechanism by which the LUC will continue to be implemented, maintained, inspected, reported, and enforced. Upon transfer, such responsibilities may shift to the transferee via appropriate provisions placed in the ECP or other environmental transfer document. The U.S. Army retains the responsibility for remedy integrity and is responsible for addressing substantive violations of the LUC performance objective that would undermine the U.S. Army CERCLA remedy. The U.S. Army will be responsible for outlining the transferee's LUC obligations in property transfer documents.

## 2.4 Opportunity to Review Text of Intended Land Use Controls

The U.S. Army will provide copies of the groundwater use restriction notification to the TCEQ and USEPA prior to its recordation in Harrison County, and will produce an ECP or other environmental document prior to transfer of the LHAAP-67 site and provide a draft to the USEPA and TCEQ.

## 2.5 Notification Should Action(s) which Interfere with Land Use Control Effectiveness be Discovered Subsequent to Conveyance

Should the U.S. Army discover any activity on the property inconsistent with the LUC performance objectives after conveyance of the site, USEPA and TCEQ will be notified within 72 hours. The U.S. Army, in conjunction with the USEPA, TCEQ, and the transferee will correct

the problem(s) discovered. This reporting requirement does not preclude the U.S. Army from taking immediate action pursuant to its CERCLA authority to prevent any perceived risks to human health and the environment.

## 2.6 Land Use Controls Enforcement

Should the LUC remedy fail, the U.S. Army will coordinate with the USEPA and TCEQ to ensure that appropriate actions are taken to reestablish its protectiveness. The U.S. Army may notify the local agencies with jurisdiction of any LUC violation(s) by future property owners and will work cooperatively with them to restore owner/user compliance with the LUC.

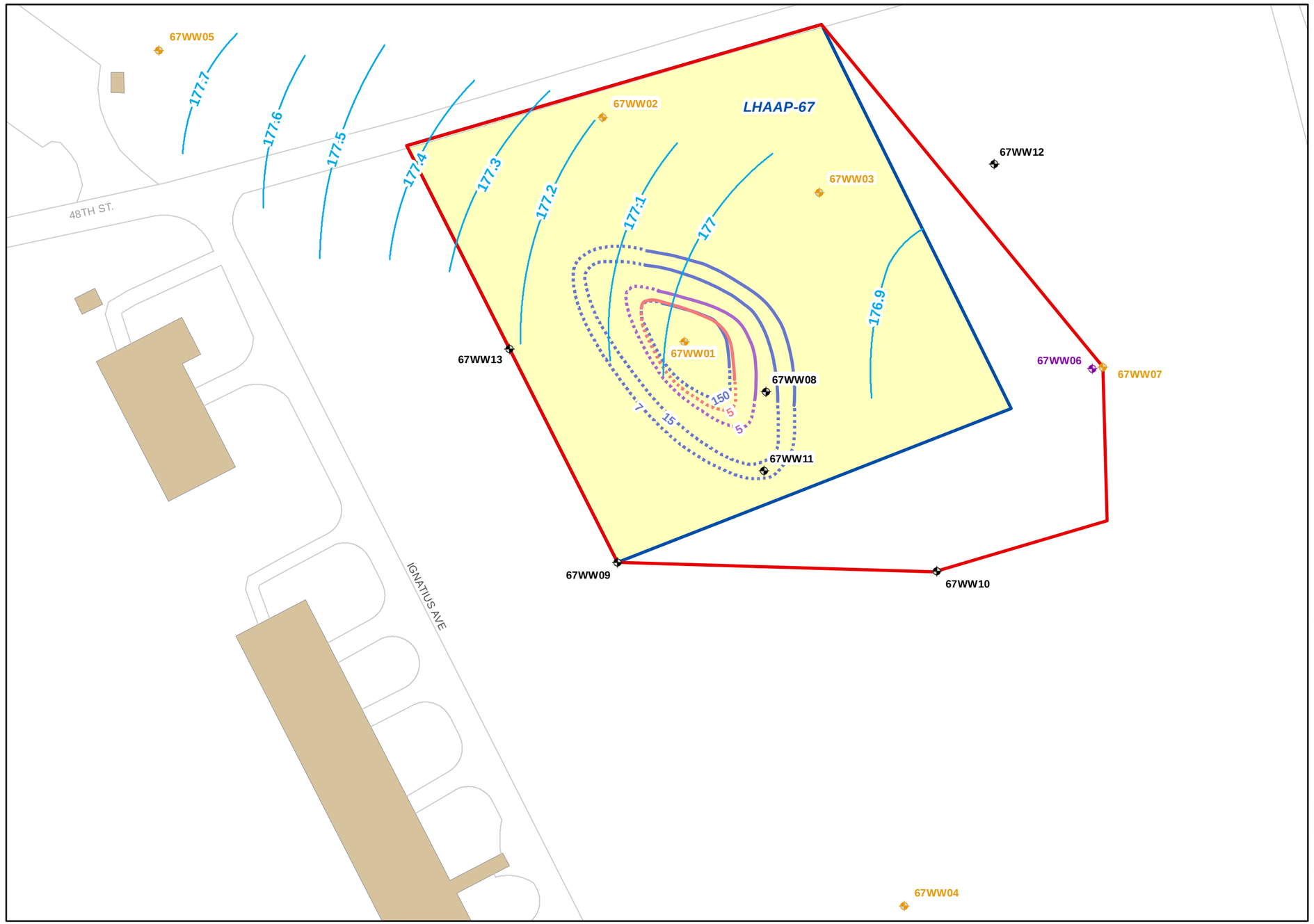
## 2.7 Modification or Termination of Land Use Controls

The U.S. Army will only make a significant modification to, or terminate the LUC or make a land use change inconsistent with the LUC objective with USEPA and TCEQ concurrence before commencing actions that may impact remedy integrity.

The LUCs will remain in effect until such time as the U.S. Army, TCEQ, and USEPA agree that the concentrations of COCs have met cleanup levels. When this occurs, the LUCs will be terminated consistent with the NCP process for post-ROD changes, including an explanation of significant differences or a remedial action completion report. If the property has been transferred and a determination by the U.S. Army, TCEQ and USEPA has been made to terminate one or more of the LUCs, the U.S. Army shall provide to the owner of the property an appropriate release for recordation pertaining to the site and will also provide timely advice to other local stakeholders of the action.

## 2.8 Comprehensive Land Use Control Management Plan of Land Use Controls

Upon finalization of this LUC RA, a copy will be inserted into the Comprehensive LUC Management Plan for LHAAP. The Comprehensive LUC Management Plan figure and table will be updated to reflect the inclusion of LHAAP-67.




**Legend**

- Existing Intermediate Well
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- Proposed Shallow Well Location
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- TCE Concentration Contour (Dashed Where Inferred)
- Roads
- Buildings
- Proposed LHAAP-67 LUC Boundary
- LHAAP-67 Site Boundary

***Source: August 2011 Final Remedial Design LHAAP-35B(37), Chemical Laboratory and LHAAP-67, Aboveground Storage Tank Farm, Longhorn Army Ammunition Plant, Karnack, Texas (Shaw, 2011)***

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2. Concentrations reported in µg/L.
3. Concentration contours are based on December 2006 sampling event data.
4. µg/L = micrograms per liter.
5. LUC = Land Use Control.
6. ft msl = feet above mean sea level.
7. Groundwater Elevation Contours are based on December 2007 Water Level Measurement Data.
8. The LUC boundary will be finalized after collecting first round of groundwater monitoring data and after concurrence with the U.S. Army and the regulatory agencies.

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# Figure 2-1
## Proposed Land Use Control Boundary
## Remedial Action Work Plan
## LHAAP-67
Longhorn Army Ammunition Plant
Karnack, Texas

60256135 September 2012

# 3 MONITORED NATURAL ATTENUATION

This section discusses the objectives and details of the MNA program under the RA.

COCs are present in the shallow groundwater zone at the LHAAP-67 site. While chemicals exceeding their cleanup levels are not detected in the intermediate groundwater zone, this zone will be monitored since past monitoring has indicated presence of chemicals at less than cleanup levels. The nature and extent of groundwater contamination in the shallow groundwater zone is discussed in section 1.2.2.

Performance monitoring will be performed to evaluate remedy effectiveness and will include groundwater and surface water monitoring. The groundwater monitoring program is designed to evaluate and monitor natural attenuation of COCs in shallow zone groundwater and the surface water monitoring program is designed to evaluate potential migration of contaminated groundwater to surface water.

The combined monitoring program shall meet the following objectives (USEPA, 1999):

- Demonstrate that natural attenuation is effectively occurring;
- Detect changes in environmental conditions (e.g. geochemical, hydrogeologic, etc.) that may reduce the efficacy of any of the natural attenuation processes;
- Identify potentially toxic and/or mobile transformation products;
- Verify that the plume(s) is not expanding;
- Verify no unacceptable impact to downgradient receptors;
- Detect new releases of contaminants to the environment that could impact effectiveness of the natural attenuation remedy; and,
- Verify attainment of the remediation objectives.

## 3.1 Plume Refinement Activities

Currently, there is only one well (67WW01) located within the plumes and there are no wells located downgradient of well 67WW01 in the east-southeast direction. Additional monitoring wells will be installed at LHAAP-67 to provide additional data to assist in evaluation of natural attenuation, and to refine the shape of VOC plumes.

Discrete groundwater samples will be collected from a minimum of two temporary borings advanced using direct push technology (DPT) drilling and will be analyzed for VOCs. The approximate locations of the temporary borings and monitoring wells are depicted in **Figure 3-1**. Table 3-1 provides the rationale for proposed DPT points and the shallow monitoring well locations. The exact locations will be adjusted in the field based on site conditions and available data. The additional data, along with sampling and analysis of existing wells, will be used as guidance to optimize placement of new monitoring wells. During the plume refinement activities, groundwater from intermediate zone wells will also be sampled to determine the need for any additional intermediate zone wells.

In addition to the wells installed to refine the shape of the plumes, a minimum of four additional shallow monitoring wells will be installed for use in long-term monitoring. This information will

be used to establish LUC boundaries for the site. Two of these wells (67WW10 and 67WW12) will be installed beyond the site boundary. One well (67WW13) will be installed along the western site boundary. The proposed locations of these new monitoring wells for establishing the LUC boundary are depicted in **Figure 3-1**.

In summary, a minimum of six additional wells are proposed at LHAAP-67 site. **Figure 3-1** depicts the approximate expected locations of the proposed monitoring wells, subject to change based upon the findings of the discrete groundwater sampling effort. The use of existing wells will be maximized as they provide historic data that can be used for MNA evaluation.

## 3.2 MNA Implementation

This section describes the field and other activities planned at the LHAAP-67 site that relate to the MNA component of the groundwater remedy. General activities would apply to any site with similar characteristics. Site-specific activities are described in associated subsections.

### 3.2.1 Pre-mobilization Activities

A pre-construction meeting will be held prior to initiation of field activities.

### 3.2.2 Preliminary Activities/Mobilization

AECOM will finalize the field schedule with the selected drilling contractor and mobilize to the LHAAP-67 site per the schedule. An on-site project kickoff meeting will be held with the contractor to review the scope of work including the drilling locations, utility clearances, and health and safety issues.

### 3.2.3 Site/Utility Clearance

AECOM will coordinate with the U.S. Army to evaluate the location of subsurface utilities based on existing utility maps. All proposed borehole locations will be marked, Underground Service Alert (One Call) will be notified at least two working days prior to intrusive work, and the utility clearance standard operating procedure will be followed.

### 3.2.4 Direct Push Groundwater Sampling

DPT will be used to collect discrete groundwater samples to refine understanding of the shallow groundwater zone plume to assist in implementing the remedy. A minimum of two DPT well points will be installed to collect discrete groundwater samples. Discrete groundwater samples will be collected from DPT points using a Geoprobe SP-15® or equivalent which has a 3.5-foot screen length. Groundwater samples will also be collected from permanent shallow and intermediate zone wells. The drilling equipment will be decontaminated after each sample is collected to prevent cross-contamination.

The collected groundwater samples will be analyzed for VOCs utilizing USEPA Method 8260B. Sample analyses and analytical results validation will be conducted in accordance with the Installation-Wide Work Plan in place at the time field work is conducted.

### 3.2.5 Monitoring Well Installation

A minimum of six new monitoring wells (**Figure 3-1**) are proposed in the shallow groundwater zone. Monitoring wells will be installed using a hollow-stem auger, mud rotary or sonic drilling techniques as appropriate. Well installation and development will follow the procedures specified in the Installation-Wide Work Plan in place at the time field work is conducted.

### 3.2.6 Site Survey

After completion of the sampling activities, the monitoring wells will be surveyed by a licensed land surveyor. The survey activities (for location and elevation) will be performed in accordance with the Installation-Wide Work Plan in place at the time field work is conducted.

### 3.2.7 MNA Program Groundwater Monitoring

Groundwater monitoring will be performed to demonstrate effectiveness of the MNA remedy. A minimum of thirteen monitoring wells (**Figure 3-1**) is proposed to be included in the monitoring program for VOCs. Twelve of these wells will be located in the shallow zone, and one in the intermediate zone. These wells have been selected for their placement relative to the VOC plumes to monitor effectiveness of natural attenuation at the LHAAP-67 site as well as ensure the plume extent to verify that the LUC boundaries are valid. The number of monitoring wells included in the network may be reduced based on results of the initial data collection activities. Table 3-2 indicates the wells in each zone and the analytes for each well. Table 3-3 lists the analytes, test methods, and other sampling information.

Prior to sampling, depth to groundwater measurements will be recorded using an interface probe capable of detecting the presence of free phase hydrocarbons. The depth to water will be measured from a specified location on top of the casing where elevation has been determined. The depth to water will be recorded in the appropriate field forms and the water elevation calculated using the top of casing elevation. These results will be used to construct a potentiometric map for the site.

Prior to sampling groundwater, each well will be purged and general water quality parameters (temperature, pH, specific conductivity, dissolved oxygen (DO), oxidation reduction potential (ORP), and turbidity) will be collected. Upon completion of these activities, groundwater samples will be collected and placed into laboratory-provided containers. The containerized samples will be properly labeled, placed within ice-filled coolers, and shipped to the laboratory under chain-of-custody control for analytical testing. All well purging, groundwater sampling, sample labeling and shipping activities will be conducted in accordance with the Installation-Wide Work Plan in place at the time field work is conducted.

The schedule for groundwater monitoring for MNA will be quarterly for two years. Samples from a subset of the monitoring wells (67WW01 and 67WW08), will also be tested for the following biogeochemical parameters: nitrate, nitrite, sulfate, ferrous iron, chloride, methane, ethane, ethene, inorganic and organic carbon, and Dehalococcoides ethenogenes (DHC).

Sample analyses and analytical results validation will be conducted in accordance with the Installation-Wide Work Plan in place at the time field work is conducted

#### 3.2.7.1 Surface Water Sampling

Surface water samples from Central Creek locations downgradient of LHAAP-67 site will be collected on a quarterly basis for the first year and then annually until the next CERCLA five-year review to confirm contaminated groundwater is not migrating into the surface water. **Figure 3-2** depicts the proposed location to collect surface water sample. The collected surface water samples will be analyzed for VOCs. Surface water sampling, sample labeling and shipping activities will be conducted in accordance with the Installation-Wide Work Plan in place at the time field work is conducted. The annual surface water sampling events will be scheduled at a time of the year which represents greatest potential for groundwater discharge to surface water. This will be determined from the data collected during the quarterly sampling events in the first year and quarterly review of groundwater levels.

#### 3.2.7.2 Long-term Monitoring

After the first two years of quarterly groundwater monitoring, the long-term monitoring frequency will be reduced to semiannual for three additional years, then annually until the next CERCLA five-year review. The suite of analyses performed will also be limited to VOC analysis to be used for ongoing confirmation of declining concentration trends. Further reductions in sampling frequency will depend upon results of CERCLA five-year reviews, but sampling will continue at least once every five years until cleanup levels are attained.

### 3.2.8 Investigation Derived Wastes

Investigation-Derived Waste (IDW) generated during the investigation and monitoring activities will include disposable sampling equipment, purge water, equipment decontamination fluids, and personal protection equipment (PPE). IDW (except PPE and disposable sampling equipment) will be containerized and stored on-site pending analytical results and waste profiling. The IDW management storage and disposal will be performed in accordance with the Installation-Wide Work Plan in place at the time field work is conducted.

### 3.2.9 Decontamination of Equipment and Personnel

Decontamination of equipment and personnel will be performed as discussed in the Installation-Wide Work Plan in place at the time field work is conducted.

## 3.3 Health and Safety Procedures

AECOM and its subcontractors will comply with the health and safety procedures specified by the Installation-Wide Work Plan in place when field work is performed. AECOM anticipates field work will be performed in modified Level D PPE that will include a hard hat, safety glasses, steel-toed boots, and nitrile gloves. Additional PPE may include bug spray, Tyvek® suits, poison oak block, and reflective safety vests depending on the location and type of field activities.

The medical centers associated with this project include Workcare (Occupational Clinic) located at Marshall, Texas. An emergency contact list and emergency route maps will be included in the Installation-Wide HASP.

## 3.4 Quality Assurance/Quality Control

All work will be done in accordance with the Installation-Wide Work Plan in place when field work is conducted. The Installation-Wide Work Plan provides information on quality assurance/quality control (QA/QC) procedures for this project, identifies personnel, procedures, controls, instructions, tests, verifications, documents, and forms to be used and the types of records to be maintained. The Installation-Wide Work Plan also addresses quality control requirements specific to each major feature of work.

**Table 3-1: Rationale for Selection of Proposed DPT Point and Monitoring Well Locations in Shallow Groundwater Zone**

| Proposed DPT/Well ID | Location relative to the Plume | Rationale/Purpose |
|---|---|---|
| 67WW08(1) | Downgradient near southeastern plume edge | VOC screening; refine southeastern plume edge; MNA evaluation; Long-term monitoring |
| 67WW09 | At the site boundary; cross gradient to the south of the plume | Define LUC boundary; Long-term monitoring |
| 67WW10 | Offsite; downgradient of the plume (southeast direction) | Define LUC boundary; Long-term monitoring |
| 67WW11(1) | Downgradient near southeastern plume edge | VOC screening; refine southeastern plume edge; MNA evaluation; Long-term monitoring |
| 67WW12 | Offsite; cross-gradient to the northeast of the plume | Define LUC boundary; Long-term monitoring |
| 67WW13 | Along western site boundary; upgradient of the plume (southwest direction) | Define LUC boundary; Long-term monitoring |

Note: (1) Direct-push technology (DPT) points will be initially installed at locations of proposed wells 67WW08 and 67WW11 for screening of groundwater for VOCs. Locations of these two wells will be adjusted as necessary based on the results of the VOC screening.

**Table 3-2: Monitored Natural Attenuation (MNA) Performance Monitoring Wells**

| Monitoring Well(1) ID | VOCs | Field Parameters*** | MNA Parameters**** |
|---|---|---|---|
| 67WW01 | X | X | X |
| 67WW02 | X | X | |
| 67WW03 | X | X | |
| 67WW04 | X | X | |
| 67WW05 | X | X | |
| **67WW06 | X | X | |
| 67WW07 | X | X | |
| *67WW08 | X | X | X |
| *67WW09 | X | X | |
| *67WW10 | X | X | |
| *67WW11 | X | X | |
| *67WW12 | X | X | |
| *67WW13 | X | X | |

Notes:

(1) The number of monitoring wells included in the network and the sampling frequency may be adjusted based on results of the initial data collection activities.

* - Proposed monitoring wells (shallow zone)

** - Existing intermediate zone well

*** - Field parameters to be monitored for all wells: pH, temperature, conductivity, turbidity, ORP, DO

**** - MNA parameters include nitrate, nitrite, sulfate, ferrous iron, chloride, methane, ethane, ethene, inorganic and organic carbon, DHC

X - Well will be analyzed for that parameter.

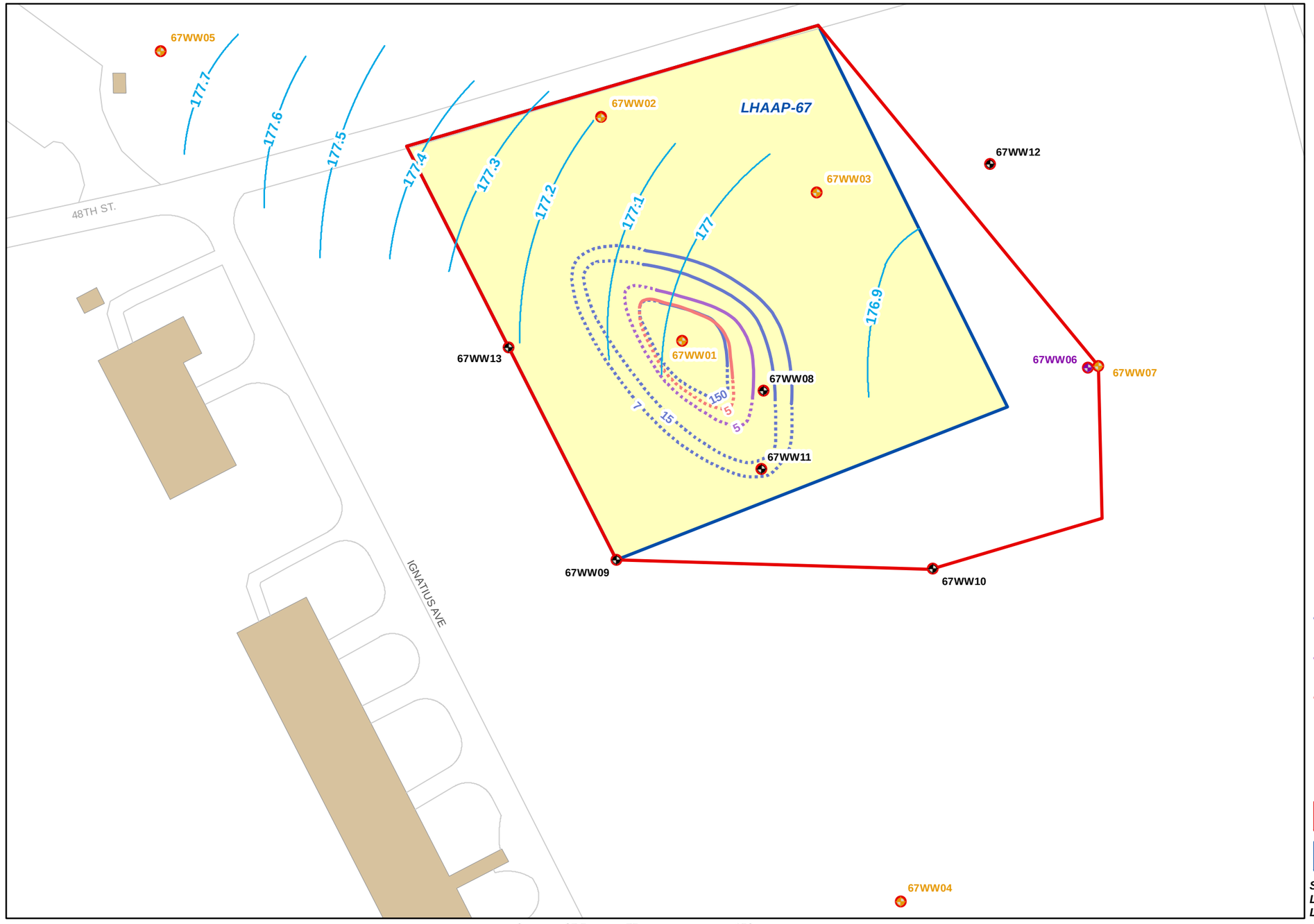
MNA - monitored natural attenuation

VOCs - volatile organic compounds.

**Table 3-3: Analytical Methods, Containers, and Preservatives**

| Parameter | Minimum Sample Volume | Holding Time | Preservation | Method |
|---|---|---|---|---|
| Volatiles | 3x40 mL glass vial with PTFE septa cap | 14 days | pH < 2 HCl, Cool at 4°C, no headspace | 8260B (or latest method) |
| DHC | 2x1 L amber glass bottles with teflon-lined cap(s) | 14 days | Cool at 4°C | Polymerase Chain Reaction (PCR) |
| Common Anions (chloride, sulfate) | 250 mL polyethylene bottle | 28 days ($Cl/SO_4$) | Cool at 4°C | USEPA 300.0 |
| Nitrate/nitrite as N | 500 mL polyethylene bottle | 28 days | pH < 2 $H_2SO_4$, Cool at 4°C | USEPA 353.2 |
| Total organic carbon (TOC) | 3x40 mL Amber Glass Vials | 28 days | pH < 2 $H_2SO_4$ or HCL, Cool at 4°C | USEPA 415.1 |
| Dissolved gases (methane, ethane, ethene) | 3x40 mL glass vial with PTFE septa cap | 14 days | Cool at 4°C | RSK 175 |
| Ferrous iron | NA | Immediately in field (with a field kit) | NA | NA |

Notes and Abbreviations:
The above listed volumes provide an adequate quantity of samples to analyze a matrix spike (MS) and matrix spike duplication (MSD)
°C – degrees centigrade
$H_2SO_4$ – sulfuric acid
HCL – hydrochloric acid
$HNO_3$ – nitric acid
L – liter
mL – milliliter
PTFE – polytetrafluoroethylene
NA – Not applicable
USEPA – United States Environmental Protection Agency




N

0 37.5 75 150 Feet

## Legend

- Existing Intermediate Well
- Existing Shallow Monitoring Well
- Proposed Shallow Well Location
- Wells to be Monitored for Natural Attenuation
- 176.9 — Groundwater Elevation Contour December 2007 (ft msl)
- 1,1-DCE Concentration Contour (Dashed Where Inferred)
- 1,2-DCA Concentration Contour (Dashed Where Inferred)
- TCE Concentration Contour (Dashed Where Inferred)
- Roads
- Buildings
- Proposed LHAAP-67 LUC Boundary
- LHAAP-67 Site Boundary

***Source: August 2011 Final Remedial Design LHAAP-35B(37), Chemical Laboratory and LHAAP-67, Aboveground Storage Tank Farm, Longhorn Army Ammunition Plant, Karnack, Texas (Shaw, 2011)***

Note:
1. Reporting limit (<5 µg/L) results were considered not detected to develop contours.
2. Concentrations reported in µg/L.
3. Concentration contours are based on December 2006 sampling event data.
4. µg/L = micrograms per liter.
5. LUC = Land Use Control.
6. ft msl = feet above mean sea level.
7. Groundwater Elevation Contours are based on December 2007 Water Level Measurement Data.
8. Wells 67WW09, 67WW10, 67WW12, and 67WW13 will be installed to establish LUC boundary.
9. Locations 67WW08 and 67WW11 will be used to advance direct push technology borings and collect groundwater samples from temporary well points for analysis of volatile organic compounds. After receipt of the data, monitoring wells 67WW08 and 67WW11 will be located and installed.

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Figure 3-1
Proposed Monitoring Well Network for MNA
Remedial Action Work Plan
LHAAP-67
Longhorn Army Ammunition Plant
Karnack, Texas

60256135 September 2012

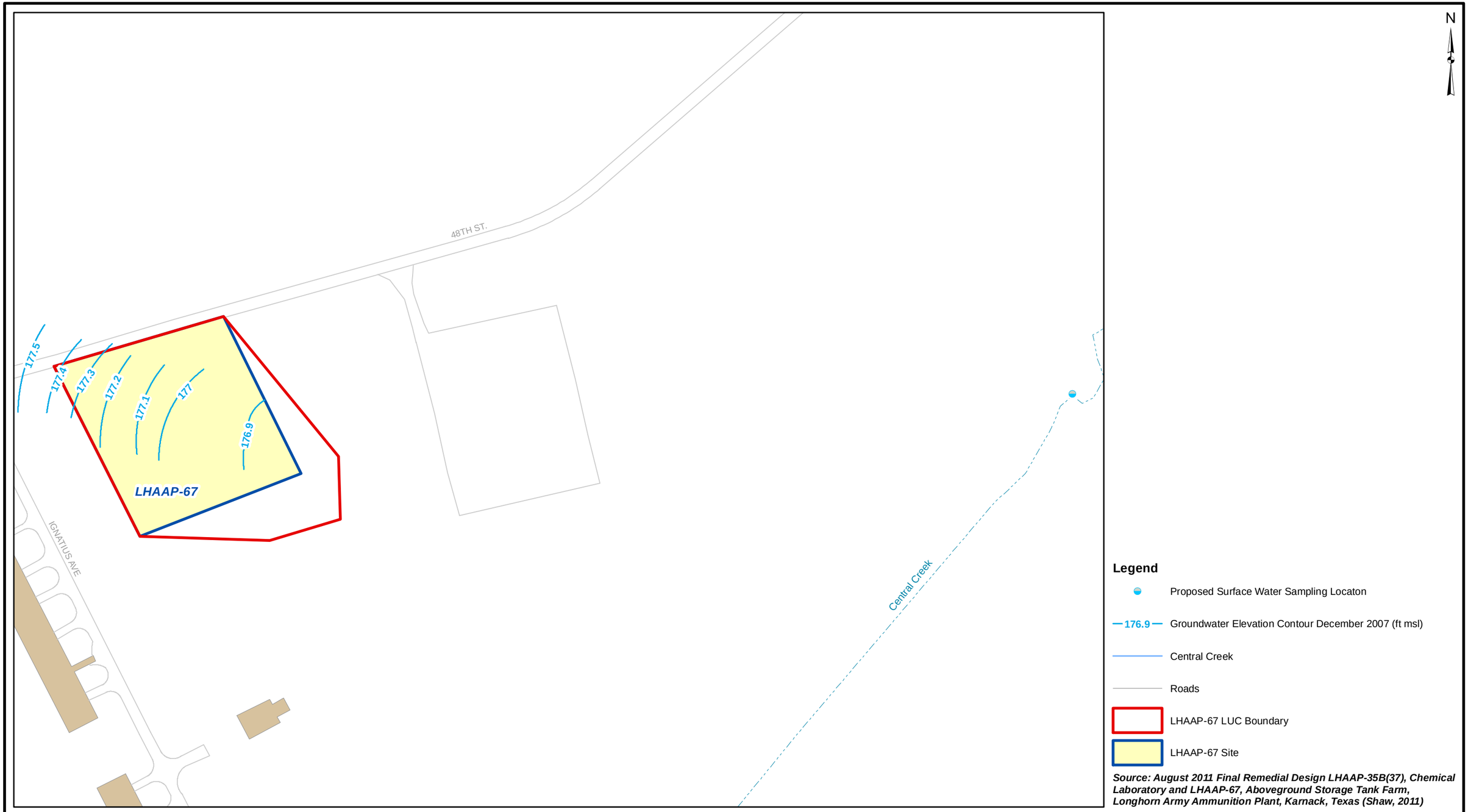


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Figure 3-2
Proposed Surface Water Sampling Location
Remedial Action Work Plan
LHAAP-67
Longhorn Army Ammunition Plant
Karnack, Texas

60256135 September 2012

# 4 REMEDY PERFORMANCE EVALUATION AND REPORTING

Reporting will consist of formal annual reports, supplemented by the sharing of validated data as it becomes available to shorten the time between sampling and data receipt by the regulators. Annual reports will be prepared for any year in which sampling occurs to document the monitoring program. The groundwater monitoring will be terminated after the remedy has achieved cleanup levels. The CERCLA five-year reviews will be conducted and reports prepared until levels allowing for unlimited use and unrestricted exposure are achieved. The TCEQ guidance document, 'Monitored Natural Attenuation Demonstrations under TRRP' (TCEQ, RG-366/TRRP-33, revised September 2010) will be used as guideline for evaluation of groundwater data.

## 4.1 MNA Evaluation

The first year's annual report will include a review of the first four quarters of data, which include natural attenuation parameters and relevant historical data and provide an evaluation for the evidence of MNA as a remedial method and a review of the first year's surface water sample data. The MNA performance criteria are listed in **Table 4-1**. The first annual report will include:

- Figures of the site, wells, and groundwater elevation contours;
- Groundwater and surface water results;
- Plume extent and concentration over time;
- Consideration of the first and second lines of evidence for MNA (see sections 4.1.2 through 4.1.3); and
- An evaluation of the effectiveness of MNA at the site.

For the subsequent annual reports, the data evaluation presented will focus on trend analysis for the COCs.

### 4.1.1 Migration/Expansion

The MNA evaluation should demonstrate a stable or decreasing plume if the MNA remedy is to be considered favorable at the LHAAP-67 site. A groundwater plume is stable when the pollutant concentrations and plume footprint are relatively unchanged over time. A stable plume shows that pollutant migration in groundwater is under control.

A decreasing plume is diminishing in contaminant concentrations and/or its footprint is not migrating or expanding. A decreasing plume situation occurs when the attenuation rate of dissolved-phase pollutants exceeds their generation rate from all sources. A decreasing plume supports natural attenuation as a viable remedial alternative.

Monitoring must occur over a period of time sufficient to demonstrate plume stability or decrease under natural conditions. This may take up to several years depending on site-specific conditions, including the monitoring data trend analysis, potential threats to beneficial uses, and other uncertainties. The non-parametric Mann-Kendall statistic will be used to evaluate solute plume stability. If monitoring data do not indicate plume stability/decrease, this may indicate that further plume remediation is necessary.

**Table 4-1: Monitored Natural Attenuation (MNA) Evaluation Performance Criteria**

| Performance Criteria | Type | Expected Performance | Commentary |
|---|---|---|---|
| Migration/Expansion | Qualitative | Stable or decreasing plume footprint, stable footprint position | An expanding or migrating plume footprint indicates MNA should not be continued. |
| Concentrations | Quantitative | Declining concentrations or total CVOC mass in a majority of performance monitoring wells | First Line of Evidence |
| Aquifer Conditions | Quantitative | Conditions favorable for natural attenuation | Second Line of Evidence |
| Microcosm Studies or Modeling (if necessary) | Quantitative | Detectable presence of appropriate microorganisms | Third Line of Evidence (if necessary) |

### 4.1.2 First Line of Evidence

The first line of evidence relies upon comparison of current and historical groundwater data from appropriate monitoring or sampling points that demonstrates a trend of stable or decreasing contaminant mass and/or COC concentrations over time or with distance traveled from the source. Decreasing concentrations should not be solely the result of plume migration, so performance wells will be evaluated to determine if the plume is migrating.

COC concentrations in individual wells can be evaluated to calculate a time-based attenuation rate or across multiple wells through the centerline of a plume to calculate distance-based attenuation rate. These calculations will be performed using the methods contained in the *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater* (USEPA, 1998).

Time-based attenuation rates will be calculated for any monitoring well that shows consistent COC concentrations exceeding cleanup levels. Distance-based attenuation rates will be calculated using wells with the highest concentrations parallel to the direction of groundwater flow. Monitoring wells 67WW01, 67WW08, and 67WW11 are expected to be the primary focus of analysis at the LHAAP-67 site due to high COC concentrations. Thus, data from these wells will be evaluated for meaningful trends indicating decreasing concentrations and/or mass.

### 4.1.3 Second Line of Evidence

The second line of evidence uses chemical analytical data in mass balance to show that decreases in contaminant and electron acceptor/donor concentrations can be directly correlated to increases in metabolic end-products or daughter compounds. This evidence can be used to show groundwater conditions are sufficiently favorable to natural attenuation so that degradation of chlorinated solvent contaminants can occur.

The second line of evidence evaluates biogeochemical parameters such as nitrates, sulfates, chloride, TOC, etc. The results of these analytes will be interpreted using the *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater* (USEPA, 1998) to determine whether conditions are favorable for continued MNA.

### 4.1.4 Third Line of Evidence

The third line of evidence, if necessary, consists of predictive modeling studies and other laboratory/field studies that demonstrate an understanding of the natural attenuation processes occurring at the site and their effectiveness in controlling plume migration and decreasing COC concentrations.

For the MNA evaluation, the presence of microorganisms in the groundwater capable of degrading the COCs will be considered the favorable condition supporting continued MNA.

## 4.2 LTM Annual Reports

An annual report will be prepared at the end of each year of LTM to present groundwater monitoring results, a description of field activities, and to document other relevant information that may be considered useful for the CERCLA five-year review.

Perimeter well data will be evaluated for plume migration while the data from wells within the plume areas will be evaluated for MNA performance.

The annual report will also provide recommendations, if possible, for reducing the number of monitoring wells to be included in the monitoring program and/or frequency of monitoring events.

## 4.3 Five-Year Review Reports

CERCLA five-year reviews will be performed for the LHAAP-67 site. The five-year review report will present summaries of information from the annual reports, as well as from the five-year review sampling event, and recommend the future course of action. The progress towards cleanup levels will be evaluated in the five-year review report.

# 5 SCHEDULE

**Table 5-1** shows the estimated duration for each major site activity and timeline. This schedule is considered to be reasonable and achievable. Adverse weather and unknown site conditions could adversely affect this schedule.

**Table 5-1: Durations for Major Site Activities**

| Activities | Duration | Elapsed Time |
|---|---|---|
| Monitoring Well Network Confirmation Sampling Event | 5 days | - |
| Installation of Monitoring Wells | 5 days | - |
| First Groundwater Sampling Event | 5 days | - |
| Establish Land Use Controls | 1 month | 2 months |
| Year 1 Quarterly MNA Sampling (remaining 3 events) | 5 days per event | 1 year |
| First Annual Report (Final Document) | 3 months | 1 year and 3 months |
| Year 2 Quarterly MNA Sampling (4 events) | 5 days per event | 2 years |
| Three years of semiannual monitoring and associated annual reporting | 3 years | 5 years |
| CERCLA Five-Year Review | 6 months | 5 years |
| Annual Sampling (years 5 through 10) | 5 years | 10 years |
| Sample once every five years (repeat activity until cleanup levels are achieved) | - | 15, 20, 25, 30 years |
| Achieve Cleanup Levels | - | 30 years or greater |

Notes:
- Time frame to achieve cleanup levels is estimated based on the ROD (U.S. Army, 2010).
- Schedule revision expected after CERCLA five-year review.

# 6 REFERENCES

Shaw, 2007, *Final Modeling Report, Derivation of Soil and Groundwater Concentrations Protective of Surface Water and Sediment, Longhorn Army Ammunition Plant, Karnack, Texas*, February.

TCEQ, 2010, *Monitored Natural Attenuation Demonstrations under TRRP*, Regulatory Guidance RG-366/TRRP-33, Remediation Division, Austin, Texas.

U.S. Army, 2008, Letter with Enclosures from LHAAP Site Manager, Rose M. Zeiler, to TCEQ Remediation Division Project Manager, Fay Duke, *Revised MNA Modeling Results for Time to MCL, LHAAP-35B(37) and LHAAP-67, Longhorn Army Ammunition Plant, Karnack, Texas*, June.

U.S. Army, 2010, *Final Record of Decision, LHAAP-35B(37), Chemical Laboratory and LHAAP-67,Aboveground Storage Tank Farm, Longhorn Army Ammunition Plant, Karnack, Texas*, June.

U.S. Army, 2011, *Final Remedial Design, LHAAP-35B(37), Chemical Laboratory and LHAAP-67,Aboveground Storage Tank Farm, Longhorn Army Ammunition Plant, Karnack, Texas*, August.

USEPA, 1998, *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater*, EPA/600/R-98/128, September.

USEPA, 1999, *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites*, Directive 9200.4-17P, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC.

# APPENDIX A: SAMPLE ANNUAL LAND USE CONTROL COMPLIANCE CERTIFICATION DOCUMENTATION

## Sample Annual Land Use Control Compliance Certification Documentation

In accordance with the Remedial Design dated _____ for LHAAP-67 a certification of site was conducted by _____ [indicate transferee] on _____.

A summary of land use control mechanisms is as follows:

Groundwater restriction – restriction of the use of groundwater to environmental monitoring and testing until cleanup levels are met [Indicate whether groundwater restrictions are still required at LHAAP-67]

A summary of compliance with land use and restriction covenants is as follows:

No use of groundwater, installation of new groundwater wells, or tampering with existing wells at LHAAP-67.

I, the undersigned, do document that the certification was performed as indicated above, and that the above information is true and correct to the best of my knowledge, information, and belief.

Date: _____

Name/Title: _____

Signature: _____

Annual compliance certification forms shall be completed no later than March 1 of each year for the previous calendar year.