

Subject: Final Minutes, Quarterly Restoration Advisory Board (RAB) Meeting, Longhorn Army Ammunition Plant (LHAAP)

Location of Meeting: Karnack Community Center, Karnack, Texas

Date of Meeting: February 19, 2015, 6:00 – 7:00 PM

Meeting Participants:

LHAAP/BRAC: Rose M. Zeiler

USACE: Aaron Williams

USAEC:

AECOM: Mark Heaston, Gretchen McDonnell

TCEQ: April Palmie

USEPA Region 6: Rich Mayer, Steve Tzhone, Janetta Coats, Kent Becher (USGS liaison)

USFWS: Paul Bruckwicki

RAB: **Present:** Paul Fortune, Carol Fortune, Terry Britt , Judy Vandeventer, Tom Walker, Charles Dixon, Richard LeTourneau, **Absent:** Ken Burkhalter, Robert Cargill, Judith Johnson, Ted Kurz, James Lambright, Nigel Shivers, John Pollard, Jr., Lee Guice,

Public: Dawn Orsak, CLI-TAG, Lee Eisenberg, Gary Krupala

An agenda handout for the RAB meeting, fact sheets on the Groundwater Treatment Plant performance, Harrison Bayou and Goose Prairie Creek and Perimeter Well data, and Remedial Action Operations at LHAAP-37, LHAAP-46, LHAAP-50, LHAAP-58 and LHAAP-67 in addition to a hard copy of the AECOM slide presentation were provided for the meeting.

Welcome and Introduction

Mr. Fortune called the meeting to order. Ms. Orsak introduced Mr. Gary Krupala as friend visiting Caddo Lake and a first time meeting attendee. Mr. Mark Heaston, AECOM introduced himself as the new Longhorn AAP project manager for AECOM, based in Nebraska.

Open Items – Dr. Rose Zeiler

RAB Administrative Issues

Minutes

The motion for approval of the August 2014 RAB meeting minutes was made by Carol Fortune and seconded by Judy Vandeventer. Motion to approve the November 2014 RAB meeting minutes were made by Judy Vandeventer and seconded by Carol Fortune.

Website Update

Dr. Zeiler followed up on a request from the last RAB meeting to place a land transfer map on the new Longhorn AAP website. She updated that Army is updating their transfer map to include the latest transfers and will then make that available on the website.

Dr. Zeiler advised that photos would be taken during the RAB meeting for posting to the Longhorn AAP website, and asked meeting participants to sign a release form provided to allow use of their images and names associated with these photos, and provide that to AECOM. The group took a moment to complete and submit release forms.

Remedial Action Underway Sites – Fact Sheets

Dr. Zeiler noted that hard copies of fact sheets updated to provide current site status were available on the RAB materials table at the entry to the Community Center.

Defense Environmental Restoration Program (DERP) Update – AECOM (Gretchen McDonnell)

MNA Site Updates (LHAAP-37, 46, 50, 58, 67)

Ms. McDonnell reiterated that updated fact sheets were made available at tonight's meeting for these sites. Most of the information has been presented before, but an update on the status of the land use controls portion of the remedy for each site has been provided in the fact sheets. For LHAAP-46 and 67, those land use control boundaries have been established and filed with Harrison County so the notifications are there prohibiting access to groundwater. Land use control boundaries at LHAAP-37 and LHAAP-58 have been surveyed and will be filed with Harrison County, likely by mid-March.

In addition to the work on land use control boundaries, quarterly groundwater and surface water monitoring is being performed as part of the remedies. Remedial Action Operation reports are also being generated to report the results of the first four quarters of monitoring at these sites. When agency review of those reports has been completed, they will be reviewed with the RAB and the fact sheets updated to include any findings from those reports.

Ms. McDonnell presented figures for each of the MNA sites, showing the land use control boundaries and the plume footprints to illustrate that the land use controls restricting groundwater fully-encompass the plumes. She also pointed out the clean wells between the plume and the land use control boundaries that allow Army and the agencies to confirm that the plumes are staying within the land use control boundaries.

For LHAAP-50, Ms. McDonnell presented the land use control boundaries proposed by Army, but not yet with concurrence from the agencies. She explained that this site has taken longer to finalize due to the need to develop protocols for appropriate sampling of the surface water locations used to verify the effectiveness of the excavation remedy to remove perchlorate-impacted surface soils.

LHAAP-29 Updates

Ms. McDonnell explained that significant field work was performed during 2014 to provide more information necessary to properly evaluate possible remedies for implementation. Through the 2014 field activities, the lateral extent of groundwater impacted with DNAPL was found to be much smaller than estimated by earlier more limited data. (Additional wells and borings were installed closer to the plume than the older wells had been enabling refinement of the plume extent.) Dr. Zeiler emphasized that there was DNAPL in groundwater at LHAAP-29.

The last bit of work on the treatability study front for LHAAP-29 is being completed. Material collected in bio-trap units that had been placed in two of the LHAAP-29 wells is now being studied in the laboratory to determine how microorganism might best be used to treat the contaminants. That information will feed into the upcoming feasibility study report that will evaluate potential treatment technologies for application to the site.

Mr. Fortune asked if there was a way to tell how fast the contaminants were moving at LHAAP-29? In evaluating the rate of contaminant movement, Mr. Fortune asked if the contamination went back to the 1940s when LHAAP-29 area was first operated. Dr. Zeiler stated that the VOC contamination is more recent than the 1940s because, although the TNT operations go back to the 1940s, it was later rocket motor wash out activities that caused the VOC groundwater impacts at the site.

LHAAP-18/24 Recap

Dr. Zeiler summarized that the GWTP was designed as a three-year interim remedy for the site, but it has obviously lasted much longer. All of the final remedies that are being evaluated for the upcoming feasibility study use the GWTP, but for various periods of time. She noted that one of the great challenges with LHAAP-18/24 is that the different types of contamination present require different remedial technologies. As an example, she stated that electrical resistivity heating (ERH) could be used to remediate the VOCs, but then another different method would have to be applied to address the perchlorate hot spots that do not respond to ERH. Over the last two years, Army has been doing additional field work to identify where those type of hot spots are and nail down where DNAPL is present. Army believes the DNAPL material has been located, although it is difficult to target because it exists as separate-phase residual material. Dr. Zeiler said she feels that the feasibility study provides some very good options and she's excited to present it to the RAB after agencies have reviewed the full report, which includes some remedy options the agencies requested be evaluated.

GWTP Update

Ms. McDonnell explained that the GWTP extracts groundwater from both LHAAP-16 and LHAAP-18/24 to control the plumes in those areas. The water is treated and currently returned to LHAAP-18/24 through the sprinkler system. Semi-annual compliance monitoring is done to ensure extraction is maintaining control over the plumes and that nothing is changing unexpectedly, and that was last completed in December 2014. Ms. McDonnell referenced the treated water volumes handout/slide, pointing out that decreased volumes can be noted for the fourth quarter of 2014, so significant maintenance has been done over the last couple of months to increase the amount of water extracted from the ICTs, by rehabilitating and replacing pumps in the ICTs. The volumes reported for first quarter 2015 should be greater than that seen in fourth quarter 2014 due to this work.

With the decrease in temperatures we've now seen with the onset of winter, the GWTP is in winter operations mode. Additional insulation has been added around some of the ICT uprights and around valves with the treatment plant. Operationally, when weather forecasts predict freezing temperatures, all the lines and pumps are drained at the end of the days' operation to minimize the chance of damage to the system from expansion of freezing water. Mr. Fortune asked what happens to the water drained from the system components. Ms. McDonnell responded that water drained from the lines and pumps is moved to tanks for continued treatment.

Surface Water and Perimeter Well Sampling

Two of the surface water sampling locations did have water present in December 2014 and results for those samples were "non-detect" for perchlorate. Hard copy handouts showing surface water and perimeter well sampling results were available during the meeting.

Other Environmental Restoration Issues – Rose Zeiler

Site LHAAP-37 Bioplug Demonstration

Dr. Zeiler briefed that although there were high expectations for the bioplug technology, the demonstration did not perform well enough to consider extending the study or use of the technology. The system has been pulled and groundwater at the site is now undergoing a restoration process because the bioplug technology was an aerobic process, while the treatment in the ROD is an anaerobic process. Before the anaerobic natural attenuation process can be evaluated, those anaerobic conditions need to once again be present in the aquifer. The aquifer will be allowed to return to baseline conditions (conditions present prior to the bioplug study) and AECOM will be conducting monitoring to determine when the site has returned to baseline conditions. Mr. Williams stated that AECOM will likely perform three rounds of groundwater monitoring, each separated by two months, to check aquifer conditions against the baseline.

Dispute Status Update

Mr. Tzhone explained that the EPA Administrator provided her decision on October 31, 2014. The EPA Administrator's decision agreed with the earlier Regional EPA Administrator's decision and provided Army with 21 days to provide revised RODs meeting the requirements of the decision. Shortly after the last RAB meeting, Army provided response to EPA stating that Army plans to appeal the EPA Administrator's decision to the Office of Management and

Budget (OMB). Mr. Mayer stated that, although six disputes of Federal Facility Agreements have gone to the EPA Administrator level, a dispute has never been elevated to OMB, so Longhorn is in uncharted territory.

Dr. Zeiler clarified this might be because the initial comments that are the point of dispute came originally from EPA headquarters, not from the Region 6 EPA staff who had agreed with the RODs. So it was not surprising when the dispute reached the EPA Administrator, again at the headquarters level, that EPA headquarters supported their original comments. Steve Tzhone stated that the Administrator did make some clarifications in her final decision. A primary issue, Dr. Zeiler stated, is that the cleanup levels must have a basis in law (for example, a MCL), but the cleanup level EPA is trying to impose for perchlorate was based not on promulgated standards, but on EPA's health advisory level (HAL).

Mr. Fortune asked, assuming EPA ultimately wins the dispute, what impact would it have on other sites around the nation? Mr. Tzhone stated that the decision will clarify that the residential groundwater standard imposed by the state should be applied if there is no MCL in place. Dr. Zeiler disagreed, asking if EPA's goal was to simply have the residential groundwater standard applied at Longhorn, why didn't EPA require Longhorn use the residential groundwater standard under the Texas Risk Reduction Rule (RRR)? Why, instead, has EPA moved Longhorn from the Texas RRR (under which it was grandfathered) to the Texas TRRP? It would appear the goal was to try to impose the EPA HAL on Longhorn. The Regional Administrator in his April 2013 decision stated it was a 2012 TRRP update of the PCLs that triggered a comparison of the two Texas residential groundwater standards to EPA's HAL and that he selected the one closest to the HAL. But the trigger of an update of the TRRP perchlorate PCL is just not true. The TRRP PCL for perchlorate is the same as it has been since 2006. And EPA Region 6 has agreed with the use of the Texas RRR industrial groundwater standard for years before that.

Mr. Tzhone said that we can all check the record of the TRRP update, but that the decision sets the clean-up level to the most relevant standard (residential) in the most current program (TRRP). Dr. Zeiler disagreed saying that the EPA Administrator's decision did not say EPA's goal was to use the most relevant standard in the most current Texas program, but that EPA had reviewed available Texas drinking water standards and selected the standard that was closest to the EPA HAL of 15 ug/L. She went on to say that the reason this is important is because all new clean-up standards must be held up for public scrutiny and review before becoming a new regulation or law (promulgated). And if this does not occur as it is required, then the result is that EPA is accountable only to itself and Longhorn must comply just because the Administrator said so. It is important to know that when the EPA perchlorate HAL of 15 ug/L went out for public review as a proposed MCL, it was met with much criticism for lack of scientific basis. A panelist from the EPA Science Advisory Board stated that the RfD being used actually supported a standard 6 to 48 times higher than the proposed 15 ug/L level. Subsequently EPA withdrew the 15 ug/L MCL and stated that they needed to go back, review the data, and build a new model, an effort that is still underway.

Ms. Orsak asked if OMB is the final level of appeal of the dispute. Mr. Tzhone stated that the appeal is outside of the FFA process and Dr. Zeiler agreed. Mr. Mayer also noted that this situation has never happened before. Ms. Palmie explained the function of the Office of Management and Budget is at the highest level of the Executive Branch of the US government and they determine funding for all aspects of the Federal government. Given this, it is difficult to think of another entity that would be a higher level to appeal it to. Mr. Tzhone noted that by elevating the dispute to OMB, Army had moved the dispute from the FFA process to a political one. Dr. Zeiler stated it is interesting that Mr. Tzhone says it is now political, when the decision to impose the perchlorate HAL came directly from the EPA Administrator at EPA Headquarters, who is a political appointee, and not from the technical folks at EPA Region 6.

Mr. LeTourneau asked what the timeline for a decision looks like. Mr. Mayer and Dr. Zeiler stated they hope we are looking at a matter of months. Mr. Tzhone noted that the timeline specified by the FFA for dispute resolution has been greatly exceeded. Mr. Fortune expressed hope there would be resolution by the next RAB.

Mr. Tzhone and Dr. Zeiler agreed that we have some good remedies waiting to be implemented and that the staff attending this meeting for both Army and EPA want the dispute to be resolved so the work to implement those remedies can begin.

Upcoming Field Work, Meetings and Documents

Quarterly sampling at the MNA sites is ongoing and the first annual Remedial Action Operation reports are being generated to summarize the groundwater and surface water monitoring results for the first four quarters of monitoring for these sites. Feasibility study reports for LHAAP-29 and LHAAP-18/24 are also underway.

Schedule

The next RAB meeting is scheduled for June 18th from 6:00PM to 7:30PM at the Karnack Community Center.

Dr. Zeiler asked that the RAB members email her or Ms. McDonnell with any technical topics they would like to have discussed at the next meeting. Mr. Britt said he was interested in knowing more about the wells and results at LHAAP-46 with respect to potential impacts on the nearby Caddo Lake Water Supply Corporation well. Mr. Mayer stated that EPA had recently sampled the CLWSC wells and found no volatile organics present. Dr. Zeiler stated that an exercise was conducted some time ago to determine the radius of influence of the CLWSC wells. Mr. Britt advised that the aquifer water levels have been declining so such testing might need to be done again due to the changed aquifer conditions.

Adjourn – Motion to adjourn made by Ms. Vandeventer, seconded by Mr. Britt.

February Meeting Attachments and Handouts:

- *Meeting Agenda*
- *AECOM PowerPoint Presentation*
- *GWTP Treated Groundwater Volumes Handout*
- *Surface Water Sampling Results Handout*

- *LHAAP Perimeter Well Sampling Results Handout*
- *LHAAP-35B(37)Remedial Action Operation Fact Sheet*
- *LHAAP-46 Remedial Action Operation Fact Sheet*
- *LHAAP-50 Remedial Action Operation Fact Sheet*
- *LHAAP-35A(58)Remedial Action Operation Fact Sheet*
- *LHAAP-67 Remedial Action Operation Fact Sheet*

Acronyms

AECOM	AECOM Technical Services, Inc.
BRAC	Base Realignment and Closure
CLI	Caddo Lake Institute
CLWSC	Caddo Lake Water Supply Corporation
DERP	Defense Environment Response Program
DNAPL	Dense Non-Aqueous Phase Liquid
ERH	electrical resistivity heating
FFA	Federal Facility Agreement
GWTP	Groundwater Treatment Plant
HAL	Health Advisory Level
ICT	interceptor-collector trench
LHAAP	Longhorn Army Ammunition Plant
MNA	Monitored Natural Attenuation
MCL	Maximum Contaminant Level
OMB	Office of Management and Budget
RAB	Restoration Advisory Board
RfD	Reference Dose
ROD	Record of Decision
RRR	(Texas) Risk Reduction Rule
TAG	Technical Assistance Grant
TCEQ	Texas Commission on Environmental Quality
TNT	trinitrotoluene
TRRP	Texas Risk Reduction Program
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Center
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
µg/L	micrograms per liter
VOC	volatile organic compound



LONGHORN ARMY AMMUNITION PLANT
RESTORATION ADVISORY BOARD
Karnack, Texas
(479) 635-0110

February 12, 2015

Distribution (one copy each)

Ken Burkhalter
Post Office Box 767
Waskom, Texas 75692

Jim Lambright
4840 Hollow Ridge Road
Dallas, Texas 75227

Robert Cargill
Post Office Box 992
Longview, Texas 75606

Richard LeTourneau
Post Office Box 12071
Longview, Texas 75607

Charles Dixon
4406 John Reagan
Marshall, Texas 75677

Nigel R. Shivers
Post Office Box 558
Karnack, Texas 75661

Carol Fortune
Post Office Box 16
Karnack, Texas 75661

Judy VanDeventer
2713 Blairs Landing Road
Karnack, Texas 75661

Paul Fortune
Post Office Box 16
Karnack, Texas 75661

Tom Walker
500 Private Rd 7222
Jefferson, Texas 75657

Walter Lee Guice
Post Office Box 3632
Longview, Texas 75606

John Pollard, Jr.
Post Office Box 107
Marshall, Texas 75671

Judith Johnson
1635 Dorough Road
Karnack, Texas 75661

Terry Britt
159 Easy Street
Karnack, Texas 75661

Ted Kurz
1487 Pine Island Road
Karnack, Texas 75661



LONGHORN ARMY AMMUNITION PLANT
RESTORATION ADVISORY BOARD

Karnack, Texas
(479) 635-0110

February 12, 2015

Dear LHAAP RAB Member,

The next Restoration Advisory Board (RAB) meeting will be held on Thursday, February 19, 2015, from 6:00 to 7:30 p.m. at the Karnack Community Center, Karnack, Texas. We hope that you can attend. If you have any questions, please do not hesitate to contact me.

AECOM is the contractor supporting the U.S. Army environmental restoration activities at the Longhorn Army Ammunition Plant (LHAAP), and will be coordinating the RAB meeting. A tentative agenda for the meeting is attached. If you have additional items for the agenda, please provide to me at rose.m.zeiler.civ@mail.mil.

Regards,

Dr. Rose Zeiler
Department of the Army
Longhorn Army Ammunition Plant
Box 220
Ratcliff, Arkansas 72951

Copy to:
Dawn Orsack, Rick Lowerre; CLI (TAG)
Janetta Coats, Donn Walters; EPA (TAG)




LONGHORN ARMY AMMUNITION PLANT
RESTORATION ADVISORY BOARD
Karnack, Texas
(479) 635-0110

AGENDA

DATE: Thursday, February 19, 2015
TIME: 6:00 – 7:30 PM
PLACE: Karnack Community Center, Karnack, Texas

- 06:00** Welcome and Introduction
- 06:05** Open Items {RMZ}
- RAB Administrative Issues
 - Minutes
 - Website
 - Remedial Action Underway Sites – Fact Sheets
- 06:15** Defense Environmental Restoration Program (DERP) Update {AECOM}
- MNA Site Updates (LHAAP-37, 46, 50, 58, 67)
 - LHAAP-18/24 and LHAAP-29 Recap / Updates
 - Groundwater Treatment Plant (GWTP) Update
 - Surface Water and Perimeter Well Sampling
- 07:15** Other Environmental Restoration Issues {RMZ}
- Bioplug Demonstration at LHAAP-37
 - Dispute Status Update
- 07:20** Next RAB Meeting Schedule and Closing Remarks
- 07:30** Adjourn {RMZ}

Longhorn Army Ammunition Plant Restoration Advisory Board Meeting February 19, 2015

A faint, semi-transparent image of green leaves is positioned on the right side of the slide, overlapping the main text area. The leaves are detailed and appear to be from a tree or shrub.

AECOM Environment

Agenda

AGENDA

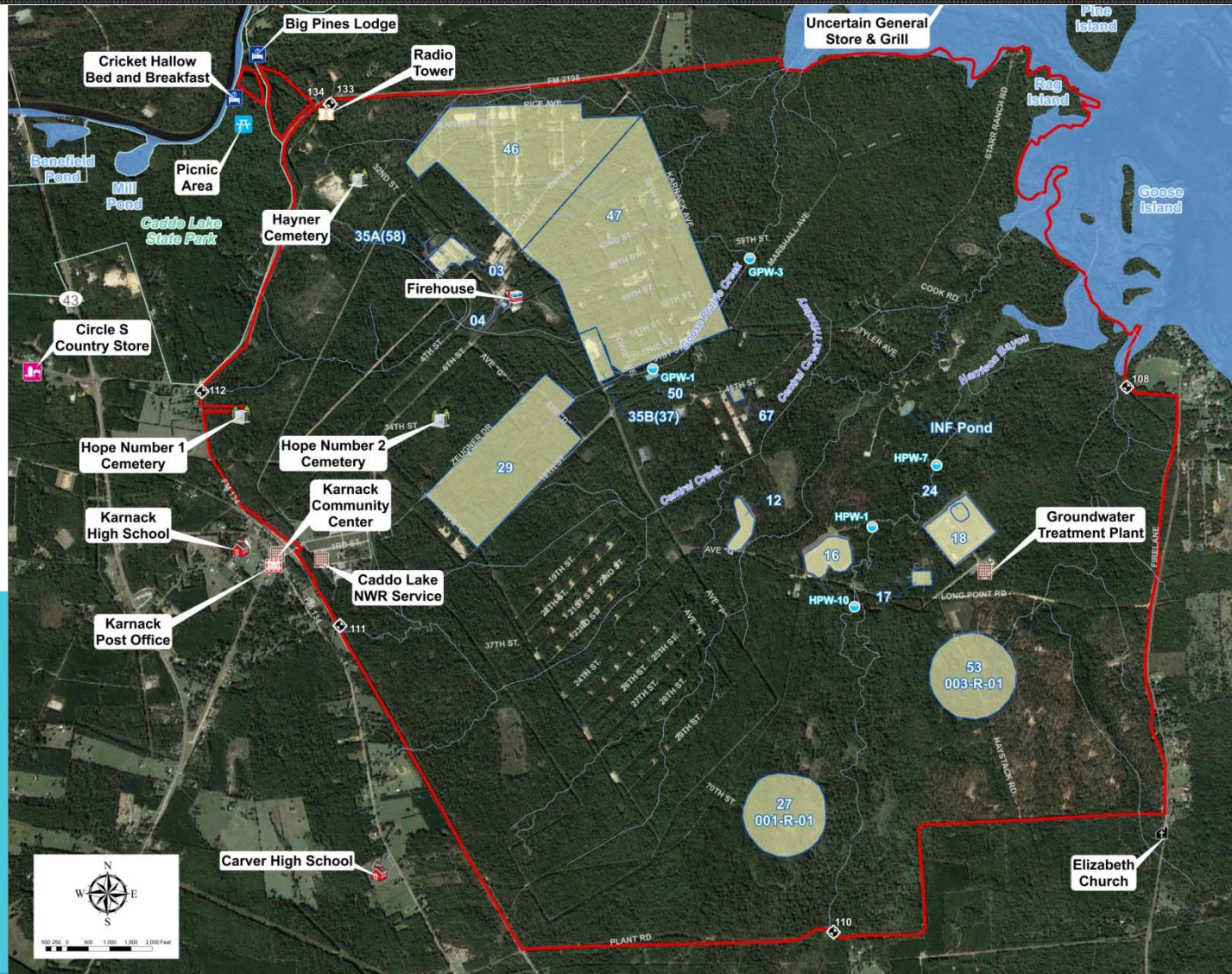
DATE: Thursday, February 19, 2015
TIME: 6:00 – 7:30 PM
PLACE: Karnack Community Center, Karnack, Texas

- 06:00** Welcome and Introduction
- 06:05** Open Items {RMZ}
- RAB Administrative Issues
 - Minutes
 - Website
 - Remedial Action Underway Sites – Fact Sheets
- 06:15** Defense Environmental Restoration Program (DERP) Update {AECOM}
- MNA Site Updates (LHAAP-37, 46, 50, 58, 67)
 - LHAAP-18/24 and LHAAP-29 Recap / Updates
 - Groundwater Treatment Plant (GWTP) Update
 - Surface Water and Perimeter Well Sampling
- 07:15** Other Environmental Restoration Issues {RMZ}
- Bioplug Demonstration at LHAAP-37
 - Dispute Status Update
- 07:20** Next RAB Meeting Schedule and Closing Remarks
- 07:30** Adjourn {RMZ}

RAB Administrative Issues

- Minutes from August and November RAB Meetings
- Website Update
- MNA Sites Fact Sheets
 - LHAAP-37 Chemical Laboratory Waste Pad
 - LHAAP-46 Plant 2 Area
 - LHAAP-50 Former Sump Water Tank
 - LHAAP-58 Maintenance Complex
 - LHAAP-67 Aboveground Storage Tank Farm

Longhorn Map



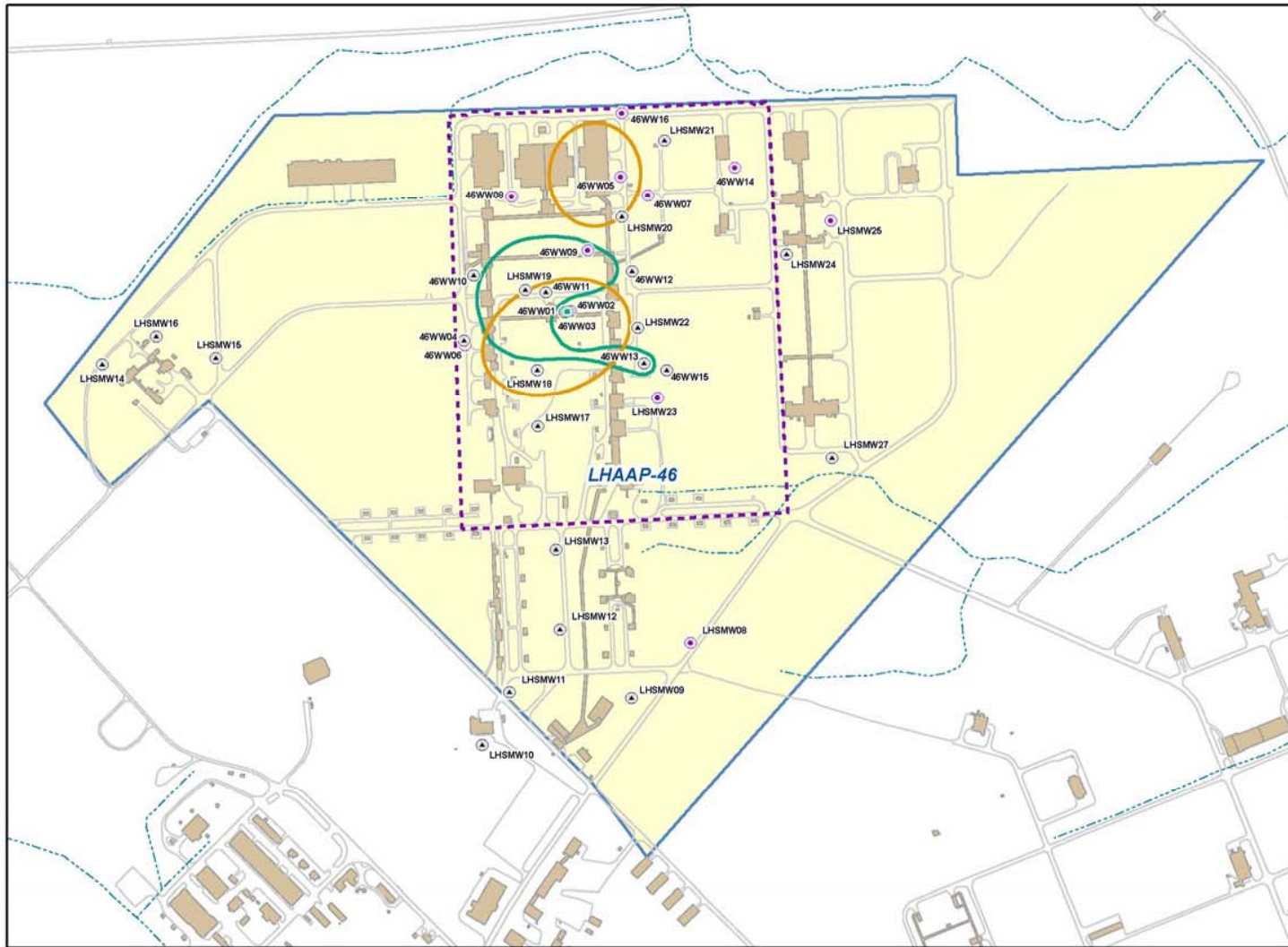
Longhorn Active Site List

LHAAP-03	Building 722 Paint Shop
LHAAP-04	Pilot Wastewater Treatment Plant
LHAAP-12	Landfill 12
LHAAP-16	Landfill 16
LHAAP-17	Burning Ground No.2/Flashing Area
LHAAP-18	Burning Ground No.3
LHAAP-24	Unlined Evaporation Pond
LHAAP-29	Former TNT Production Area
LHAAP-37	Chemical Laboratory Waste Pad
LHAAP-46	Plant Area 2
LHAAP-47	Plant Area 3
LHAAP-50	Former Sump Water Tank
LHAAP-58	Maintenance Complex
LHAAP-67	Aboveground Storage Tank Farm
LHAAP-001-R-01	South Test Area/Bomb Test Area
LHAAP-003-R-01	Ground Signal Test Area

Status of Environmental Sites

- Monitored Natural Attenuation Sites
 - LHAAP-35B (37) – Chemical Laboratory
 - LHAAP-46 – Plant Area 2
 - LHAAP-50 – Former Sump Water Tank
 - LHAAP-35A (58) – Shops Area
 - LHAAP-67 – Aboveground Storage Tank Farm
- Scheduled Quarterly Groundwater Monitoring (all sites except LHAAP-35B (37))
- Year 1 Remedial Action Operation reports for these sites are various stages of development
 - Data from first four quarters of groundwater monitoring
 - Preliminary Trend analysis
- Land Use Control boundary surveys for groundwater use restriction complete for LHAAP-35B(37), LHAAP-46, LHAAP-35A(58) and LHAAP-67

LHAAP-46 Land Use Control Boundary



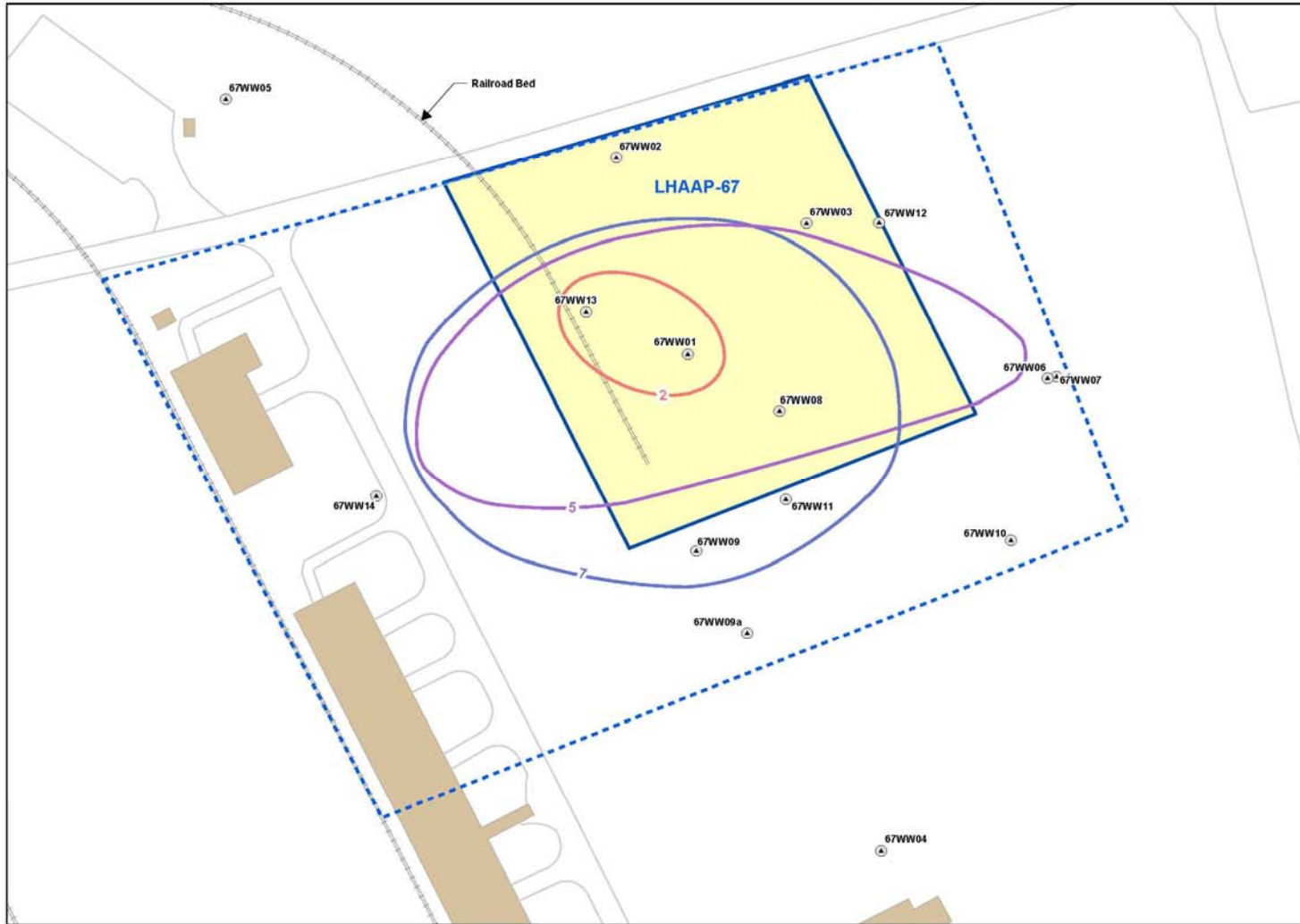
Legend

- Shallow Monitoring Well Location
- Intermediate Monitoring Well Location
- Deep Monitoring Well Location
- Intermediate Zone TCE Plume (5 µg/L)
- Shallow Zone TCE Plume (5µg/L)
- Stream
- Road
- Surveyed Land Use Control Boundary
- Former Buildings or Concrete Slab
- LHAAP-46 Site Boundary

µg/L = micrograms per liter

Source: September 2011 Final Remedial Design for LHAAP-46, Plant 2 Area, Group 4, Longhorn Army Ammunition Plant, Karnack, Texas (Shaw, 2011).

LHAAP-67 Land Use Control Boundary

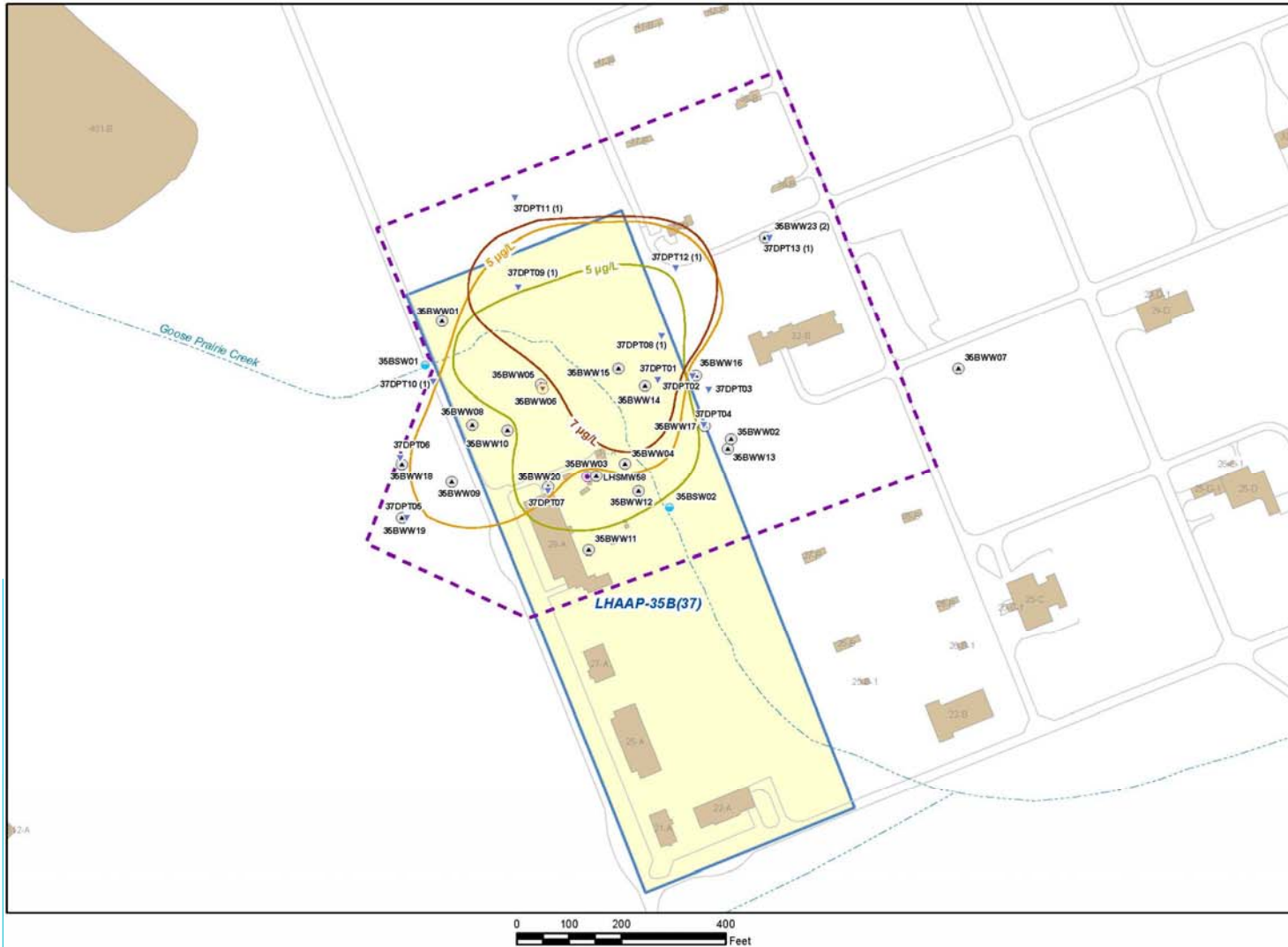


Legend

- Shallow Monitoring Well Location
- 1,1-DCE Concentration Contour exceeding its MCL (7 micrograms per liter)
- 1,2-DCA Concentration Contour exceeding its MCL (5 micrograms per liter)
- VC Concentration Contour exceeding its MCL (2 micrograms per liter)
- Roads
- Surveyed Land Use Control Boundary
- Buildings
- LHAAP-67 Site Boundary

Notes:
 1. 1,2-DCA - 1,2-dichloroethane.
 2. VC - Vinyl Chloride.
 3. 1,1-DCE - 1,1-dichloroethane.
 4. Wells 67WW03 and 67WW04 were not sampled during baseline event.
 5. MCL - Maximum Contaminant Level

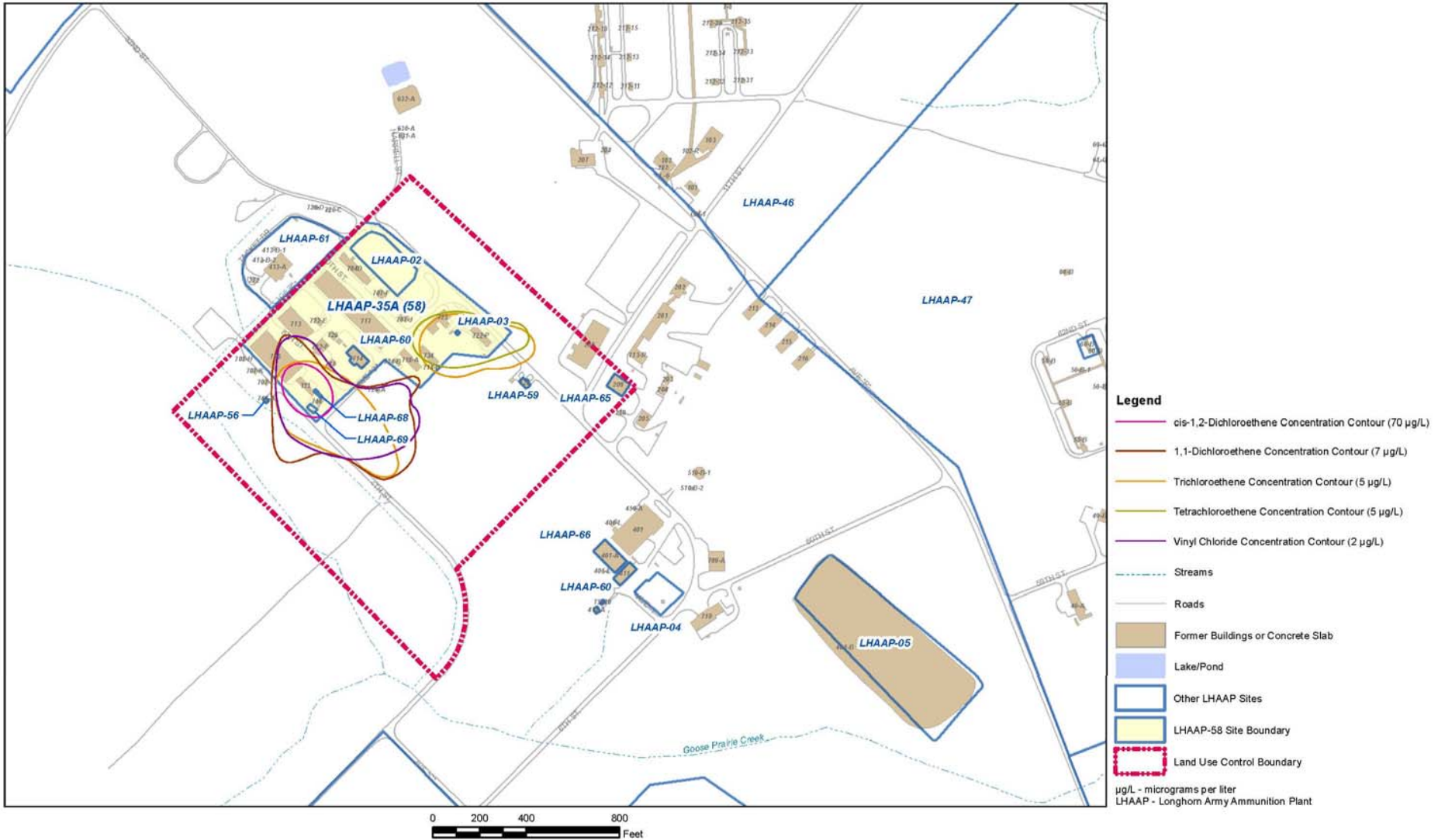
LHAAP-35B(37) Land Use Control Boundary



Legend

- Surface Water Sample Location (Approximate)
- ▼ Direct Push Technology Boring Location (Approximate)
- ▲ Shallow Monitoring Well Location
- ▼ Lower Shallow Monitoring Well Location
- Intermediate Monitoring Well Location
- 1,1-DCE Concentration Contour (7 µg/L)
(Dashed Where Inferred)
- TCE Concentration Contour (5 µg/L)
(Dashed Where Inferred)
- Tetrachloroethylene Concentration Contour (5 µg/L)
(Dashed Where Inferred)
- Goose Prairie Creek
- Roads
- Buildings
- - - LHAAP-35B (37) Land Use Control Boundary
- LHAAP-35B(37) Site

LHAAP-35A(58) Land Use Control Boundary



Status of Environmental Sites (continued)

LHAAP-29 Former TNT Production Area

To address remedy design and implementation questions at the Draft Final ROD stage, the RI and FS were re-opened:

Remedial Investigation (RI) - Feasibility Study (FS) Addendum:

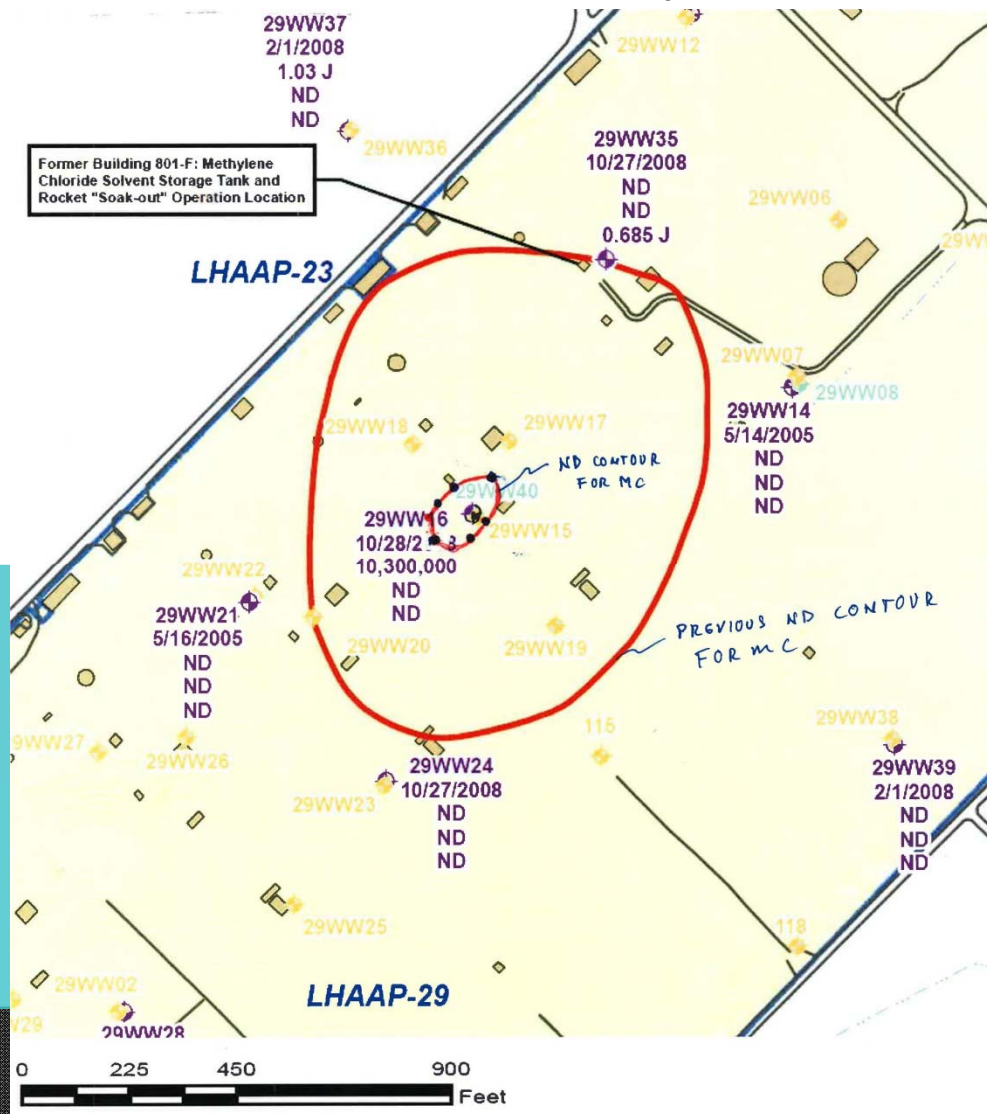
- More information on the contaminated area was needed

RI/FS Support Field Effort

- Groundwater plume has been more tightly defined
- Critical aquifer properties have been determined (pumping rates needed to control groundwater flow)
- Treatability study information
 - TOC and resistivity for soil and groundwater
 - “Biotrap” study to support in-situ bioremediation or enhanced in-situ bioremediation remedy evaluation

Status of Environmental Sites (cont)

- LHAAP-29 Former TNT Production Area- Methylene Chloride in Intermediate GW



Status of Environmental Sites (cont)

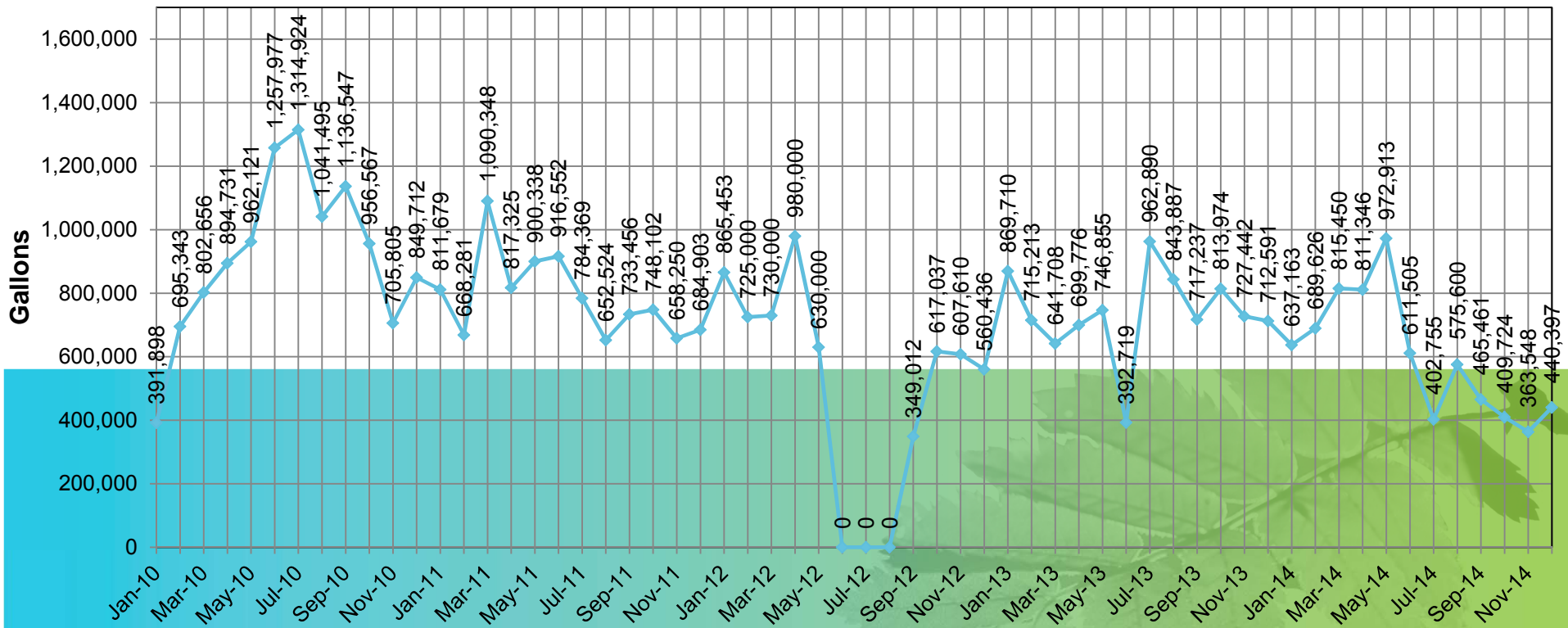
- LHAAP-03 - Record of Decision, Remedial Design/Remedial Action Work Plan On-hold Due to Dispute
- LHAAP-04 - Record of Decision, Remedial Design/Remedial Action Work Plan On-hold Due to Dispute
- LHAAP-16 - Record of Decision, Remedial Design/Remedial Action Work Plan On-hold Due to Dispute
- LHAAP-17 - Record of Decision, Remedial Design/Remedial Action Work Plan On-hold Due to Dispute
- LHAAP-47 - Record of Decision, Remedial Design/Remedial Action Work Plan On-hold Due to Dispute
- LHAAP-001-R-01 - Record of Decision, Remedial Design/Remedial Action Work Plan On-hold Due to Dispute
- LHAAP-003-R-01 - Record of Decision, Remedial Design/Remedial Action Work Plan On-hold Due to Dispute

Groundwater Treatment Plant Operations and Management

- The Groundwater Treatment Plant continues to operate to contain the plume at LHAAP-18/24 and LHAAP-16.
- Treated groundwater is currently being returned to LHAAP-18/24 through the sprinkler array.
- LHAAP-18/24 Compliance monitoring of groundwater continues per existing sampling plan.
- Maintenance and repairs of wells, pumps, tanks, and ancillary equipment is on-going.
- Winter operations mode in effect.

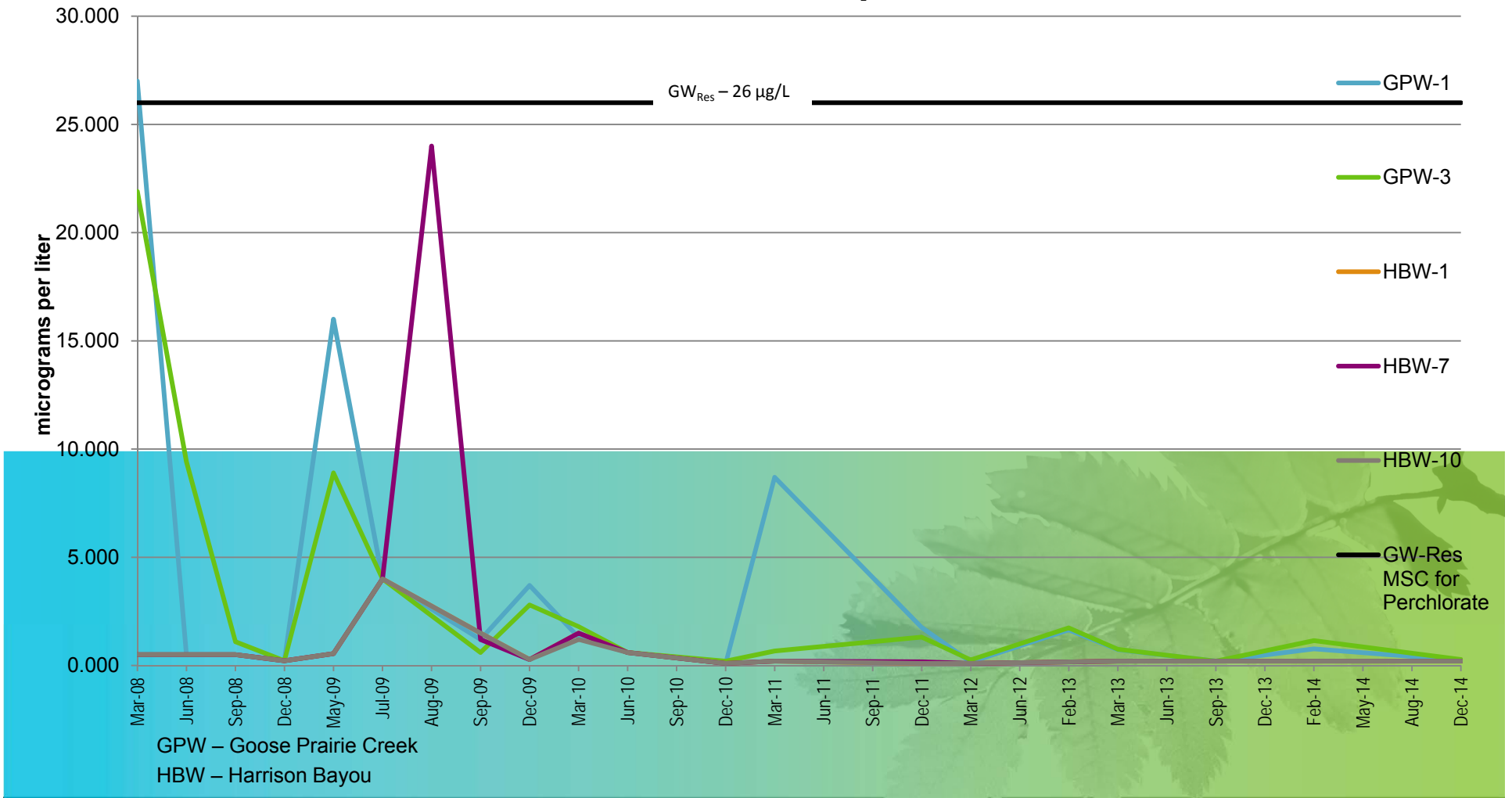
GWTP O&M (cont)

Figure ES-3
Water Treated Monthly from January 2010 through December 2014



Surface Water Sample Results

Surface Water Samples - Perchlorate



LHAAP-37 Bioplug Demonstration Update

- Final demonstration sampling conducted October 2014.
- Data indicated the Bioplug method was not particularly effective in reducing contaminant concentrations.
- System removal completed in January 2015.
- Groundwater monitoring for the remedy specified in the ROD (monitored natural attenuation) will begin when the aquifer has returned to pre-demonstration conditions.

Dispute Status

Sites Where Work has Ceased Pending Resolution of the Dispute

TIMELINE →	DISPUTE INITIATED	AECOM START	Pre-Dispute RIP	CURRENT DATE												2016	2017 Sep		
	2011 Oct	2012	2013	2014	2015														
SITE ↓					J	F	M	A	M	J	J	A	S	O	N	D			
LHAAP-16			↓																
<i>Site in Dispute</i>																		Remediation Time on Hold to date (months)	40
LHAAP-17			↓																
<i>Site in Dispute</i>																		Remediation Time on Hold to date (months)	40
LHAAP-001-R-01			↓																
<i>Site in Dispute</i>																		Remediation Time on Hold to date (months)	40
LHAAP-003-R-01			↓																
<i>Site in Dispute</i>																		Remediation Time on Hold to date (months)	40
LHAAP-29			↓																
																		Remediation Time on Hold to date (months)	40
LHAAP-04			↓																
																		Remediation Time on Hold to date (months)	20
LHAAP-47			↓																
																		Remediation Time on Hold to date (months)	19

NOTES:
 AECOM AECOM Technology Services, Inc.
 DF Draft Final
 LHAAP Longhorn Army Ammunition Plant
 RAWP Remedial Action Work Plan
 RIP Remedy In Place
 ROD Record of Decision

Upcoming Fieldwork, Meetings, and Documents

1. Continue sampling for groundwater monitoring networks at LHAAP-46, 50, 58, 67, in addition to semi-annual compliance sampling for LHAAP-18/24.
2. Final Completion Reports in progress for LHAAP-37, 50, and 58. Final Completion Reports for LHAAP-46 and LHAAP-67 have been submitted.
3. First annual Remedial Action Operation reports being developed for LHAAP-46 and LHAAP-67, followed by 50 and 58.
4. LHAAP-18/24 and LHAAP-29 – Reports for current activities leading to an FS for each site planned for spring 2015.
5. Sites where work has ceased pending dispute resolution:
 1. LHAAP-03
 2. LHAAP-04
 3. LHAAP-47
 4. LHAAP-16
 5. LHAAP-17
 6. LHAAP-29
 7. LHAAP-001-R-01
 8. LHAAP-003-R-01

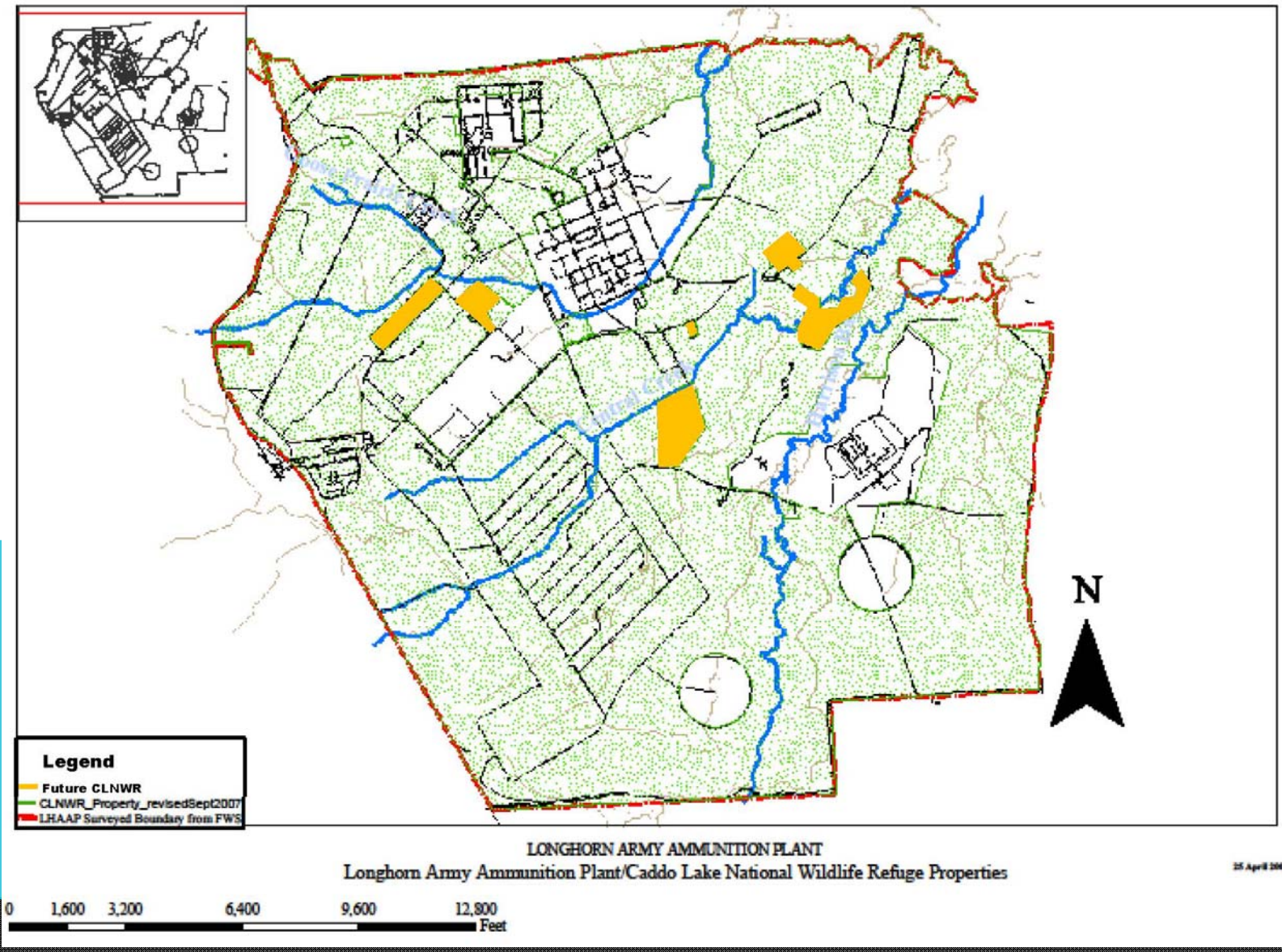
Slide 19

RMZ1

Agree with Gretchen - please show it in both places but include the statement as Gretchen presents it.

RMZeiler, 2/17/2015

Transfer Update



Groundwater Treatment Plant - Treated Groundwater Volumes

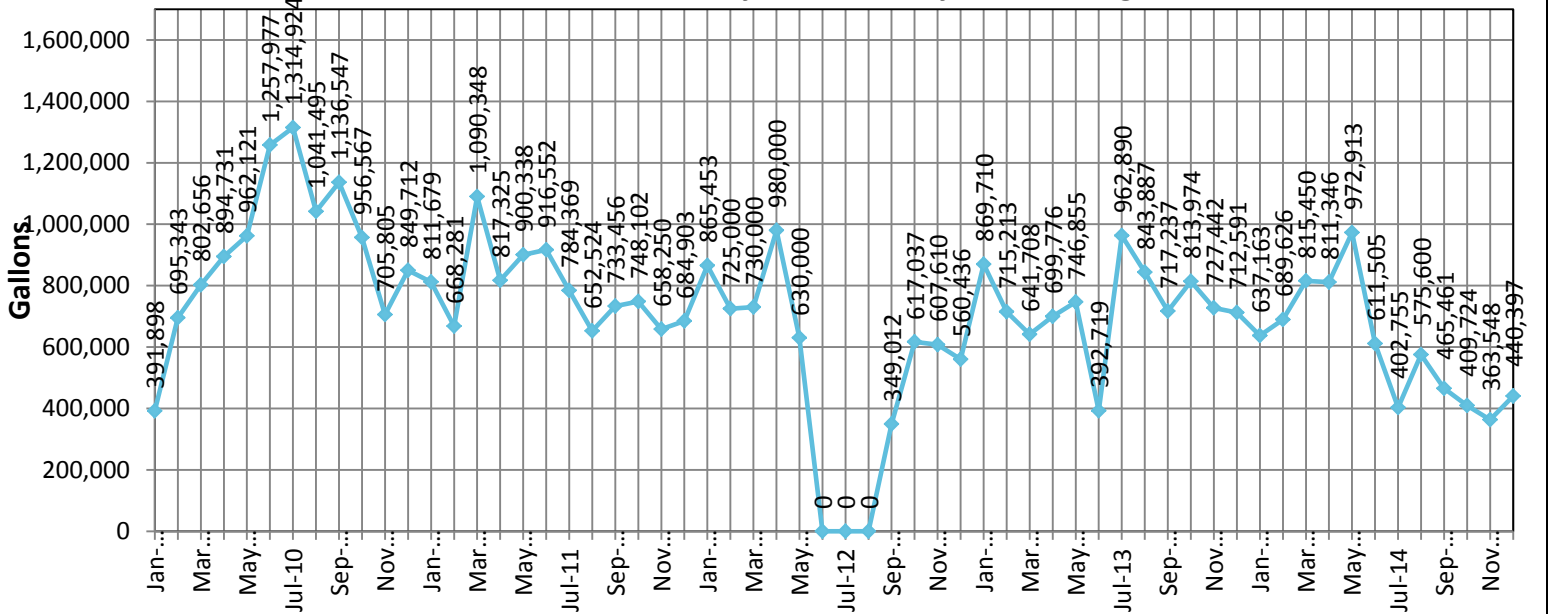
The amount of groundwater treated is determined by measuring the number of gallons of treated water returned to LHAAP-18/24, released to the INF Pond, or discharged to Harrison Bayou.

Treated Water Data (in gallons)

Oct-07	Nov-07	Dec-07	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08
1,041,491	848,356	804,822	792,148	665,883	818,872	791,306	568,812	776,904	748,377	690,052	617,199
Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09
655,059	619,274	726,118	552,299	598,144	433,800	488,807	526,958	387,644	0	414,853	735,716
Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10
808,322	636,306	727,492	391,898	695,343	802,656	894,731	962,121	1,257,977	1,314,924	1,041,495	1,136,547
Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11
956,567	705,805	849,712	811,679	668,281	1,090,348	817,325	900,338	916,552	784,369	652,524	733,456
Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12
748,102	658,250	684,903	865,453	725,000*	730,000*	980,000*	630,000*	0	0	0	349,012
Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13
617,037	607,610	560,436	869,710	751,213	641,708	699,776	746,885	392,719	962,890	843,887	717,237
Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
813,974	727,442	712,591	552,657	738,701	844,095	811,346	972,913	611,505	402,755	575,600	465,461
Oct-14	Nov-14	Dec-14									
409,724	363,548	440,397									

*Indicates Estimate

**Figure ES-3
Water Treated Monthly from January 2010 through December 2014**

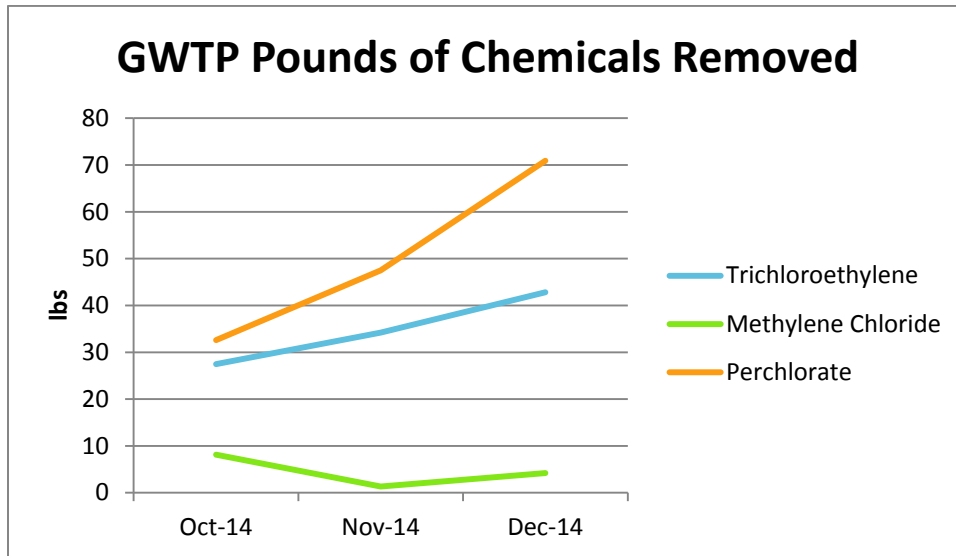


The pounds of chemicals removed for the 4th Quarter of 2014 can be found below and are calculated by the following formula:

$$\frac{(\text{GWTP Influent Contaminant Concentration } [\mu\text{g/L}] \times \text{Volume } [\text{gallons}] \times 3.785 \text{ [liters per gallon]})}{(453,600,000 \mu\text{g per pound})}$$

Pounds of Chemicals Removed From LHAAP-18/24, 4th Quarter 2014

	Trichloroethylene	Methylene Chloride	Perchlorate
Oct-14	27.46	8.13	32.6
Nov-14	34.2	1.33	47.5
Dec-14	42.8	4.20	70.9



Water Discharge Location and Volume (Gallons)

	Harrison Bayou	LHAAP-18/24 Sprinklers	INF Pond
Oct-14	0	335,192	0
Nov-14	115,031	292,554	0
Dec-14	0	371,468	0

Harrison Bayou and Goose Prairie Creek – Perchlorate Data

Surface water samples are collected quarterly from each location in Harrison Bayou and Goose Prairie Creek, unless the sampling location is dry.

Historic Surface Water Sample Data (in micrograms per liter)

Quarter	3 rd	4 th	1 st	2 nd	3 rd	4 th	1 st	2 nd	3 rd	4 th	1 st
Creek Sample ID	Jul 1999	Sep 1999	Feb 2000	Apr 2000	Aug 2000	Dec 2000	Feb 2001	Apr 2001	July 2001	Oct 2001	Jan 2002
GPW-1	<1.0U	-	4	<4.0 U	<4.0 U	<4.0 U	-	2.65	<4.0 U	<4.0 U	<4.0 U
GPW-3	<1.0U	<4.0 U	17	8	<4.0 U	<4.0 U	-	2.28	<4.0 U	<4.0 U	<4.0 U
HBW-1	-	<80.0 U	310	23	-	-	<4.0 U	-	<4.0 U	<4.0 U	<4.0 U
HBW-7	-	<8.0 U	370	110	-	-	<4.0 U	-	<4.0 U	<4.0 U	<4.0 U
HBW-10	-	<8.0 U	905	650	<4.0 U	-	<4.0 U	-	<4.0 U	-	-

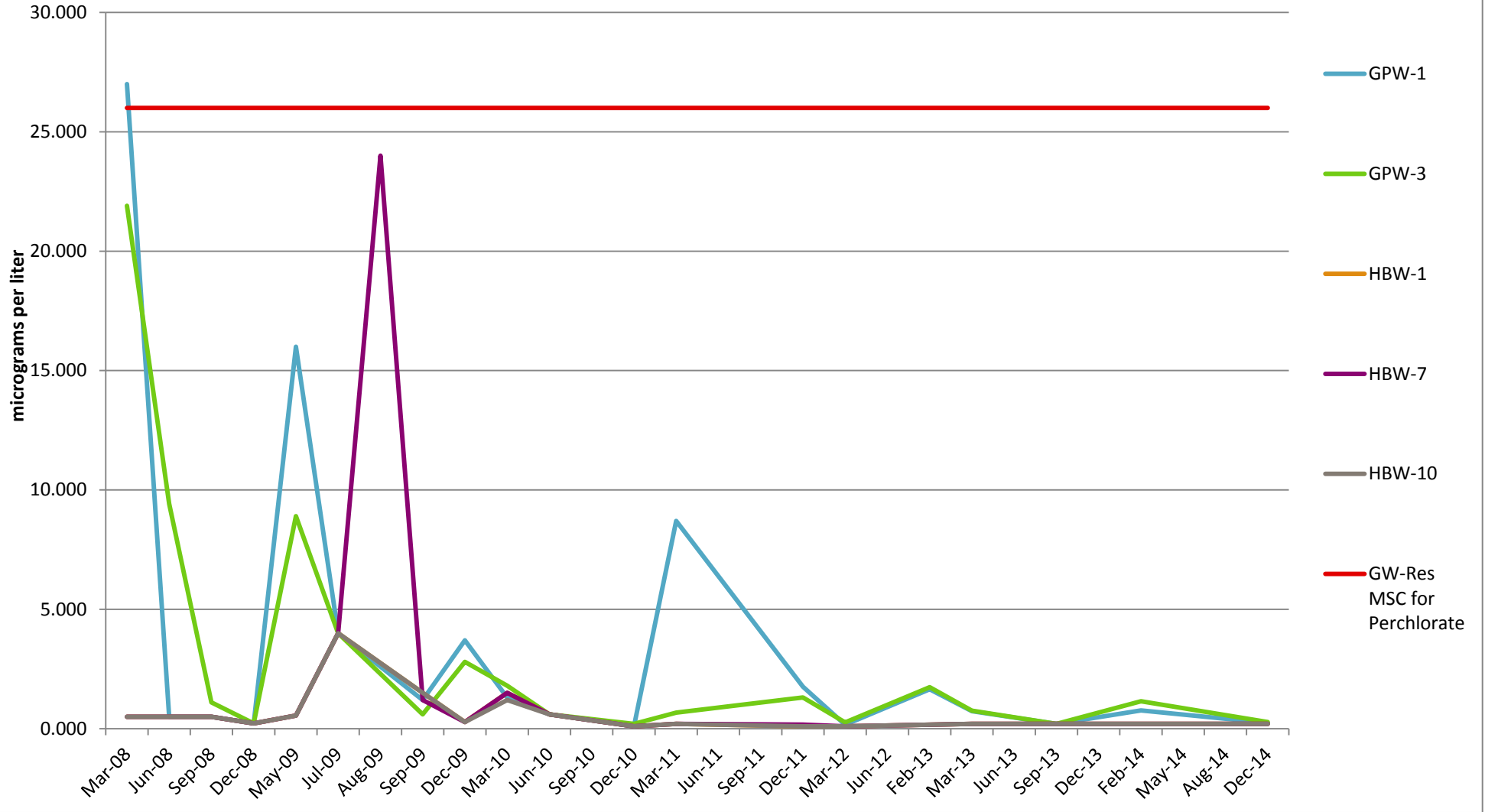
Quarter	2 nd	3 rd	4 th	1 st	2 nd	3 rd	3 rd	4 th	2 nd	3 rd	4 th
Creek Sample ID	June 2002	Sept 2002	Dec 2002	Feb 2003	June 2003	Aug 2003	July 2004	Dec 2006	May 2007	Aug 2007	Dec 2007
GPW-1	<4.0 U	<4.0 U	18.3	18.6	59.9	-	2.25	-	<1.0 U	<1.0 U	10.7
GPW-3	<4.0 U	<4.0 U	5.49	12.6	14.7	-	2.2	-	<1.0 U	<1.0 U	7.48
HBW-1	<4.0 U	<4.0 U	<4.0 U	-	<4.0 U	99.3	<0.2U	<1.0 U	<1.0 U	122	<1.0 U
HBW-7	<4.0 U	<4.0 U	<4.0 U	-	<4.0 U	<4.0 U	<0.2U	<1.0 U	<1.0 U	1.02	<1.0 U
HBW-10	<4.0 U	<4.0 U	<4.0 U	-	<4.0 U	-	<0.2U	<1.0 U	<1.0 U	<1.0 U	<1.0 U

Quarter	1 st	2 nd	3 rd	4 th	2 nd	3 rd	3 rd	3 rd	4 th	1 st	2 nd
Creek Sample ID	Mar 2008	Jun 2008	Sep 2008	Dec 2008	May 2009	Jul 2009	Aug 2009	Sep 2009	Dec 2009	Mar 2010	Jun 2010
GPW-1	27	<0.5U	<0.5U	<0.22U	16	<4U	NS	<1.2U	3.7	1.3J	<0.6U
GPW-3	21.9	9.42	1.1	<0.22U	8.9	<4U	NS	<0.6U	2.8	1.8J	<0.6U
HBW-1	<0.5U	<0.5U	<0.5U	<0.22U	<0.55U	<4U	NS	<1.5U	<0.275U	1.5U	<0.6U
HBW-7	<0.5U	<0.5U	<0.5U	<0.22U	<0.55U	<4U	24	<1.2U	<0.275U	1.5U	<0.6U
HBW-10	<0.5U	<0.5U	<0.5U	<0.22U	<0.55U	<4U	NS	<1.5U	<0.275U	1.2U	<0.6U

Quarter	3 rd	4 th	1 st	2 nd	3 rd	4 th	1 st	2 nd	3 rd	4 th	1 st
Creek Sample ID	Sep 2010	Dec 2010	Mar 2011	Jun 2011	Sep 2011	Dec 2011	Mar 2012	Jun 2012	Not Applicable	Jan & Feb 2013	Mar 2013
GPW-1	dry	<0.1U	8.7	dry	dry	1.76	0.163J	dry	NC	1.65	0.735
GPW-3	dry	0.199J	0.673	dry	dry	1.31	0.261	dry	NC	1.74	0.754
HBW-1	dry	<0.1U	<0.2U	dry	dry	<0.1U	0.1U	dry	NC	<0.2U	<0.2U
HBW-7	dry	<0.1U	<0.2U	dry	dry	0.171J	0.1U	dry	NC	<0.2U	<0.2U
HBW-10	dry	<0.1U	<0.2U	dry	dry	<0.1U	0.1U	dry	NC	<0.2U	<0.2U

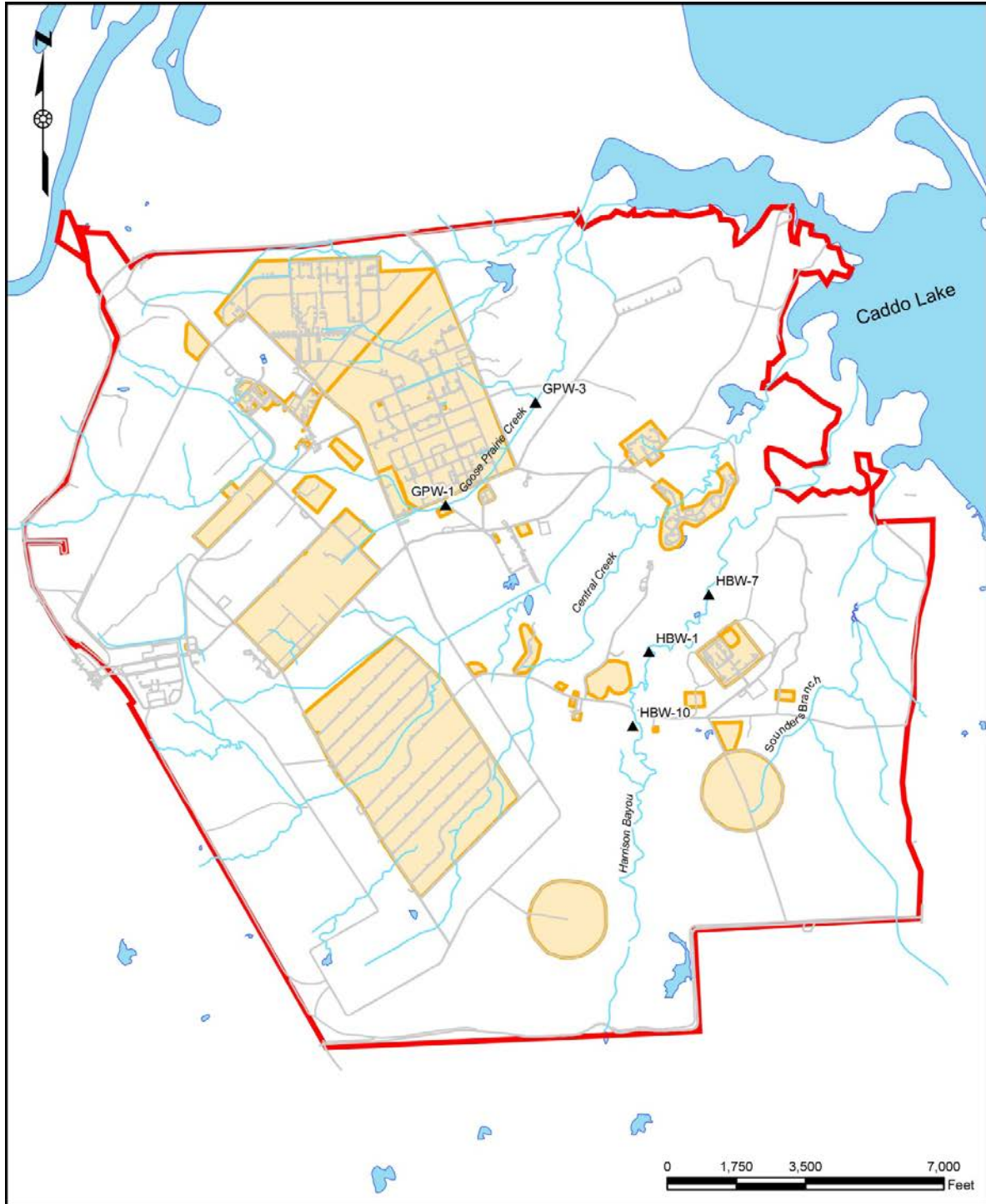
Quarter	2 nd	3 rd	4 th	1 st	2 nd	3 rd	4 th
Creek Sample ID	Jun 2013	Sept 2013	Dec 2013	Feb 2014	May 2014	Aug 2014	Nov 2014
GPW-1	dry	<0.2 U	dry	0.766	dry	dry	0.244 J
GPW-3	dry	<0.2 U	dry	1.15	dry	dry	0.276 J
HBW-1	<0.2U	<0.2 U	dry	<0.2 U	dry	dry	<0.2 U
HBW-7	<0.2U	<0.2 U	dry	0.201 J	dry	dry	<0.2 U
HBW-10	<0.2U	<0.2 U	dry	<0.2 U	dry	dry	<0.2 U

Surface Water Samples - Perchlorate



Note: Perchlorate Screening Criteria - TCEQ GW_{Res} (micrograms per liter) 26

Longhorn Army Ammunition Plant Creek Sampling Locations



Legend

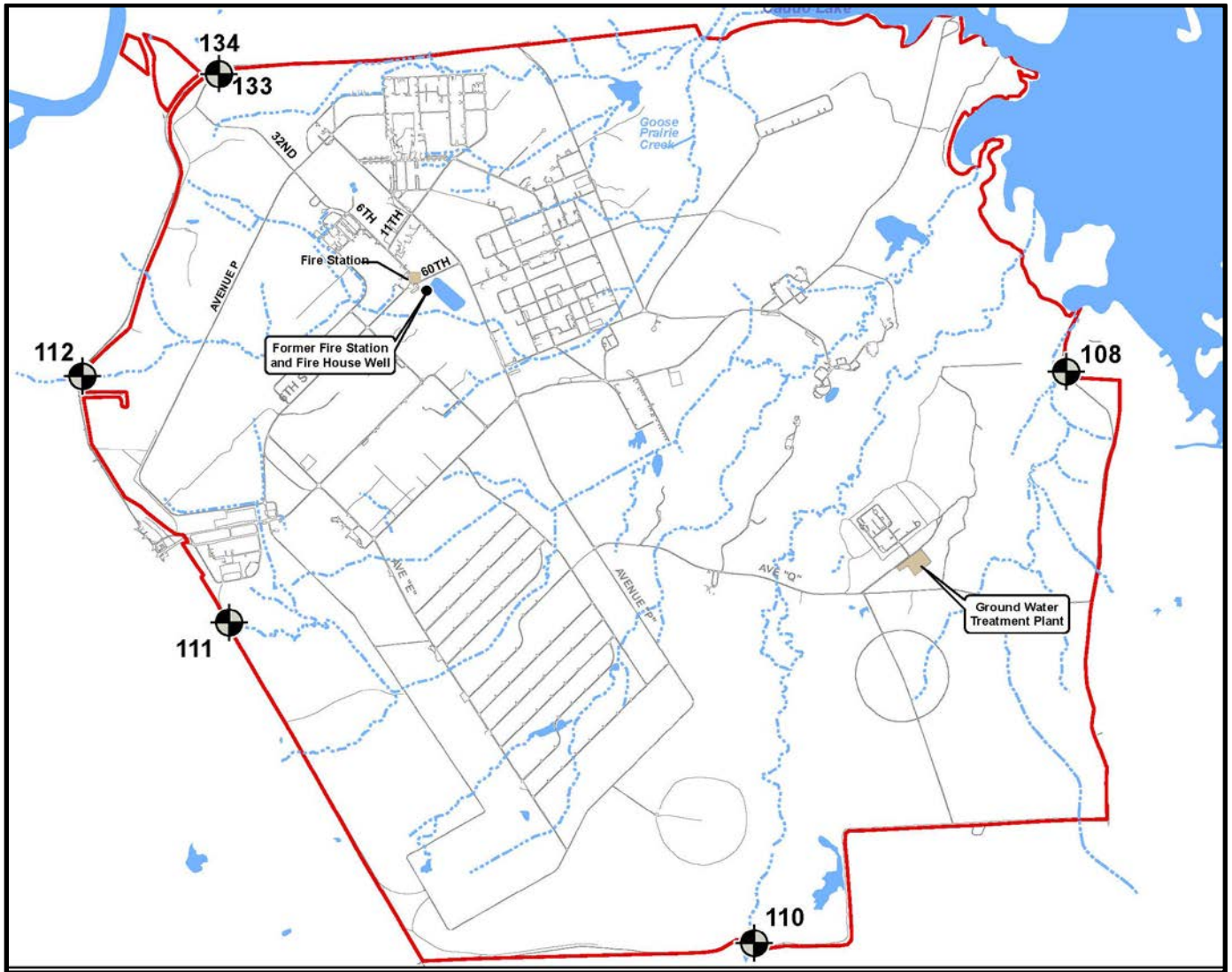
- ▲ Surface Water Sampling Location
- Stream
- Road
- Site
- Lake

U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

SURFACE WATER SAMPLING LOCATION

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Longhorn Army Ammunition Plant Map with Perimeter Well Locations



LHAAP-35B (37) – Former Chemical Laboratory Remedial Action Operations

Site History

The LHAAP-35B (37) site, the Former Chemical Laboratory, encompasses approximately 12.2 acres and is located in the north-central portion of LHAAP near the southwest corner of LHAAP-47 and in the northeast quadrant of the intersection of Avenue P and 51st Street. The laboratory was originally used to support production activities at LHAAP including research and testing of materials used in the production processes and quality assurance testing. A single waste rack sump was also located at the site.

Site Characteristics

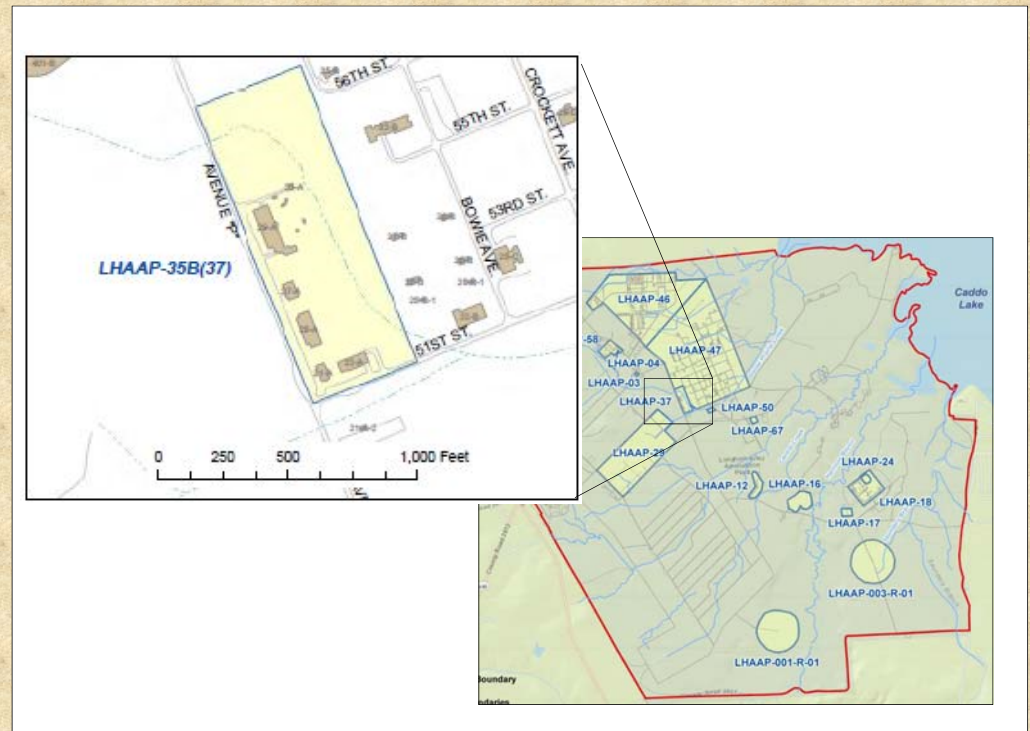
The site topography is relatively flat. The surface features at LHAAP-35B (37) include remnants of the concrete foundations and partial walls of the former administration buildings and the Chemical Laboratory (Building 29-A), and a mixture of asphalt-paved roads and parking areas, and a mixture of wooded and grassy vegetation-covered areas. The surface drainage flows into Goose Prairie Creek. The creek runs perpendicular to the western border of the site and then turns south through the east-central portion of the site and eventually flows into Caddo Lake.

Risk Assessment

A human health risk assessment (HHRA) and baseline ecological risk assessment (BERA) were conducted for LHAAP-35B (37) to determine current and future effects of contaminants on human health and the environment. The HHRA indicated that soil at the LHAAP-35B (37) site does not pose a risk to the environment or human health under an industrial exposure scenario for a future maintenance worker. However, groundwater present within the upper shallow zone posed an unacceptable cancer risk and non-cancer hazard to a future maintenance worker from hypothetical groundwater consumption. There is no groundwater contamination in the lower shallow groundwater zone or the intermediate zone. The BERA concluded that no unacceptable risk was present to the ecological receptors from the site soil and groundwater.

Chemicals of Concern

Various investigations have been conducted at LHAAP-35B (37) to evaluate the nature and extent of impacted soil and groundwater concluding that there was no significant contamination in soils, but the upper shallow groundwater zone contains volatile organic compounds including trichloroethylene (TCE), tetrachloroethene (PCE), and 1,1-dichloroethene (1,1-DCE).



LHAAP-35B (37) Location and Site Map

LHAAP-35B (37) – Former Chemical Laboratory (continued)

Remedial Action Operations

Remedial Action Objectives

The Remedial Action at LHAAP-35B (37) will protect human health and meet applicable or relevant and appropriate requirements (ARARs). There are no ecological risks at the LHAAP-35B (37) site. The RAOs for LHAAP-35B (37), consistent with the reasonably anticipated future use as a national wildlife refuge, are:

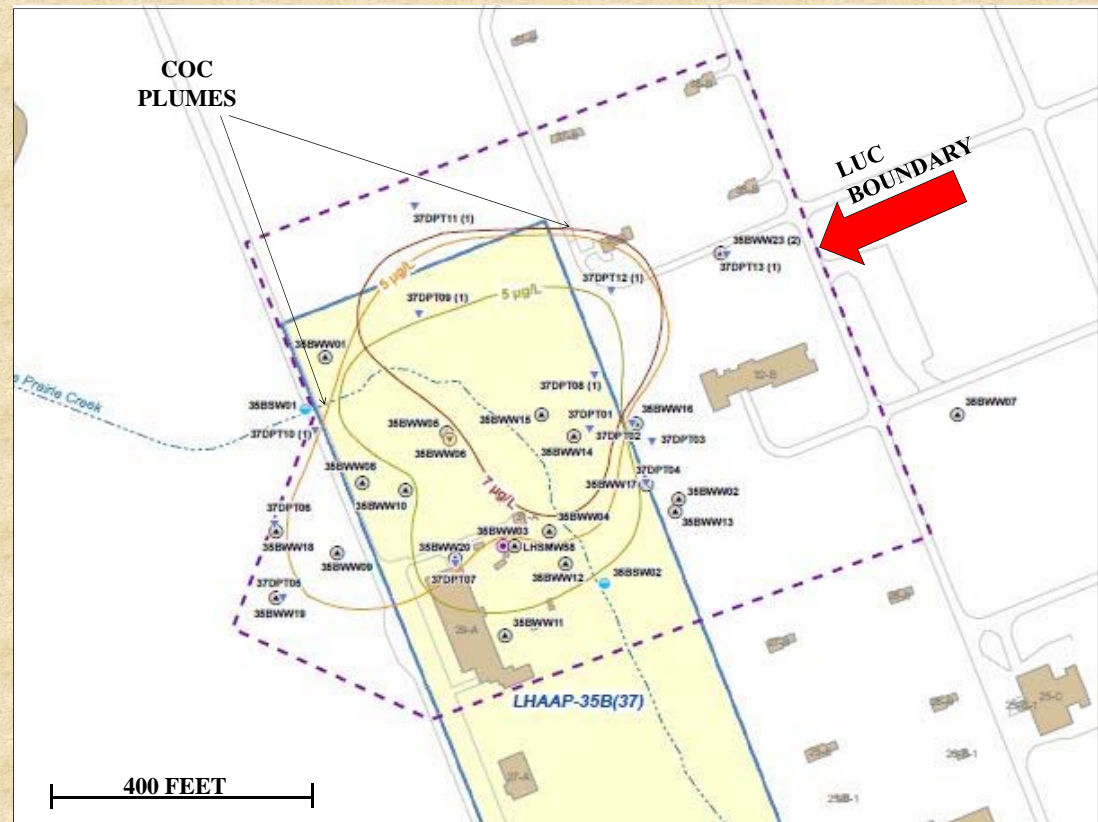
- Ensure protection of human health by preventing human exposure to the contaminated groundwater;
- Ensure protection of human health and the environment by preventing contaminated groundwater from migrating into nearby surface water; and,
- Ensure return of groundwater to its potential beneficial use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

Land Use Control Boundary

One element of the remedial action at LHAAP-35B (37) is establishment of a land use control (LUC) area where withdrawal or use of groundwater is restricted to only environmental monitoring and testing. The LUC will remain in effect until the levels of COCs in groundwater and soil allow for unrestricted use and unlimited exposure (UUUE). Army, with TCEQ and EPA concurrence, has established a LUC area to restrict groundwater use at LHAAP-35B (37), completed a civil survey of that boundary and will record the LUC notification with the Harrison County Courthouse.

Monitored Natural Attenuation (MNA)
MNA at the LHAAP-35B (37) site is implemented to monitor COCs and ensure protection of human health and the environment. Performance monitoring to evaluate remedy effectiveness includes groundwater and surface water monitoring. The groundwater monitoring program is designed to evaluate and monitor natural

attenuation of COCs in shallow zone groundwater. The surface water monitoring program is designed to monitor potential migration of contaminated groundwater to surface water. The Army will ensure return of the aquifer conditions to those existing prior to the bio-plug demonstration study (discussed below), at which time groundwater monitoring for the MNA remedy will begin.



LHAAP-35B (37) Land Use Control Boundary

LHAAP-35B (37) – Former Chemical Laboratory (continued)

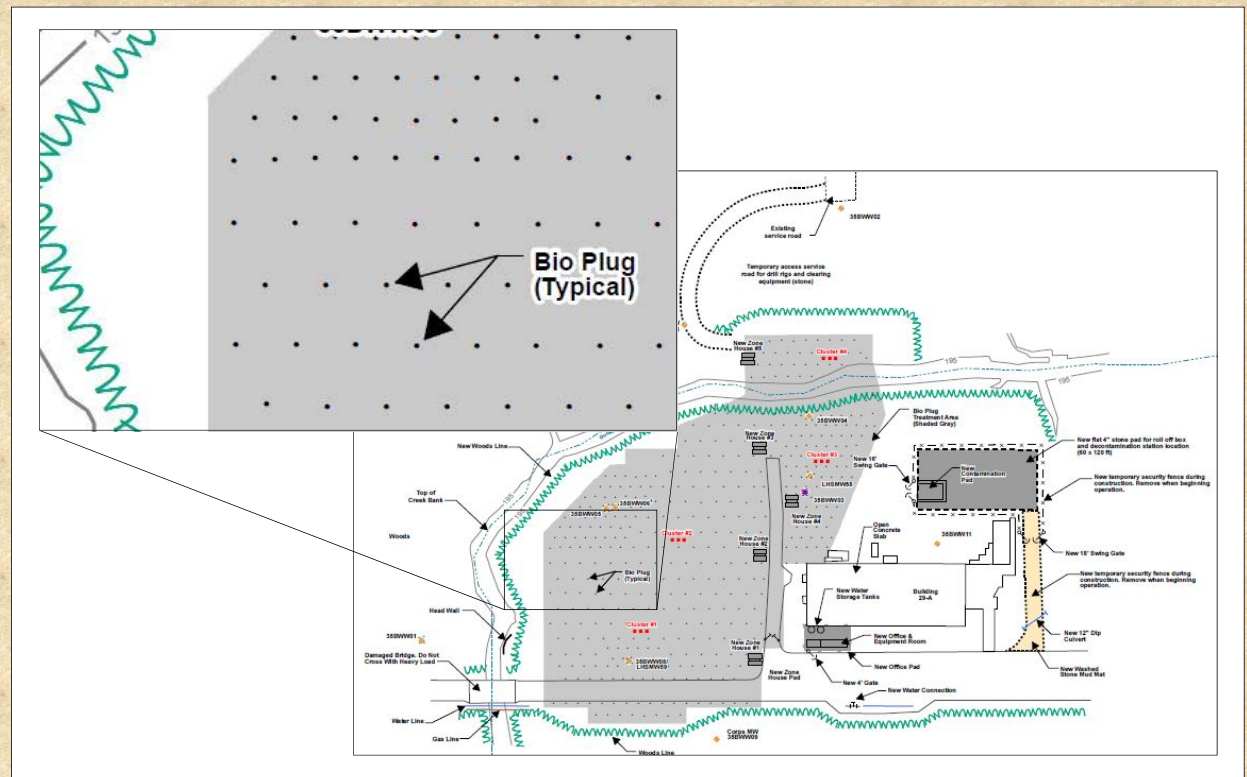
Bio-plug Field Demonstration Pilot Study

Background

A field demonstration pilot study of the bio-plug technology was initiated at the LHAAP 35B (37) site in September 2012. The pilot study was performed by an independent contractor under contract with the United States Army Aberdeen Test Center. The bio-plug technology is a method of augmenting and enhancing in-situ biological degradation of chlorinated organic contaminants. The technology involves subsurface installation of microbiological reactors (bio-plugs) that generate and disperse contaminant-specific microorganisms.

Purpose

The purpose of the pilot study was to determine the feasibility of the bio-plug technology to accelerate the biological degradation of chlorinated organic contaminants in the groundwater at the site. Bio-plugs are small, in situ immobilized microbe bioreactors installed in an array within the contaminated zone. Each bio-plug is connected to a distribution system that supplies air and nutrients to stimulate microbial respiration, reproduction, and to promote microbial dispersion. The pilot study commenced in September 2012 and concluded with the final groundwater sampling round in October 2014.



LHAAP-35B (37) Bio-plug Field Demonstration Pilot Study Layout

Conclusions

As part of the bio-plug demonstration study, the contractor collected samples for analysis of VOCs in July 2012 (baseline event), December 2012, March 2013, June 2013, September 2013, December 2013, March 2014 and June 2014. Interpretation of data generated through these events indicated reduction of contaminant concentrations was not sufficient to justify continuation of the study. The contractor conducted a final sampling event in October 2014 to close the study, and the system was decommissioned in January 2015. Periodic groundwater monitoring will be conducted to determine when groundwater aquifer conditions have returned to those existing prior to the bio-plug demonstration study, at which time groundwater monitoring for the MNA remedy will begin.

LHAAP-46, Plant 2 Area - Remedial Action Operations

Site History

LHAAP-46, (Plant 2 Area), is located in the north-central portion of LHAAP and covers approximately 190 acres. Facilities for producing JP-2 propellant fuel at LHAAP-46 began in 1944, but construction was halted in 1945 with the end of World War II. Plant 2 was used to produce pyrotechnic devices from February 1952 to 1956 and was reactivated to produce pyrotechnic and illumination devices in 1964 until approximately 1997.

Site Characteristics

The surface features at LHAAP-46 are a mixture of asphalt-paved roads, parking areas, building foundation remnants, old buildings, and overgrown wooded and grassy vegetation-covered areas. The topography in this area is relatively flat with the surface drainage flowing east into tributaries of Goose Prairie Creek, which eventually flows into Caddo Lake. The lake is a source of drinking water for several neighboring communities in Louisiana. Shallow zone groundwater is approximately 11 to 23 feet below ground surface (bgs) and flows to the east. Intermediate zone groundwater is approximately 23 to 30 feet bgs and flows to the Northeast.

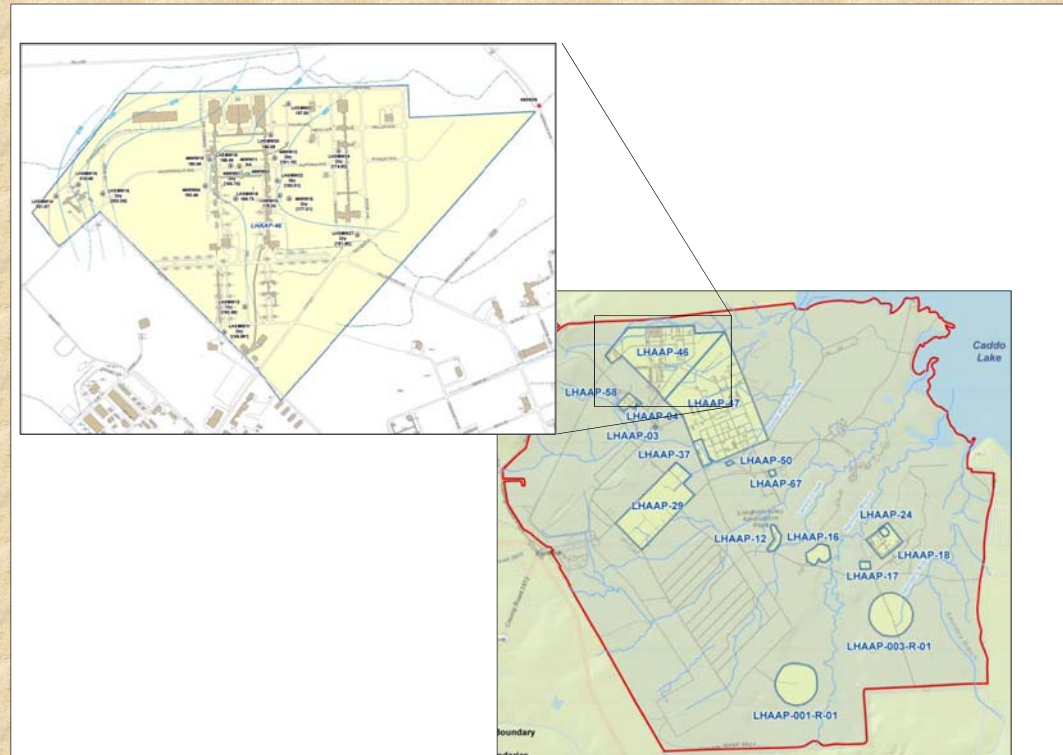
Risk Assessment

A baseline human health risk assessment (BHHRA) and ecological risk assessment were conducted for LHAAP-46 to determine current and future effects of contaminants on human health and the environment.

Based on the BHHRA the soil does not pose a cancer risk or non-cancer hazard to the hypothetical future maintenance worker. However, the groundwater at LHAAP-46 poses an unacceptable non-cancer hazard to a hypothetical future maintenance worker under an industrial scenario with the exposure route of drinking the water or using the water for hand washing and showering. The baseline ecological risk assessment concluded no action is needed at LHAAP-46 for the protection of ecological receptors.

Chemicals of Concern

Between 1992 and 2008 numerous investigations were conducted in a phased approach to determine the nature and extent of contamination at LHAAP-46. Media investigated included soil and groundwater. Additional data gathered since the risk assessment (2003) did not change its outcome. Chemicals of Concern (COCs) for LHAAP-46 identified in the Feasibility Study are the trichloroethene (TCE) in the shallow and intermediate groundwater zones. TCE daughter products dichloroethene and vinyl chloride are also COCs.



LHAAP-46 Site Location

LHAAP-46, Plant 2 Area – Remedial Action Operations (cont.)

Remedial Action Objectives

The Remedial Action Objectives (RAOs) for LHAAP-46 which address contamination associated with the media at the site and take into account the future uses of LHAAP surface water, land, and groundwater are:

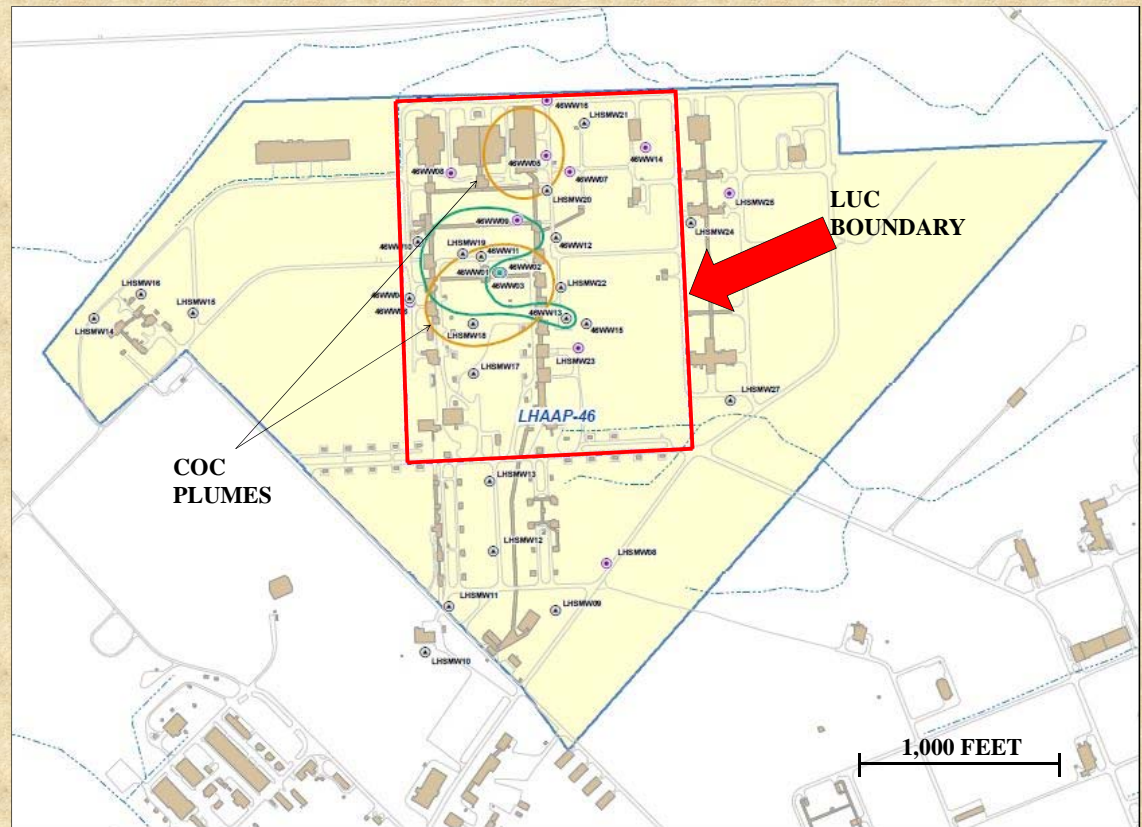
- Protect human health for the hypothetical future maintenance worker by preventing exposure to groundwater contaminated by VOCs (TCE and its daughter products).
- Protect human health and the environment by preventing contaminated groundwater from migrating into nearby surface water.
- Return groundwater to its potential beneficial use as a drinking water, wherever practicable.

Land Use Control Boundary

One element of the remedial action at LHAAP-46 is establishment of a land use control (LUC) area where withdrawal or use of groundwater is restricted to only environmental monitoring and testing. The LUC will remain in effect until the levels of COCs in groundwater and soil are at levels that allow for unrestricted use and unlimited exposure (UUUE). Army, with TCEQ and EPA concurrence, has established this LUC area to restrict groundwater use at LHAAP-46, completed a civil survey of that boundary and recorded the LUC notification with the Harrison County Courthouse in December 2014.

Monitored Natural Attenuation (MNA)

MNA at the LHAAP-46 site is implemented to monitor COCs and ensure protection of human health and the environment. Performance monitoring to evaluate remedy effectiveness includes groundwater and surface water monitoring. The groundwater monitoring program is designed to evaluate and monitor natural attenuation of COCs in groundwater. The surface water monitoring program is designed to monitor potential migration of contaminated groundwater to surface water. Quarterly groundwater samples were last collected from LHAAP-46 in February 2015, and will be collected again in May 2015.



LHAAP-46 Land Use Control Area and COC Plume Footprints

LHAAP-50 – Former Sump Water Tank Remedial Action Operations

Site History

The LHAAP-50 site (Former Sump Water Tank) is in the north-central portion of LHAAP and covers an area of approximately 1 acre. LHAAP-50 contained a 47,000-gallon capacity aboveground storage tank which received industrial wastewater from industrial waste production sumps throughout LHAAP from 1955 to 1988. After the solids were filtered, the storage tank contents were discharged upstream of the bridge on Crockett Avenue, south of 51st Street into Goose Prairie Creek.

Site Characteristics

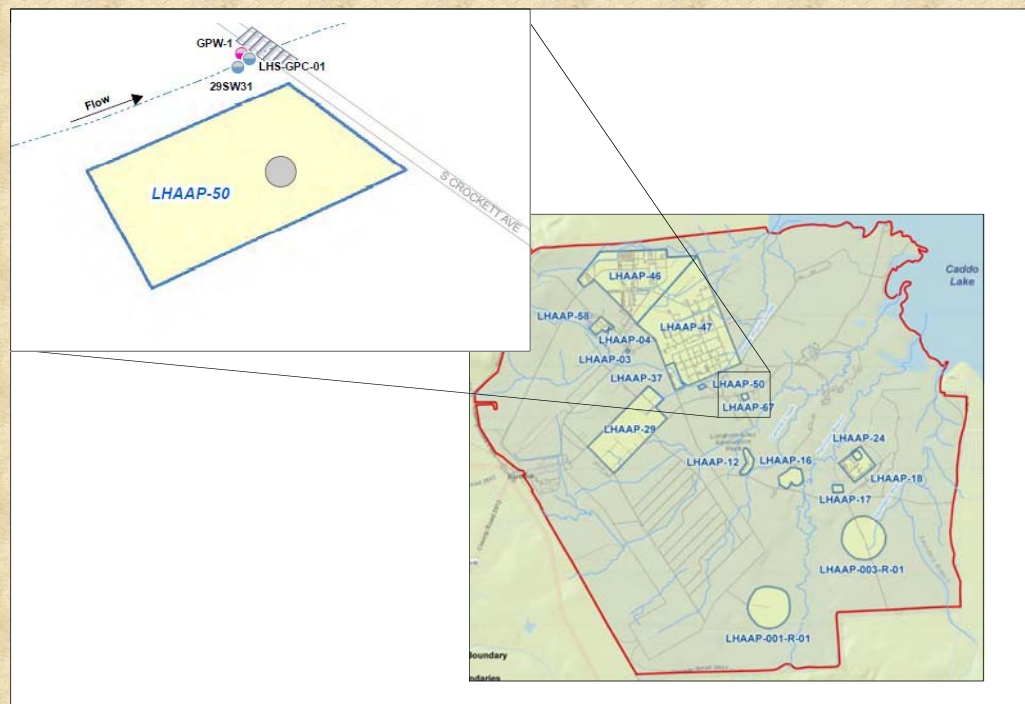
The northeastern half of the LHAAP-50 is an open area of grass and brush that is bounded by South Crockett Avenue to the northeast, a drainage ditch to the west, a railroad spur to the south, and Goose Prairie Creek to the north. Runoff from the northeastern half of the site is generally toward the northeast. Runoff is collected by a drainage ditch to the northeast that runs parallel to South Crockett Avenue and eventually joins Goose Prairie Creek. Runoff from the southwestern portion of the site is collected to the west by a drainage ditch that carries the runoff north into Goose Prairie Creek. Goose Prairie Creek eventually empties into Caddo Lake.

Risk Assessment

A baseline human health risk assessment (BHHRA) was conducted for LHAAP-50 that used data from the investigations conducted through 2001 and between 2006 and 2008; and a baseline ecological risk assessment (BERA) was conducted based on investigations conducted from 1993 through 2006 to determine current and future effects of contaminants on human health and the environment. The RA at LHAAP-50 is protective of human health and meets applicable or relevant and appropriate requirements (ARARs). The ecological risk assessment concluded no action is needed at LHAAP-50 for the protection of ecological receptors.

Chemicals of Concern

Between 1992 and 2010, numerous investigations were conducted in a phased approach to determine the nature and extent of contamination at LHAAP-50. COCs at the LHAAP-50 site include dissolved phase perchlorate and volatile organic compounds (VOCs) including tetrachloroethylene (PCE), trichloroethylene (TCE), 1,1-dichloroethylene (1,1-DCE), 1,2-dichloroethane (1,2-DCA), cis-1,2-dichloroethylene (cis-1,2-DCE), and vinyl chloride (VC) in groundwater, and perchlorate in soil. There are no COCs in other environmental media at the LHAAP-50 site.



LHAAP-50 Location and Site Map

LHAAP-50 – Former Sump Water Tank (continued)

Remedial Action Operations

Remedial Action Objectives

The Remedial Action Objectives (RAOs) for LHAAP-50, consistent with the reasonably anticipated future use as a national wildlife refuge, are:

- Protection of human health by preventing human exposure to the contaminated groundwater;
- Protection of human health by preventing further potential degradation of groundwater and surface water from contaminated soil;
- Protection of human health and the environment by preventing contaminated groundwater from migrating into nearby surface water; and,
- Return of groundwater to its potential beneficial uses as drinking water, wherever practicable.

Land Use Control Boundary

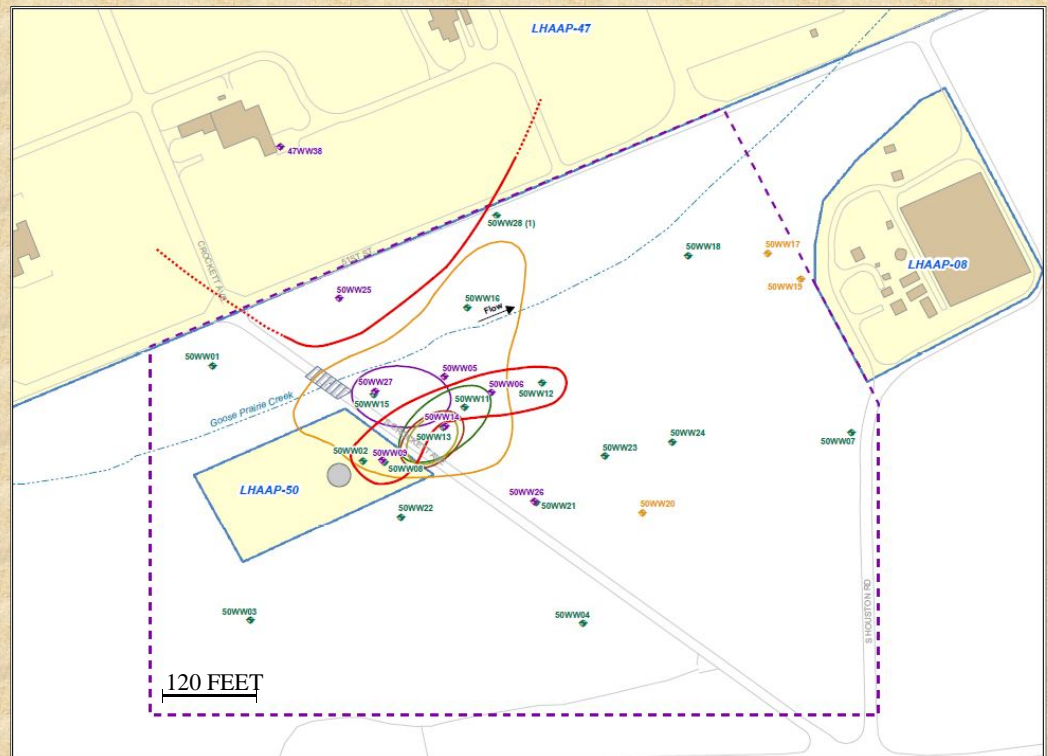
The objectives of the LUC at LHAAP-50 are to prevent human exposure to groundwater contamination presenting an unacceptable risk to human health and ensure that there is no withdrawal or use of groundwater beneath the site for anything other than environmental monitoring and testing. The LUC will remain in effect until the levels of COCs in groundwater and soil allow for unrestricted use and unlimited exposure (UUUE). Army, with TCEQ and EPA concurrence, will establish a LUC area to restrict groundwater use at LHAAP-50, and notification of that LUC to be recorded with the Harrison County Courthouse.

Monitored Natural Attenuation

MNA at the LHAAP-50 site is implemented to monitor COCs and ensure protection of human health and the environment. Performance monitoring to evaluate remedy effectiveness includes groundwater and surface water monitoring. The groundwater monitoring program is designed to evaluate and monitor natural attenuation of COCs in shallow zone groundwater. The surface water monitoring program is designed to monitor potential migration of contaminated groundwater and surface runoff to surface water. Quarterly groundwater samples were last collected from LHAAP-50 in February 2015, and will be collected again in May 2015.

Soil Removal Action

Perchlorate-impacted surface soils were excavated and disposed off-site in 2013 as part of the remedial action. The excavation area was backfilled with clean soil and seeded to restore vegetation.



LHAAP-50 Land Use Control Boundary and COC Plume Footprints

LHAAP-35A (58) - Shops Area Remedial Action Operations

Site History

LHAAP-35A (58), also known as the Shops Area, is located in the north-central portion of LHAAP and is approximately 11 acres in size. LHAAP-35A (58) was established in 1942 as part of the installation's initial construction. The facility was used to provide plant-operated laundry, automotive, woodworking, metalworking, painting, refrigeration, and electrical services. LHAAP-35A (58) was active throughout LHAAP's mission and became inactive in 1996-1997, along with the entire installation.

Site Characteristics

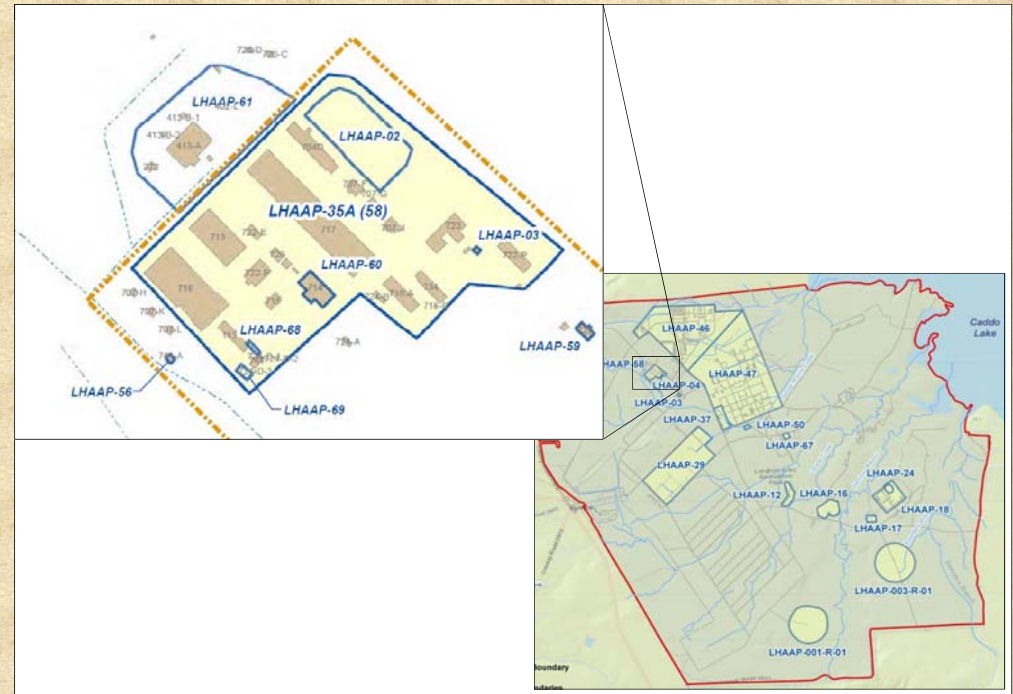
The surface features are a mixture of asphalt-paved roads, a parking area, and areas of wooded and grassy vegetation. The topography is relatively flat with the surface drainage flowing into the tributaries of Goose Prairie Creek. Runoff from the site enters Caddo Lake via Goose Prairie Creek.

Risk Assessment

A baseline human health risk assessment (BHHRA) and baseline ecological risk assessment (BERA) were conducted for LHAAP-35A (58) to determine current and future effects of contaminants on human health and the environment. The findings from these investigations was that the shallow zone groundwater was impacted with volatile organic compounds (VOCs), while the soil and former sump/waste rack sump areas posed no unacceptable threat to human health or the environment.

Chemicals of Concern

Between 1992 and 2008, multiple investigations were conducted in a phased approach to evaluate the nature and extent of contamination at the LHAAP-35A (58) site. The findings from these investigations were that the shallow zone groundwater was impacted with volatile organic compounds (VOCs) tetrachloroethene (PCE), trichloroethene (TCE), 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, and vinyl chloride (VC). Soil and former sump/waste rack sump areas were found to pose no unacceptable threat to human health or the environment.



LHAAP-35A (58) Location and Site Map

Remedial Action Objectives

The Remedial Action Objectives (RAOs) for LHAAP-35A (58), consistent with the reasonably anticipated future use as a national wildlife refuge, are:

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

LHAAP-35A (58) – Shops Area (continued)

Remedial Action Operations

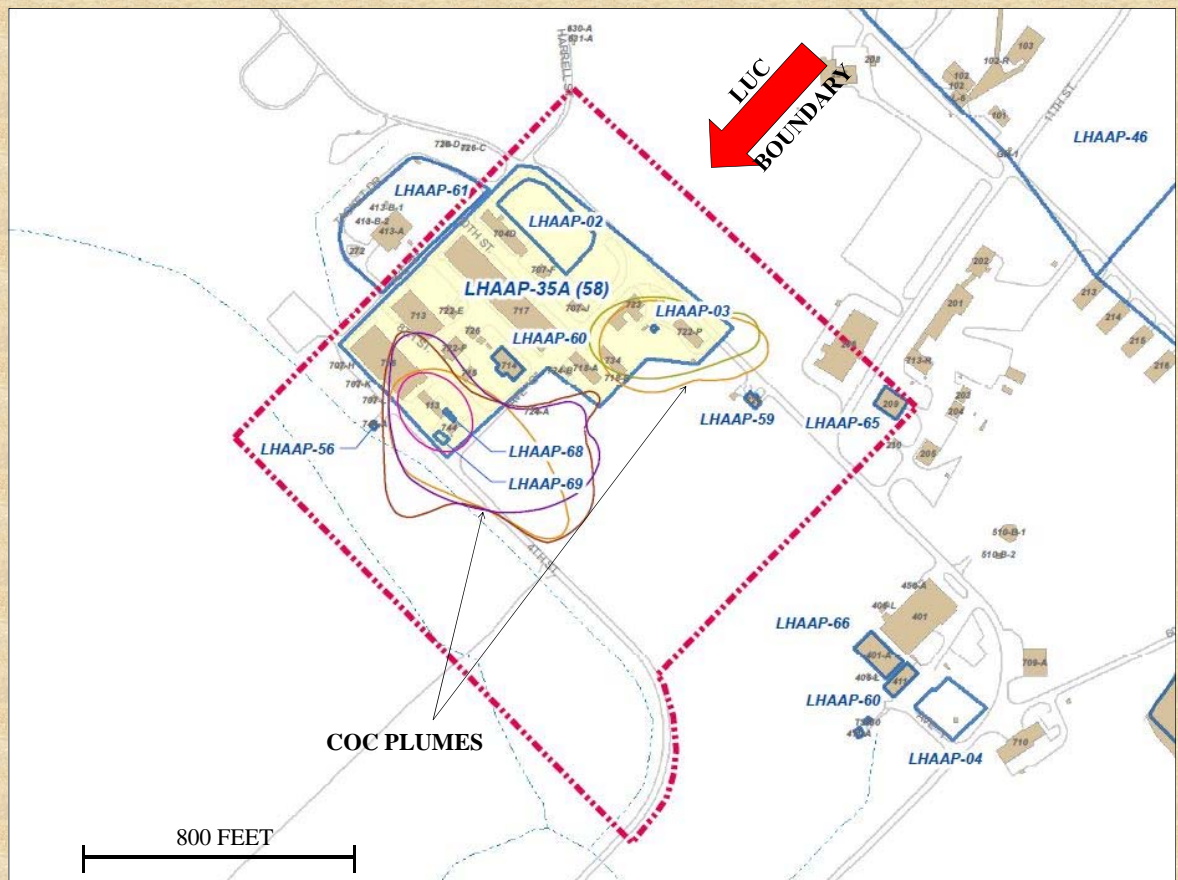
Land Use Control Boundary

The objectives of the Land Use Control (LUC) at LHAAP-35A (58) are to prevent human exposure to groundwater contamination presenting an unacceptable risk to human health and ensure that there is no withdrawal or use of groundwater beneath the site for anything other than environmental monitoring and testing. The LUC will remain in effect until the levels of COCs in groundwater and soil allow for unrestricted use and unlimited exposure (UUUE). Army, with TCEQ and EPA concurrence, has established a LUC area to restrict groundwater use at LHAAP-35A (58), completed a civil survey of that boundary and will record the LUC notification with the Harrison County Courthouse. The following sites are located within the LUC boundary for LHAAP-35A (58): LHAAP-02, LHAAP-03, LHAAP-56, a vehicle 209 wash rack & oil/water separator Building 744-A, LHAAP-59, Storage Building 725, LHAAP-60, LHAAP-65, Former Building 209 (flammable materials storehouse), LHAAP-68, LHAAP-69.

Monitored Natural Attenuation

MNA at the LHAAP-35A (58) site is implemented to monitor COCs and ensure protection of human health and the environment. Performance monitoring to evaluate remedy effectiveness includes groundwater and surface water monitoring. The groundwater monitoring program is designed to evaluate and monitor natural attenuation of COCs in groundwater.

Quarterly groundwater samples were last collected from LHAAP-35A (58) in January 2015, and will be collected again in April 2015.



LHAAP-35A (58) Land Use Control Area and COC Plume Footprints

LHAAP-35A (58) – Shops Area (continued)

Remedial Action Operations

Enhanced In-situ Bioremediation (EISB)

EISB technology involves biological degradation of contaminants in groundwater via respiratory or metabolic processes through appropriate microbes. The EISB treatment involves injection of carbon substrates (electron donor), nutrients, and, if needed, microbial cultures, into the subsurface.

Treatment via EISB at LHAAP-35A (58) was specified to treat COCs in the eastern plume area to enhance their biological degradation and create subsurface conditions favorable for MNA after completion of the EISB treatment. EISB implementation included selection of carbon substrate, mixing and injection procedures, a baseline sampling event, bioaugmentation (injections of microbial culture), post-injection monitoring and analysis of data.



LHAAP-35A (58) EISB Treatment Area

LHAAP-67, Former Aboveground Storage Tank Farm Remedial Action Operations

Site History

When operational, LHAAP-67 consisted of seven aboveground storage tanks of unknown size. The tanks were surrounded with earthen dikes designed to contain potential spills. Site personnel indicated that the tanks were used for solvent storage. The tanks have been removed and the only structure remaining at the site is a railroad bed.

Site Characteristics

LHAAP-67, a former aboveground storage tank farm is located in the central portion of LHAAP and covers approximately 1.91 acres. The site is relatively flat. The nearest significant surface water body is Central Creek located ~870 feet southeast of the site.

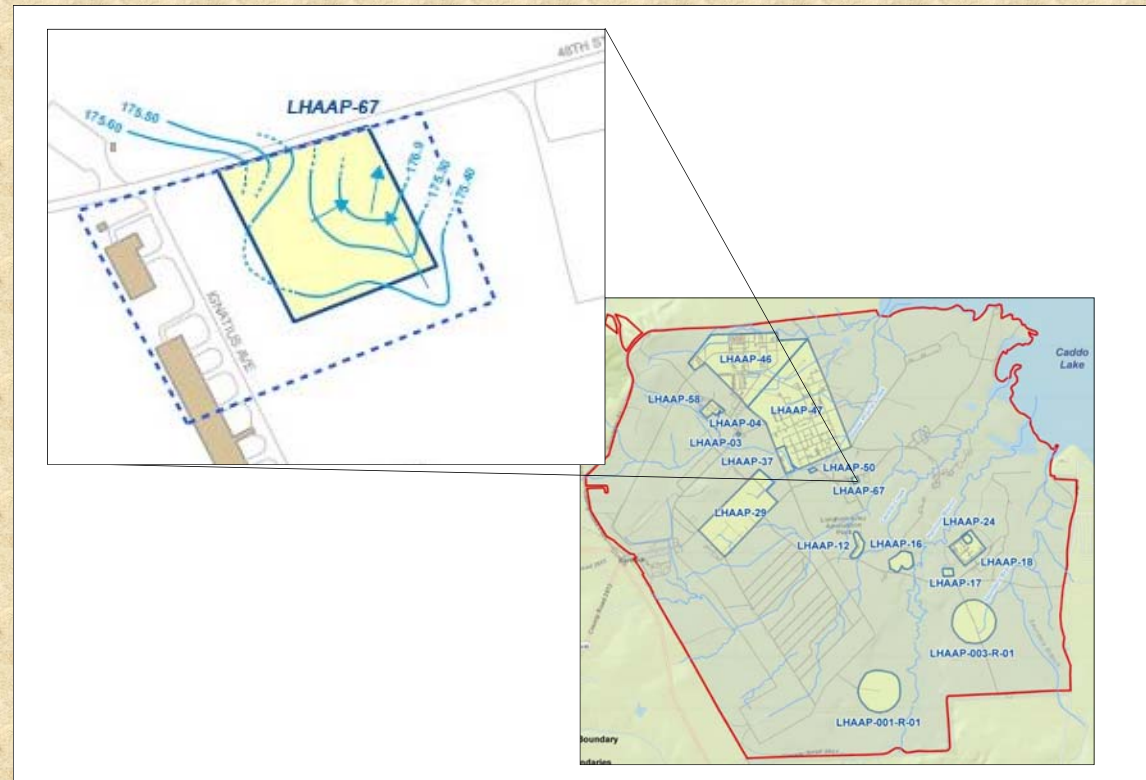
Risk Assessment

A baseline human health risk assessment (BHHRA) and ecological risk assessment were conducted for LHAAP-67 to determine current and future effects of contaminants on human health and the environment. Based on the BHHRA the soil does not pose a cancer risk or non-cancer hazard to the hypothetical future maintenance worker. However, the groundwater at LHAAP-67 pose an unacceptable cancer risk and non-cancer hazard to a hypothetical future maintenance worker under an industrial scenario with the exposure route of drinking the water or using the water for hand washing and showering.

The baseline ecological risk assessment (BERA) concluded no action is needed at LHAAP-67 for the protection of ecological receptors.

Chemicals of Concern

Between 1998 and 2006 numerous investigations were conducted in a phased approach to determine the nature and extent of contamination at LHAAP-67. Media investigated included soil and groundwater. Additional data gathered since the risk assessment (2003) did not change its outcome. Chemicals of concern (COCs) for LHAAP-67 identified in the Feasibility Study are 1,1-dichloroethene (DCE), 1,2 dichloroethane (DCA), 1,1,1-trichloroethane (TCA), 1,1,2-TCA and trichloroethene (TCE) in the shallow groundwater zone.



LHAAP-67 Site Location

LHAAP-67, Former Aboveground Storage Tank Farm (cont.) Remedial Action Operations

Remedial Action Objectives

The Remedial Action 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 (USACE, 2010). 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.

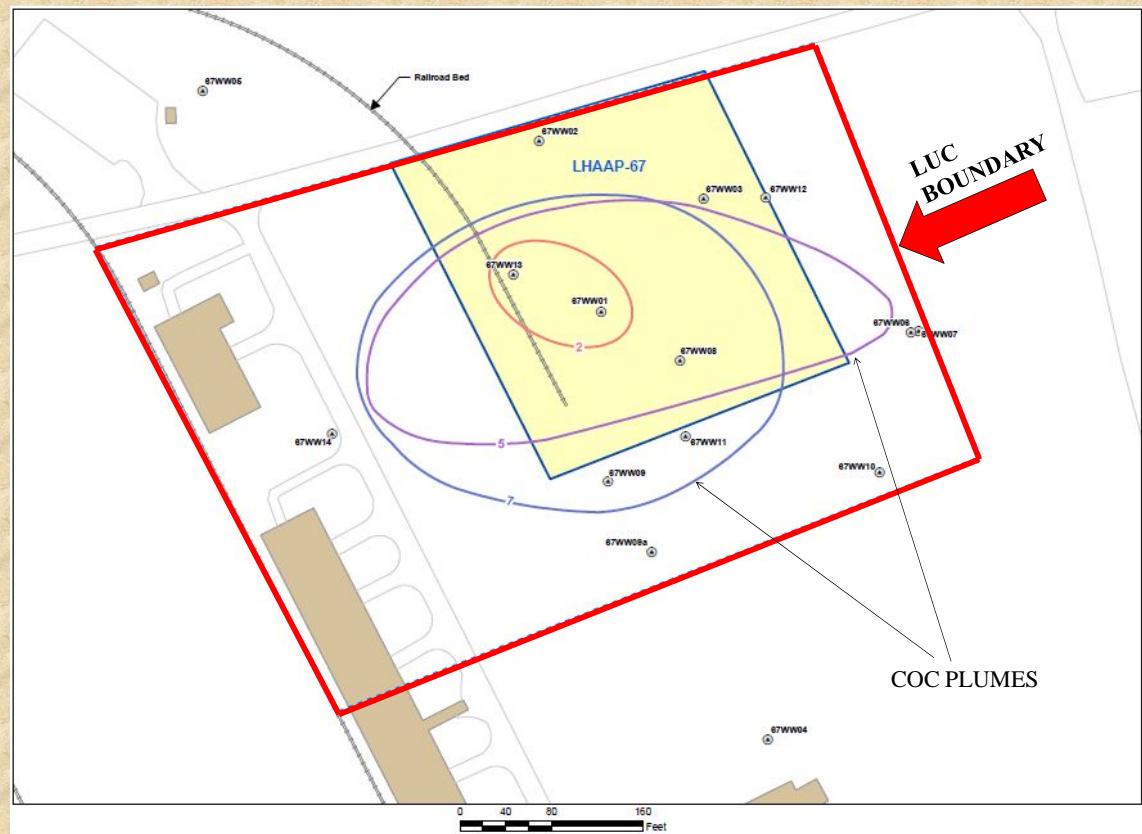
Land Use Control Boundary

One element of the remedial action at LHAAP-67 is establishment of a land use control (LUC) area where withdrawal or use of groundwater is restricted to only environmental monitoring and testing. The LUC will remain in effect until the levels of COCs in groundwater and soil at the site allow for unrestricted use and unlimited exposure (UUUE). Army, with TCEQ and EPA concurrence, has established a LUC area to restrict groundwater use at LHAAP-67, completed a civil survey of that boundary and recorded the LUC notification with the Harrison County Courthouse in December 2014.

Monitored Natural Attenuation

MNA at the LHAAP-67 site is implemented to monitor COCs and ensure protection of human health and the environment. Performance monitoring to evaluate remedy effectiveness includes groundwater monitoring, designed to evaluate and monitor natural attenuation of COCs in shallow zone groundwater.

Quarterly groundwater samples were last collected from LHAAP-67 in February 2015, and will be collected again in May 2015.



LHAAP-67 Land Use Control Area and Plume Footprints