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 20, 2014, 6:00 – 7:30 PM**

Meeting Participants:

LHAAP/BRAC:	Rose M. Zeiler
USACE:	Aaron Williams, Rick Smith
USAEC:	Robin Paul
AECOM:	Dave Wacker, Gretchen McDonnell
TCEQ:	April Palmie
USEPA Region 6:	Rich Mayer, Janetta Coats, Kent Becher (USGS liaison), Barry Forsythe (USFWS Liason)
USFWS:	Paul Bruckwicki
RAB:	**Present:** Paul Fortune, Terry Britt, Charles Dixon, Carol Fortune, Judith Johnson, Ted Kurz, Richard LeTourneau, Tom Walker, John Pollard, Jr., Nigel Shivers, Pickens Winters **Absent:** Ken Burkhalter, Robert Cargill, Lee Guice, James Lambright, Judy Vandeventer
Public:	Dawn Orsak, CLI-TAG Mary Britt, Carlos Black, Joe Black, Robert Keathley

An agenda handout for the RAB meeting was provided for the meeting. Additional hard copy meeting materials provided included the AECOM slide presentation, a surface water and perimeter well perchlorate data handout, and a GWTP summary handout showing pounds of chemicals removed and volume of water treated. Draft November 2014 RAB meeting minutes were provided to RAB members for review prior to the meeting.

Welcome – Rose Zeiler
Mr. Fortune opened the meeting and invited any first-time attendees to introduce themselves.

Mr. Joe Black introduced himself as a first-time meeting attendee, but lifelong Caddo Lake area resident. Mr. Black stated his son, also named Joe Black, is a candidate for Harrison County judge.

Open Items – Rose Zeiler

Minutes
Ms. McDonnell noted that one change was made to the version of the minutes that had been distributed for RAB review, which was to correct the name of the church where Mr. Pollard serves as deacon. Ms. Fortune made a motion to approve the November 2013 RAB meeting minutes. Motion seconded by Mr. Pollard.

Tour of Longhorn Sites Planned for May
By vote of the RAB members, the tour was scheduled for May 15th at 3PM. Participants should meet in front of the entrance for the USFWS building, just inside the gates of the refuge. The tour will likely take two hours. The tour is for RAB members, but members of the public may attend if their name and contact information is submitted in advance.

New Members
Mr. Kurz stated that he knew a potential candidate for the RAB. Mr. Fortune asked that AECOM provide an application.

Website
The Longhorn website is schedule for debut at the next RAB meeting. When the site becomes active, a notice will be sent to the RAB members and the interested parties list. The address will be http://www.longhornaap.com.

A map of the site will allow viewers to click on a site of interest, and be led directly to documents relating to that site. Groundwater plume map updates, fact sheets on remedial technologies in use, and administrative record documents are anticipated to be available on the website.

Installation Action Plan
Dr. Zeiler asked the group if any RAB member had not received their copy of the Installation Action Plan. No member indicated they had not received the document.

Open Questions
Ms. Coats, USEPA, asked if any local government officials had requested tours of Longhorn. Dr. Zeiler stated that local government officials are on the Longhorn interested parties list, so receive notifications of Longhorn RAB activities, but no requests have been received for several years. Dr. Zeiler stated that the interested parties list would be reviewed to ensure it is updated to include current local government officials. William Hatfield was identified as the current county commissioner for the Longhorn area and should be on the interested parties list.

Defense Environmental Restoration Program (DERP) Update – AECOM (Dave Wacker)

Fieldwork Completed and Upcoming Field Activities Planned
Mr. Wacker provided a brief overview of the CERCLA process phases, to facilitate discussion on the status of progress at several LHAAP sites where field work has recently been completed or is underway (LHAAP-46, LHAAP-67, LHAAP-18/24, LHAAP-35B(37), LHAAP-50,

LHAAP-35A(58), LHAAP-12 and LHAAP-16). Five sites (LHAAP-46, LHAAP-67, LHAAP-35B(37), LHAAP-50, LHAAP-35A(58)) are currently in the "remedy in place" phase of the process, undergoing monitored natural attenuation (MNA). See attached AECOM PowerPoint presentation for maps and tables associated with sites referenced below.

LHAAP-46 Plant 2 Area Update – Remedy In Place

Primary contaminant is trichloroethene (TCE) in groundwater with a maximum current concentration of 144 micrograms per liter (μg/L), and a clean-up level of 5 μg/L. The remedy for the site is MNA and land use controls, so additional wells were installed earlier this year and the initial monitoring round conducted.

Contamination at the site consists of shallow (to ~30' bgs) and intermediate (~30-60' bgs) groundwater zone plumes with a total of 21 wells now being monitored to observe the plumes. Mr. Wacker showed maps of the shallow and intermediate zone groundwater TCE plumes. Quarterly MNA monitoring is in progress. A Remedial Action Completion Report is being generated at this time.

Mr. Fortune asked how long a site will be monitored to determine whether MNA is a suitable remedy. Eight quarters of monitoring are prescribed before enough data is collected to perform an initial evaluation of MNA effectiveness. Mr. Wacker stated that the total estimated duration to complete remediation is stated in the ROD. Mr. Fortune asked when the quarterly monitoring started. Mr. Wacker stated that the remedy for LHAAP-46 has been in place for about a year, and the eight quarters of monitoring needed to judge MNA effectiveness started when the remedy was put in place. Mr. Fortune asked if there was additional data collected from prior to AECOM that could be used in determining whether MNA is working. Mr. Wacker stated that, although older data was used for nature and extent definition prior to implementation of the remedy, the eight quarters of monitoring needed to judge the effectiveness of MNA started when the remedy was implemented.

LHAAP-67 AST Farm – Remedy In Place

This site has TCE concentrations similar to the LHAAP-46 site, but confined to the shallow groundwater zone. MNA and land use controls for TCE in groundwater is the remedy. Additional wells were installed and the initial monitoring round conducted. The total plume size is relatively small, approximately 300 feet by 400 feet.

A Remedial Action Completion Report is being generated at this time, and the annual report will be prepared in August 2014.

LHAAP-18/24 Burning Ground 3 & Unlined Evaporation Pond – Interim Remedy In Place

As background, Mr. Wacker stated that LHAAP-18/24 was the primary waste management area for LHAAP and is the most highly contaminated site at Longhorn. Currently, the interim remedial action in place consists of collection of impacted groundwater from collection trenches (located along down-gradient sides of the site and in hot spots within the site), and routing of collected groundwater to the GWTP for removal of contaminants. Annual sampling of the interceptor collection trenches (ICTs), will be conducted in February.

A significant amount of additional investigation work has been completed at LHAAP-18/24 this year toward completing a revised feasibility study for the site, and additional work is being proposed to collect more information required to support the revised feasibility study. The

additional work relates to defining the extent of DNAPL source material in the former Unlined Evaporation Pond (UEP) area where liquid wastes were disposed on a daily basis during the site's operation.

Mr. Fortune asked for clarification on the UEP versus the INF Pond. Mr. Wacker explained that the UEP was a waste disposal area within the LHAAP-18/24 site. The INF Pond is in different location, not within the LHAAP-18/24 site, where treated water from the GWTP can be stored when water cannot be discharged to Harrison Bayou due to low water flow in the bayou.

LHAAP-35B(37) – Chemical Laboratory – Remedy In Place

This site is the former Chemical Laboratory with shallow groundwater impacted by tetrachloroethylene (PCE) and TCE plumes. LHAAP-35B(37) is also the site of the bioplug demonstration study being conducted by the US Army's Aberdeen Testing Center. The bioplug demonstration study is separate from the remediation specified in the ROD for the site.

If the bioplug approach does not reduce contaminants to acceptable levels during its performance period, the aquifer will be allowed to return to natural conditions and AECOM will begin the monitored natural attenuation remedy as approved in the ROD. AECOM has already installed the MNA monitoring well network specified in the ROD.

LHAAP-50 Former Sump Water Tank – Remedy In Place

LHAAP-50 was the site of a large above-ground water tank that received sump water from across the plant. Issues at the site are perchlorate in soil, and perchlorate and VOCs in groundwater.

Areas of perchlorate-impacted surface soil have been excavated and removed (approximately 183 cubic yards), and disposed at an off-site landfill. Mr. Wacker showed a map defining the excavation area.

To address groundwater, 19 new monitoring wells were installed to support implementation of the approved monitored natural attenuation remedy. An annual report will be prepared to provide an evaluation of the remedy.

LHAAP-58 Shops Area – Remedy In Place

Multiple plant activities that were conducted in this area and could have contributed to contamination at the site (paint shop, laundry, carpentry, etc.). VOCs have impacted groundwater at the site. There are two separate groundwater plumes; "eastern plume" and "western plume", each with their own remediation strategy.

In the center of the east plume, where concentrations are on the order of a few thousand micrograms per liter, In-Situ Bioremediation (ISB) is being completed to more aggressively treat those higher concentration impacts. Approximately 225 gallons of Wil-Clear Plus, a sodium lactate food source for microbes that will degrade VOCs, was injected at each of 12 injection points in the east plume. Injection of the food source was followed by injection of bioaugmentation solution after confirmation that the type of microbes required to degrade the contaminants were not present at the site. This site is subject to quarterly MNA monitoring.

Mr. Wacker reviewed some initial contaminant data from the eastern plume, showing a reduction of PCE and TCE in well 03WW01. However, well 35AWW09 showed an increase of PCE, which is likely due to movement of contaminated water resulting from injection of the food source and bioaugmentation solution. Mr. Wacker used these examples to illustrate why we perform eight quarters of sampling over two years to obtain a better view of the actual performance of the remedy after the immediate effects of fluid injection dissipate.

Mr. Fortune asked what the western plume contaminants were. Mr. Wacker stated that the contaminant is TCE. Mr. Fortune asked what activities were done to create the contamination. Mr. Wacker stated that there were multiple operations in this area that could have caused solvent impacts, including a paint shop.

LHAAP-12 and LHAAP-16 – Remedy In Place (Operation and Maintenance)
Continuing operation and maintenance activities have been performed at these landfill sites.

Annual sampling of wells associated with LHAAP-12 was recently completed. MNA is being reevaluated at LHAAP-12 and there is the possibility some minor additional work may be done (i.e., installation of a new well). The contaminant concentrations at LHAAP-12 are fairly low and Army is working to demonstrate that MNA is reducing contaminant concentrations at the site. This year, MNA effectiveness could not be effectively evaluated because the only contaminated well at the site was dry during the sampling event, and could not be sampled, leaving us without a new data point for the trend analysis.

As an interim measure to prevent impacts to Harrison Bayou, LHAAP-16 has extraction wells collecting water for treatment at the GWTP. The annual sampling of these extraction wells was done in February. An additional round of sampling more wells at LHAAP-16 was done a few months ago, and that data will likely be presented at the next RAB meeting. Mr. Wacker noted that decision on a final remedy for LHAAP-16 has been delayed due to the dispute between Army and USEPA.

CERCLA 5-Year Review Process for Multiple Sites
The 5-Year Review has been performed and the report document is being reviewed by the USEPA. The review included sites with either final or interim remedies in place, such as LHAAP-12 and LHAAP-16 landfill sites, LHAAP-18/24 associated with the GWTP, the Pistol Range and LHAAP-49 Acid Storage Area.

Mr. Wacker explained that a CERCLA 5-Year Review is required every five years for any site that has been closed but not restored to unrestricted use conditions. Sites at Longhorn that are restored to conditions suitable for future industrial use, but not suitable for residential use, require these reviews.

GWTP
The GWTP continues to operate to contain the groundwater plumes at LHAAP-18/24 and LHAAP-16. See attached handout showing treated groundwater volumes and mass of chemicals removed. Treated water is either discharged to Harrison Bayou or released back to the LHAAP-18/24 site.

Mr. Dixon asked if the chemicals removed from groundwater are destroyed or released to the air. Mr. Wacker stated that perchlorate is destroyed by bacterial treatment. Metals are precipitated from the water, resulting in a small amount of sludge that is periodically disposed of at a landfill. VOCs are stripped from the water and discharged to the air, with air discharges being monitored in several locations to ensure Texas air standards are not exceeded. Mr. Wacker pointed out that air samples have been collected from multiple locations for over a year without any Texas air standard being exceeded. Dr. Zeiler stated that the GWTP will be on the Longhorn RAB tour route in May, where the RAB will be provided with a briefing on how the plant works.

Perimeter Well and Surface Water Sampling

Perchlorate sampling is conducted quarterly for groundwater at several locations along the perimeter of the former facility footprint in accordance with the 1999 dispute resolution. Historically, Army voluntarily sampled these wells for a wide variety of chemicals that were used at the plant. Surface water is also sampled for perchlorate at five locations. The latest quarterly data is from the September 2013 sampling event indicated no detections of perchlorate at any of the surface water sampling locations (see attached handout), and no real changes in observations from the monitoring wells.

Upcoming Work, Meetings and Documents

Remedial Action Operation quarterly sampling will continue at LHAAP-46, LHAAP-50, LHAAP-58 and LHAAP-67. Semi-annual compliance sampling will be conducted at LHAAP-18/24 in May. Finalization of the CERCLA 5-Year Review report will be signed this year. Generation of remedial action completion reports for LHAAP-37, LHAAP-46, LHAAP-50, LHAAP-58 and LHAAP-67 is ongoing.

LHAAP-18/24 and LHAAP-29 will have some additional field work completed to install a few wells, and perform some soil sampling associated with the feasibility studies for both the sites. Work on remaining sites will be delayed until resolution of the dispute between Army and USEPA.

Mr. LeTourneau asked who is responsible for abandonment of monitoring wells once they are no longer needed. Dr. Zeiler stated that most wells are maintained for long periods of time, beyond the contract duration of any one consultant, so the Army is responsible for abandonment of wells.

Other Environmental Restoration Issues – Rose Zeiler

Dispute Resolution

Mr. Wacker showed a list of sites where work is being delayed due to the dispute between Army and USEPA over clean-up levels and land use controls. Mr. Mayer explained that USEPA has a dispute process that is followed when they disagree with what another federal agency wants to do with respect to conducting clean-up of sites. Mr. Mayer stated that the Longhorn dispute is being worked at the highest levels in both Army and USEPA, where it is in the hands of the Deputy Assistant Secretary of the Army and the USEPA Administrator.

Mr. Mayer stated that a meeting between Army and USEPA had been planned for next week, but it has now been tentatively rescheduled for April.

Mr. Fortune asked if the dispute will be settled at this meeting. Mr. Mayer stated that the Deputy Assistant Secretary of the Army will present their side of the dispute to the USEPA Administrator during this meeting, and the USEPA Administrator will likely make a decision after that meeting. Dr. Zeiler stated that the Army has an appeal process to follow if the Army does not agree with the USEPA Administrator's decision.

Mr. Britt asked what we are doing to make sure conditions are not degrading while the dispute goes on. Dr. Zeiler stated that we are doing monitoring.

Dr. Zeiler asked AECOM to prepare a slide bulleting the dispute issues for the next RAB meeting.

DNAPL Presentation
Dr. Zeiler provided a basic introduction to Dense Non-Aqueous Phase Liquids, or DNAPLs. DNAPLS are heavier than water, opposed to light non-aqueous phase liquids (LNAPLs) like gasoline or oil which will float on water. Due to their density, DNAPLs will travel down through the subsurface until they hit an aquitard (a layer that impedes its progress, like a clay). The layered sands and clays at Longhorn provide discontinuous "shelves" of limited extent that can be overflowed with DNAPL. (See attached AECOM Powerpoint presentation slides 8 through 10 for an illustration of how DNAPL moves in the subsurface.)

There are areas where DNAPL "pools" in places, but there is also "residual" left behind in cracks and fractures where DNAPL once was in greater quantities. Our biggest challenge is to find it. Whatever treatment is used, it will be to treat that DNAPL where it is. DNAPL is extremely difficult to clean-up. In 2003, well-known contaminant hydrogeologist John Cherry said that a DNAPL residual site had never been remediated to true drinking water standards. Many DNAPL sites have instead been remediated to "alternative clean-up levels" developed and agreed to by regulatory agencies because the technology did not exist to achieve clean-up to drinking water standards. In summary, Ms. Zeiler stated that the best approach is to find the DNAPL and get rid of it, because it is a long-term endeavor to clean-up residual DNAPL left in an aquifer.

For LHAAP-18/24 and LHAAP-29, we will be working to collect additional data to more closely define the volumes of DNAPL we need to treat so we can identify which technology has the best chance of success. Mr. Mayer stated that even dissolved-phase chlorinated solvents are very difficult to remediate because they partition into soil materials and then release into groundwater later. Mr. Mayer further stated that over 100 sites nationwide have been approved for an alternative clean-up level because they have tried various technologies and demonstrated that remediation to the USEPA maximum contaminant level (MCL) is "impracticable".

Mr. LeTourneau asked what depth the contamination is at. Mr. Wacker stated that LHAAP-29 has contaminants at 90 feet below ground surface. The perimeter of the contamination has

been defined horizontally, and we have identified clean groundwater underneath the contamination at 90 feet, but we need to tighten the perimeter to know better how much true volume we are dealing with. Mr. LeTourneau asked how we know contamination will not move from where it is now at 90 feet down to 150 feet or other depths. Dr. Zeiler remarked that is was a primary question, but not one that anyone here could answer, but we do believe the contamination moved quickly to where it is now, in a matter of days or months rather than years. We know where the bottom of the contamination is now, but it could change. An aquitard could stop the travel of the contaminant, but if the aquifer is fractured or discontinuous, it could allow contamination to move deeper.

Mr. Kurz asked whether the work at Longhorn would end up being judged as having diminishing returns at some point, resulting in the government ending funding of remediation work there. Dr. Zeiler responded that Army must continue to fund remediation work at Longhorn until remediation is complete. For funding, Army generates a liability projection every year for their sites as part of the budgeting process, and it projects costs for the next 30 years. Until Army can demonstrate that a clean-up goal will be met, costs will be projected for 30 years out every year.

Dr. Zeiler went on to explain that when a remedial technology reaches a point of "diminishing returns", you typically to switch to a different method to reach the end goal. Or, using LHAAP-29 as an example, when you find the assumptions made when the remedy was decided were not valid, another option needs to be explored. For LHAAP-29, an additional technology will be evaluated and treatability testing done to ensure options being evaluated are viable. The last resort is to arrive at agreement on an alternative clean-up standard, as has been done at many sites with residual DNAPL impacts similar to LHAAP-18/24, where clean-up to the usual standards is beyond our existing technology.

Mr. Fortune stated that when Longhorn first became an National Priorities List site, the initial estimates given for time and funding to remediate Longhorn were 6-7 years and $50M dollars to clean-up. Mr. Mayer stated that the estimates done at that time were done before migration of contaminants was well understood, and what has been learned since then that has shown those estimates to be invalid.

Look Ahead at the Schedule
Next RAB meeting is tentatively scheduled for May 15th from 6PM – 7:30PM at the Karnack Community Center.

A motion to adjourn was made by Ms. Fortune and seconded by Mr.Britt.

Adjourn

February Meeting Attachments and Handouts:

- *Meeting Agenda*
- *Minutes from November 2013 RAB meeting*
- *AECOM Powerpoint Presentation*
- *GWTP Treated Groundwater Volumes Handout*
- *Surface Water Sampling Results Handout*

Acronyms

AECOM	AECOM Technical Services, Inc.
bgs	below ground surface
BRAC	Base Realignment and Closure
CERCLA	Comprehensive, Environmental Response, Compensation, and Liability Act
CLI	Caddo Lake Institute
DERP	Defense Environment Response Program
DNAPL	Dense Non-Aqueous Phase Liquid
GWTP	Groundwater Treatment Plant
ICT	interceptor-collector trench
INF	Intermediate-Range Nuclear Forces
ISB	In-Situ Bioremediation
LHAAP	Longhorn Army Ammunition Plant
LNAPL	Light Non-Aqueous Phase Liquid
MCL	Maximum Contaminant Level
MNA	Monitored Natural Attenuation
PCE	tetrachloroethylene
RAB	Restoration Advisory Board
ROD	Record of Decision
TAG	Technical Assistance Grant
TCE	trichloroethene
TCEQ	Texas Commission on Environmental Quality
TSDH	Texas State Department of Health
UEP	Unlined Evaporation Pond
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

AGENDA

DATE:	Thursday, February 20, 2014
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
- Tour of Longhorn Sites Planned for May
- Website
- Installation Action Plan

06:15 Defense Environmental Restoration Program (DERP) Update {AECOM}
- Fieldwork completed and upcoming field activities planned
- Groundwater Treatment Plant (GWTP) Update
- Environmental Update for Active Sites (progress since last meeting)

06:50 Other Environmental Restoration Issues {RMZ}
- Sitewide LUC Management Plan Update
- Bioplug Demonstration at LHAAP-37
- Dispute Status Update
- Schedule

07:00 Presentations:
- Dense Non-Aqueous Phase Liquids (DNAPLs)

07:30 Adjourn {RMZ}

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:	**November 14, 2013, 6:00 – 7:30 PM**

Meeting Participants:

LHAAP/BRAC:	Rose M. Zeiler
USACE:	Aaron Williams, Rick Smith
USAEC:	Marilyn Plitnik, Robin Paul, Cathy Kropp
AECOM:`	Dave Wacker, Gretchen McDonnell
TCEQ:	April Palmie
USEPA Region 6:	Rich Mayer, Janetta Coats, Kent Becher (USGS)
USFWS:	Paul Bruckwicki, Jason Roesner
RAB:	**Present:** Paul Fortune, Carol Fortune, Richard LeTourneau, Tom Walker, Judith Johnson, James Lambright **Absent:** Judy Vandeventer, Ken Burkhalter, Ted Kurz, Charles Dixon, Pickens Winters, Robert Cargill, Lee Guice, Nigel Shivers
RAB Candidates	Terry Britt, John Pollard, Jr.
Public:	Rick Lowerre, CLI-TAG Bridget LaBorde and Robert Whittaker, TMD Technologies Group Tina Walker, Tom Ellerbee, Carrie Bradford, and David Rivera, Texas State Department of Health

An agenda handout for the RAB meeting was provided for the meeting. Additional hard copy meeting materials provided included the AECOM slide presentation, Draft July RAB meeting minutes, a surface water and perimeter well perchlorate data handout, and a GWTP summary handout showing pounds of chemical s removed and volume of water treated.

Welcome – Rose Zeiler
Ms. Zeiler welcomed attendees to the meeting. Special guests were introduced by Ms. Zeiler:

- TMD Technologies Group (Ms. LaBorde and Mr. Whitaker) will be presenting an update on the demonstration study being conducted at LHAAP-37.
- Texas State Department of Health (TSDH) representatives (Mr. Rivera, Mr. Ellerbe, Ms. Walker and Dr. Bradford). Mr. Ellerbe stated that TSDH brought a handout to the meeting containing information relating to Longhorn, and that if anyone has any questions related to public health, they should contact TSDH.
- Ms. Cathy Kropp from US Army Environmental Center was introduced and will be providing an overview of the Longhorn RAB charter and the process of appointing new members.
- Mr. Rick Lowerre of Caddo Lake Institute (CLI) was introduced.
- Mr. Rick Smith of the U.S. Army Corps of Engineers (USACE) was introduced as replacing Mr. John Lambert as the USACE Project Manager for Longhorn.
- Mr. Terry Britt, a RAB membership candidate, was also introduced.

Open Items – Rose Zeiler

Minutes
Ms. Fortune made a motion to approve the July 2013 RAB meeting minutes. Motion seconded by Ms. Johnson.

New Members
Ms. Kropp provided a summary of the RAB member selection process and the RAB charter. Community RAB members must agree to attend regularly and on a voluntary basis (no compensation). A two-thirds vote of sitting RAB members in attendance is required to approve a new RAB member, and membership is effective starting with the next meeting, assuming approval of the Army BRAC Director.

Mr. Terry Britt was introduced as an applicant for RAB membership. Mr. Britt stated he is a resident of Uncertain, and has already been attending RAB meetings. Mr. Britt is interested in restoration of the refuge as a community member and hunter. Mr. Britt is also the President of the Caddo Lake WSC, with public water supply wells near the boundary of the former LHAAP footprint.

Mr. John Pollard, Jr. (arriving after the meeting was called to order) was introduced upon arrival as an applicant. Mr. Pollard stated that he is 79 years old and married, with children and grandchildren. Mr. Pollard served in the United States Army from 1954 – 1957 and is a deacon at Ebenezer Baptist Church in Marshall. Mr. Pollard stated that he feels it is important to be educated on what is going on in the community, and was interested in RAB membership when he saw the newspaper solicitation. Mr. Pollard is on the city planning and zoning commission, and has been on other boards in the past.

The voting members of the RAB in attendance were provided with paper ballots, and voted unanimously to accept both Mr. Britt and Mr. Pollard as new members. Mr. Britt and Mr. Pollard will be officially seated after approval by Mr. Tom Lederle, Army BRAC Director.

Tour
A RAB tour of Longhorn environmental sites will be scheduled for May on the day of the RAB meeting.

LHAAP-37 Bioplug Demonstration Project Update

Ms. Bridget LaBorde and Mr. Robert Whitaker of TMD Technologies Group provided a presentation explaining the Bioplug demonstration project being conducted at LHAAP-35B(37) by Aberdeen Test Center. RAB member questions regarding the technology were answered. See attached LHAAP-37 Bioplug Demonstration Study Presentation. RAB members were given the opportunity to ask questions about the technology.

Ms. Zeiler prefaced the presentation by saying that, prior to implementation of the approved monitored natural attenuation (MNA) remediation remedy for LHAAP-37, Aberdeen Test Center requested permission to conduct a demonstration study using the "bioplug" remediation technology at the site. Army is holding off on full implementation of the approved MNA remedy while the demonstration study is conducted to see what this technology can do to address the groundwater impacts.

Ms. LaBorde stated that the June 2013 data (after 8 months of operation) was not showing a trend for remediation, attributed to slower-than-anticipated groundwater flow across the site. Groundwater elevations have dropped at the site due to relatively dry conditions over the past several years, and groundwater flow rates have decreased along with that. However, September 2013 data (after 11 months of system operation) showed trends in some wells for degradation of volatile organic compounds (VOCs). The system is planned to operate for a total of 24 months.

Defense Environmental Restoration Program (DERP) Update – AECOM (Dave Wacker)

Fieldwork Completed and Upcoming Field Activities Planned
Mr. Wacker provided an update and summary of several sites where field work has recently been completed or is underway (LHAAP-46, LHAAP-67, LHAAP-18/24, LHAAP-35B(37), LHAAP-50, LHAAP-35A(58), LHAAP-03, LHAAP-12 and LHAAP-16). See attached AECOM PowerPoint presentation for maps and tables referenced below. Mr. Wacker also noted a display of photographs depicting recent field work conducted.

<u>LHAAP-46 Plant 2 Area Update – Remedy In Place</u>

Primary contaminant is trichloroethene (TCE) in groundwater at levels less than 100 micrograms per liter (μg/L), with a clean-up level of 5 μg/L. The remedy for the site is MNA and land use controls, so additional wells were installed earlier this year and the initial monitoring round conducted.

Contamination at the site consists of shallow (to ~30' bgs) and intermediate (~30-60' bgs) groundwater zone plumes with a total of 21 wells now being monitored to observe the plumes. Mr. Wacker showed maps of the shallow and intermediate zone groundwater TCE plumes,

comparing how the plumes were mapped before and after the addition of data from 7 new monitoring wells installed this Spring.

Mr. Wacker noted that during the most recent sampling event several of the wells monitoring the east side of the shallow groundwater zone plume were dry due to drought conditions. If water returns to those wells, the shape of the plume could change if the water is impacted. The analytical results from the first round of sampling were similar to historical results.

The intermediate groundwater zone plume was previously mapped as one continuous area of impact. However, analytical results from the first round of sampling showed no impacts at 46WW09, resulting in the plume being redrawn as two separate but smaller areas of contamination. Delineation of the north edge of the northern plume area has not been accomplished, so another well will be installed in that area to obtain a clean data point that defines the extent of the plume when future field work is completed in the next several months.

LHAAP-67 AST Farm – Remedy In Place

This site has TCE concentrations similar to the LHAAP-46 site, but confined to the shallow groundwater zone. MNA and land use controls for TCE in groundwater is the remedy. Additional wells were installed and the initial monitoring round conducted.

New wells and direct push sampling identified groundwater impacts farther to the west than had been previously mapped, so the next plume configuration map the RAB will see will show the plume extending farther west. The total plume size is still relatively small, approximately 300 feet by 400 feet.

LHAAP-18/24 Burning Ground 3 & Unlined Evaporation Pond – Interim Remedy In Place

A significant amount of additional investigation work has been completed at LHAAP-18/24 this year and a draft data report has been generated and submitted to TCEQ and EPA for review and comment. Ultimately, a revised feasibility study will be completed for the site.

As background, Ms. Zeiler stated that LHAAP-18/24 is the most highly contaminated at Longhorn. Mr. Wacker added that, because of the high level of contamination, compliance monitoring is performed at this site semi-annually, with ~60 wells being sampled during each event and the next event is planned for December.

LHAAP-35B(37) – Chemical Laboratory – Remedy In Place

This site is the former Chemical Laboratory with shallow groundwater impacted by tetrachloroethylene (PCE) and TCE plumes. LHAAP-35B(37) is the subject of the bioplug demonstration study briefed earlier in the meeting by TMD Technologies Group.

If the bioplug approach does not reduce contaminants to acceptable levels, the aquifer will be allowed to return to natural conditions and AECOM will begin the approved remedy using monitored natural attenuation. New wells have recently been installed, so the approved monitored natural attenuation remedy is ready for implementation if the bioplug activity is not successful.

LHAAP-50 Former Sump Water Tank – Remedy In Place

LHAAP-50 was the site of a large above-ground water tank that received sump water from across the plant. Issues at the site are perchlorate in soil, and perchlorate and VOCs in groundwater.

Two areas of perchlorate-impacted soil were recently excavated and removed (approximately 183 cubic yards), and disposed at an off-site landfill. Mr. Wacker showed several photographs of the excavation work that had been performed, including photos demonstrating the depth of the excavation and silt fencing installed between the excavation site and the nearby Goose Prairie Creek.

Confirmation samples were taken to establish that all perchlorate-impacted soils exceeding the clean-up goals had been removed, and the area was backfilled with clean soil. The confirmation sampling layout showing samples collected from the floor and sidewalls of the excavation was presented and explained.

To address groundwater 19 new monitoring wells were installed to support implementation of the approved monitored natural attenuation remedy.

LHAAP-58 Shops Area – Remedy In Place

Multiple plant activities were completed in this area and could have contributed to contamination at the site. VOC impacts to groundwater is the issue at the site. There are two groundwater plumes; "eastern plume" and "western plume", each with their own remediation strategy.

In the heart of the east plume, where concentrations are on the order of a few thousand micrograms per liter, In-Situ Bioremediation (ISB) is being completed to more aggressively treat those higher concentration impacts. Approximately 225 gallons of Wil-Clear Plus, a sodium lactate nutrient for microbes that will degrade VOCs, was injected at each of 12 injection points in the east plume over a month ago. Nutrient was injected at depths of between 23 and 33 feet bgs. Mr. Wacker presented and explained photographs of the injection event activities. The type of microbes required to degrade the contaminants were not present at the site as confirmed by a treatability study completed several months ago by the Army, so bioaugmentation was performed this week to add the required microbes. Approximately one gallon of augmentation solution was injected at each of the locations. The next sampling event will be in January and will collect data to monitor progress of the ISB activities.

Fifteen new groundwater monitoring wells were installed this summer at LHAAP-58 to allow implementation of the monitored natural attenuation remedy for both the eastern and western plumes.

LHAAP-03 – Record of Decision In Progress

LHAAP-03 is a small area within LHAAP-35A(58) associated with the former paint shop. The remedy consists of excavating an approximate 20-feet by 25-feet area (~50 cubic yards) of shallow soil that is impacted with arsenic and lead, for landfill disposal. This will result in two or three truckloads of soil being transported. Any groundwater issues associated with LHAAP-03 will be dealt with as part of LHAAP-35A(58) which fully-encompasses LHAAP-03. Army has received TCEQ's comments on the Record of Decision, and is awaiting EPA's comments.

LHAAP-12 and LHAAP-16 – Remedy In Place (Operation and Maintenance)
Continuing operation and maintenance activities have been performed at these landfill sites. Repainting and relabeling of wells has been a recent focus to improve visibility.

CERCLA 5-Year Review Process for Multiple Sites
The 5-Year review has been performed and the report document is being reviewed by the agencies. The review includes LHAAP-12 and LHAAP-16 which are landfill sites with remedies in place, LHAAP-18/24 associated with the GWTP, the Pistol Range and LHAAP-49 Acid Storage Area.

GWTP
The GWTP continues to operate to contain the groundwater plumes at LHAAP-18/24 and LHAAP-16. See attached AECOM PowerPoint Presentation for more detail where a groundwater extraction data chart and contaminant mass was presented. There has been no flow in Harrison Bayou lately to facilitate discharge of treated water, so treated water has been applied to the ground surface of LHAAP-18/24 through the sprinkler system. The next semi-annual compliance monitoring event for LHAAP-18/24 will be conducted at the end of the month. Preventive maintenance and repairs continue. Quarterly extraction rates are on par with what has been extracted historically.

Perimeter Well Sampling
Perchlorate sampling is conducted for groundwater at several locations along the perimeter of the former facility footprint. A table showing perchlorate results for perimeter wells was presented and included in the hard copy slide packet available at the meeting. Mr. Wacker noted that five of the six designated perimeter wells were dry during the June 2013 event. These wells show a history of being dry depending upon site weather conditions.

Surface Water Sampling
Mr. Wacker explained a handout showing results of surface water sampling for perchlorate in Goose Prairie Creek and Harrison Bayou. The chart indicates very little perchlorate detected in surface water for the past few years.

Upcoming Work, Meetings and Documents
Remedial Action Operations will continue at LHAAP-46, LHAAP-50, LHAAP-58 and LHAAP-67. Semi-annual compliance sampling will be conducted at LHAAP-18/24. Finalization of the CERCLA 5-Year Review report and generation of draft Remedial Action Completion reports for LHAAP-37, LHAAP-46, LHAAP-50, LHAAP-58 and LHAAP-67 is ongoing.

Other Environmental Restoration Issues – Rose Zeiler

Dispute Resolution
Resolution of the ongoing dispute between USEPA and Army regarding clean-up goals continues. While no specific information is available on details of dispute resolution, Ms. Zeiler explained the impacts of the dispute on the remediation work.

LHAAP-16, LHAAP-17, LHAAP-001-R-01, and LHAAP-003-R-01 were on the original list of disputed RODs and progress on those sites stopped in September 2011 when the dispute was initiated. Progress on LHAAP-29 was halted shortly after the dispute was initiated, when it reached the draft final ROD stage. Draft final RODs have been generated for LHAAP-04 and LHAAP-47, but final RODs could not be achieved due to the dispute.

Ms. Zeiler stated that she would bring any new information relating to resolution of the dispute to the RAB as soon as she receives it. She advised the RAB that there are dispute issues on the table that could cause Army to have to go back and do more work on these sites (even those sites that have already been "closed").

Mr Fortune asked if USEPA was telling Army that the sites haven't been cleaned up correctly. Mr. Mayer stated that there is a disagreement on cleanup level that should be used for certain contaminants. Another part of the issue relates to what land use controls must consist of to protect residents if contamination is left at the site.

Ms. Palmie added that there are promulgated federal clean-up standards for most contaminants, but there is not a federal clean-up standard for perchlorate. Where a federal standard does not exist, state standards are usually used when available. The Texas perchlorate clean-up goals have been historically used at Longhorn, but USEPA now feels that a lower "health advisory level" should be used instead, so the crux of the dispute is whether we continue to use the Texas clean-up goal or start to use a lower concentration goal as USEPA wants to do.

Ms. Zeiler stated that Army can only agree to clean-up standards that have actually been made into legal standards by either state or Federal law, and the health advisory level USEPA wants to use is not a legal standard. Further, when the Federal Facility Agreement was signed, USEPA, TCEQ and Army agreed that the Army was grandfathered into the original Texas Risk Reduction Rules and would conduct all remediation work at LHAAP in accordance with those standards. Therefore, all the sampling and investigation that has been done at LHAAP has been done using those clean-up levels.

Mr. Fortune asked who in USEPA made this decision to dispute Longhorn's contaminant clean up goals. Mr. Mayer stated that USEPA now has a policy that all Superfund sites where groundwater could be used for residential use would be cleaned up to residential standards. Mr. Mayer is hopeful a decision will be made within the next three or four months.

Community Involvement Plan / Community Relations Plan
Comments from the RAB Technical Assistance Grant (TAG) holder, CLI, were reviewed and discussed by Ms. Zeiler.

- CLI's comment regarding placing all Administrative Record documents on a searchable website open to the general public (in addition to the Marshall Public Library repository) is being addressed. Although Army is not required to provide internet accessibility to the data to the general public, they have been working toward a website for some time. USAEC has agreed to fund the current contractor (AECOM) to develop a website. The site should be available about 6-8 weeks from when AECOM is authorized to proceed with development of the website.

- CLI suggested that criteria for determining whether the Community Relations Plan has met its objectives should be developed. Army believes that the best and most direct method for making this determining is through feedback through periodic questionnaires. Questionnaires allow open communication where suggestions for changes or improvements can be made directly.
- CLI suggested that the public be provided the opportunity to make formal comments on a variety of technical documents throughout the CERCLA remedy selection process, and specifically during the Remedial Design phase. Ms. Zeiler states that Army follows CERCLA regulation with respect to public comment, through the Proposed Plan public review process. While the Proposed Plan document itself does not provide all technical remedy selection details, it refers the reader to the documents used in the decision-making process leading to the Proposed Plan. Comments, including technical comments, received from the public during the Proposed Plan public comment period are addressed prior to the ROD. For example, Mr. Wacker cited two rounds of groundwater thallium sampling conducted at twenty wells as part of the remedial action at LHAAP-46, which was included in response to public comments on the ROD for LHAAP-46. Ms. Zeiler also stated that the RAB would be updated throughout the Remedial Design phase for upcoming sites and was welcome to provide comments in or after meeting updates.
- Population density information in the Community Relations Plan was questioned by CLI. Ms. Zeiler stated that the information in the plan was taken from the latest census data at the time it was being written.

Ms. Zeiler asked for any additional questions on these responses. Receiving no additional comments from either the RAB or Mr. Lowerre, CLI, Ms. Zeiler stated the Community Relations Plan would be finalized after the RAB meeting.

Look Ahead at the Schedule
Next RAB meeting is tentatively scheduled for February 20th from 6PM – 7:30PM at the Karnack Community Center.

A motion to adjourn was made by Mr. Fortune and seconded by Mr. Lambright.

Adjourn

November Meeting Attachments and Handouts:
- *Meeting Agenda*
- *Minutes from July 2013 RAB meeting*
- *AECOM Powerpoint Presentation*
- *GWTP Treated Groundwater Volumes Handout*
- *Surface Water Sampling Results Handout*
- *LHAAP-37 Bioplug Demonstration Study Presentation*

Acronymns

AECOM	AECOM Technical Services, Inc.
AST	above-ground storage tank
BRAC	Base Realignment and Closure
CERCLA	Comprehensive, Environmental Response, Compensation, and Liability Act
CLI	Caddo Lake Institute
DERP	Defense Environment Response Program
GWTP	Groundwater Treatment Plant
ISB	In-Situ Bioremediation
LHAAP	Longhorn Army Ammunition Plant
MNA	Monitored Natural Attenuation
PCE	tetrachloroethylene
RAB	Restoration Advisory Board
ROD	Record of Decision
TAG	Technical Assistance Grant
TCE	trichloroethene
TCEQ	Texas Commission on Environmental Quality
TSDH	Texas State Department of Health
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
WSC	Water Supply Corporation

Longhorn Army Ammunition Plant Restoration Advisory Board Meeting February 20, 2014

AECOM Environment

Agenda

06:00 Welcome and Introduction

06:05 Open items {RMZ}
- RAB Administrative Issues
- Minutes
- Tour of Longhorn Sites Planned for May
- Website
- Installation Action Plan

06:15 Defense Environmental Restoration Program (DERP) Update {AECOM}
- Fieldwork completed and upcoming field activities planned
- Groundwater Treatment Plant (GWTP) Update
- Environmental Update for Active Sites (progress since last meeting)

06:50 Other Environmental Restoration Issues {RMZ}
- Sitewide LUC Management Plan Update
- Bioplug Demonstration at LHAAP-37
- Dispute Status Update
- Schedule

07:00 Presentations:
- Dense Non-Aqueous Phase Liquids (DNAPLs)

07:30 Adjourn {RMZ}

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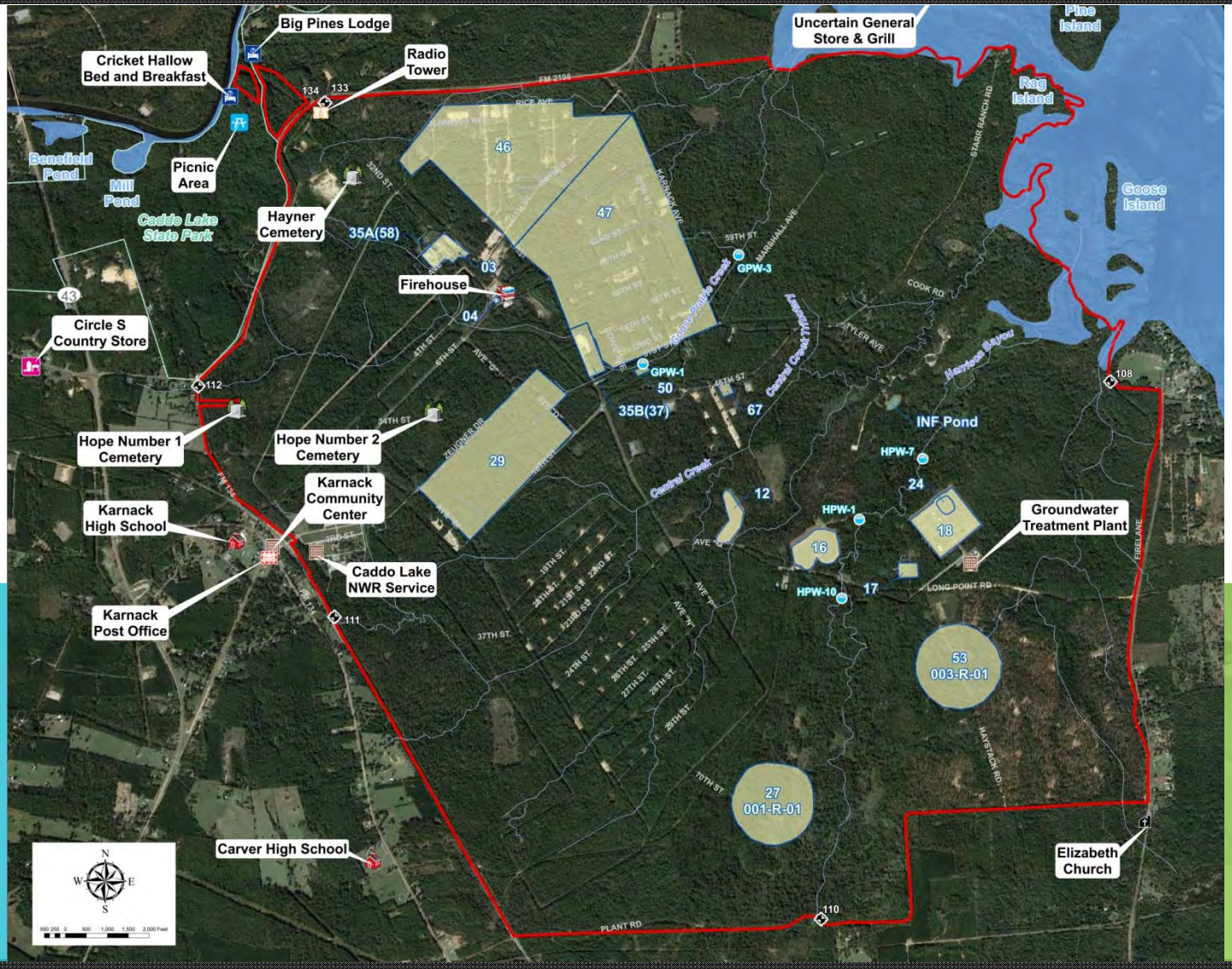
Longhorn Map



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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

RAB Administrative Issues

- Minutes
- Installation Action Plan
- RAB Tour - Planned to coincide with May RAB – Discuss Schedule and Planned Destinations
- Planned Destinations:
  - Groundwater Treatment Plant (LHAAP-18/24)
  - Landfills 12 and 16
  - LHAAP-29
  - LHAAP-03
  - LHAAP-50
  - LHAAP-37
  - LHAAP-58
- Any Other Specific Areas of Interest?

LHAAP Restoration Website

http://www.longhornaap.com

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LHAAP Restoration Website (cont)

- Created to present the project to the Public and allow for easy access to information and communication between the Army and the Public.
- Contains an overview of LHAAP, individual sites, contamination plume maps, documents, RAB meeting minutes, and Administrative Record.
- Lets you keep up with current LHAAP events and upcoming RAB meetings.

Dense Non-Aqueous Phase Liquid (DNAPL)

- Dense Non-Aqueous Phase Liquids are present at LHAAP-29 and LHAAP-18/24
  - Typically chlorinated hydrocarbons, such as trichloroethylene (TCE) and Methylene Chloride (MC)
  - Compounds with densities greater than water or specific gravity greater than 1
  - These compounds ‘sink’ until they reach an confined unit (aquitard) then spread via preferential pathways along the aquitard (which may be opposite of groundwater flow direction)
- Present in two locations in shallow groundwater at LHAAP-18/24 and one location at LHAAP-29, all three of these locations are proposed for further work to delineate the extent of DNAPL this spring

DNAPL (cont)

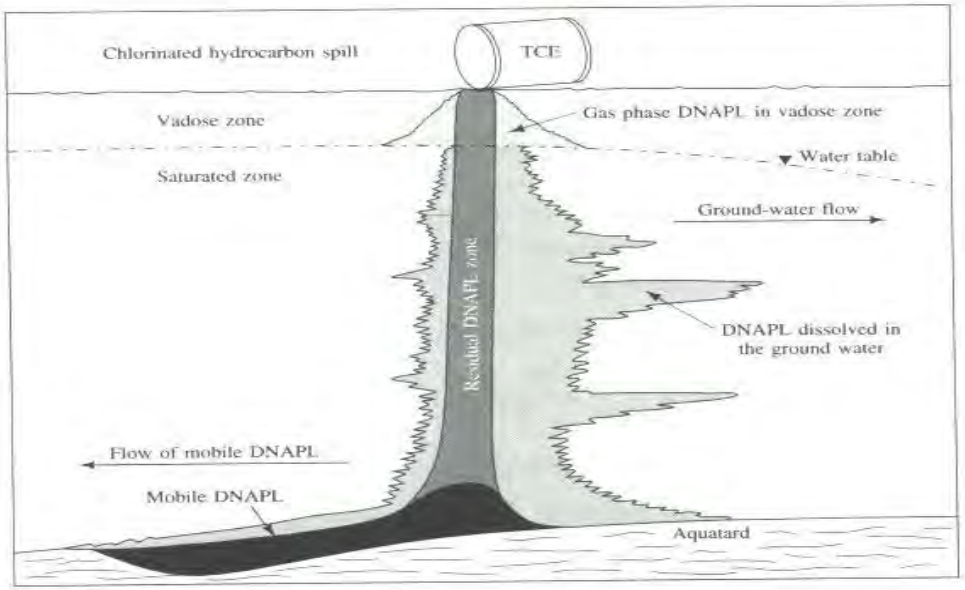

FIGURE 5.28 Distribution of a dense nonaqueous phase liquid in the vadose and saturated zone.

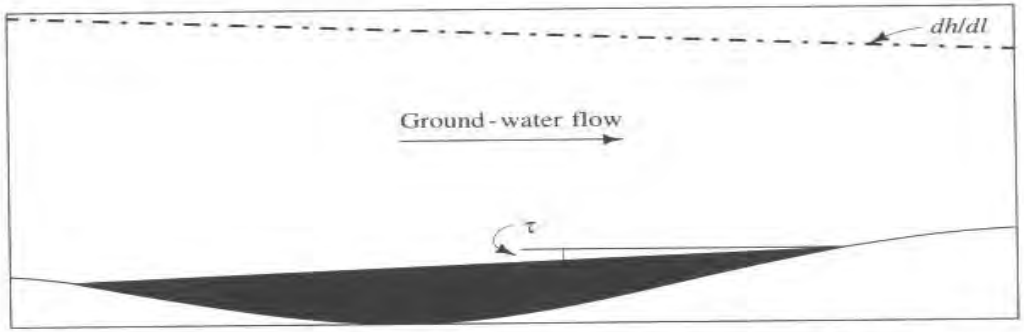

FIGURE 5.29 Sloping interface between a static layer of DNAPL and flowing ground water.

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DNAPL (cont)

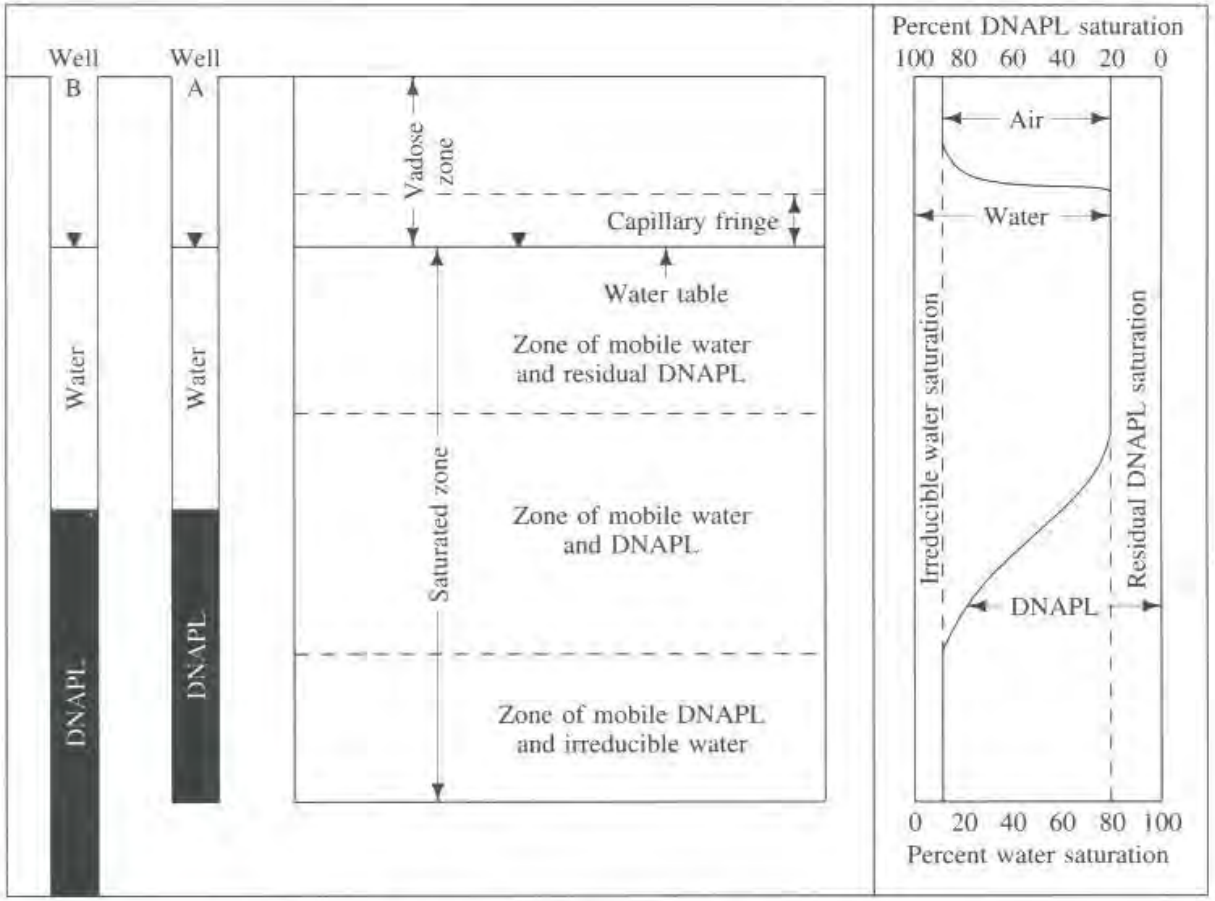

FIGURE 5.26 Zones of a DNAPL and the relationship of mobile DNAPL and nonmobile DNAPL to the DNAPL saturation; relationship of mobile DNAPL thickness to thickness of DNAPL is measured in a monitoring well.

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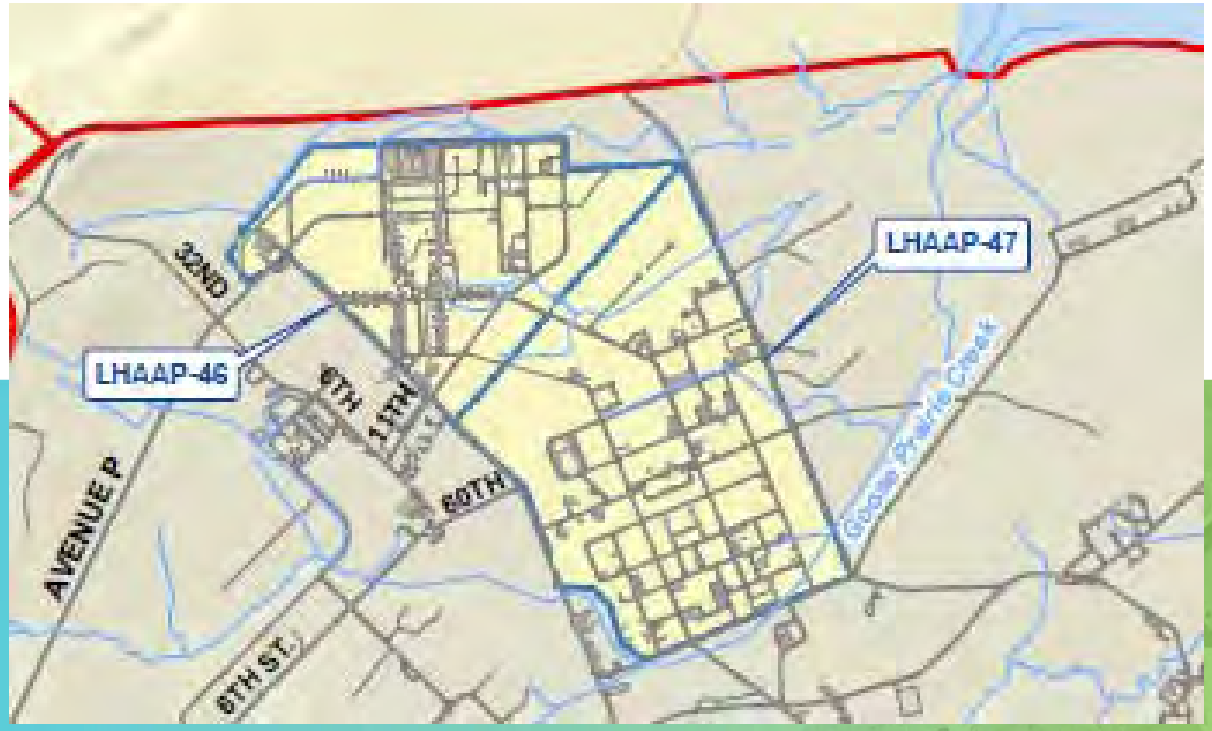
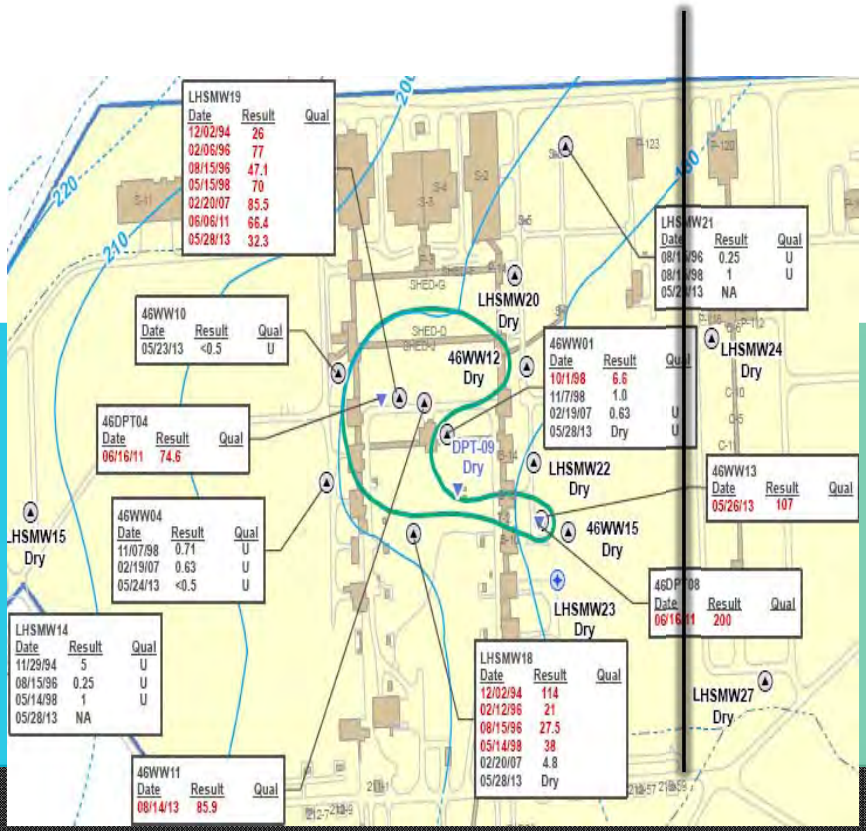
Status of Environmental Sites

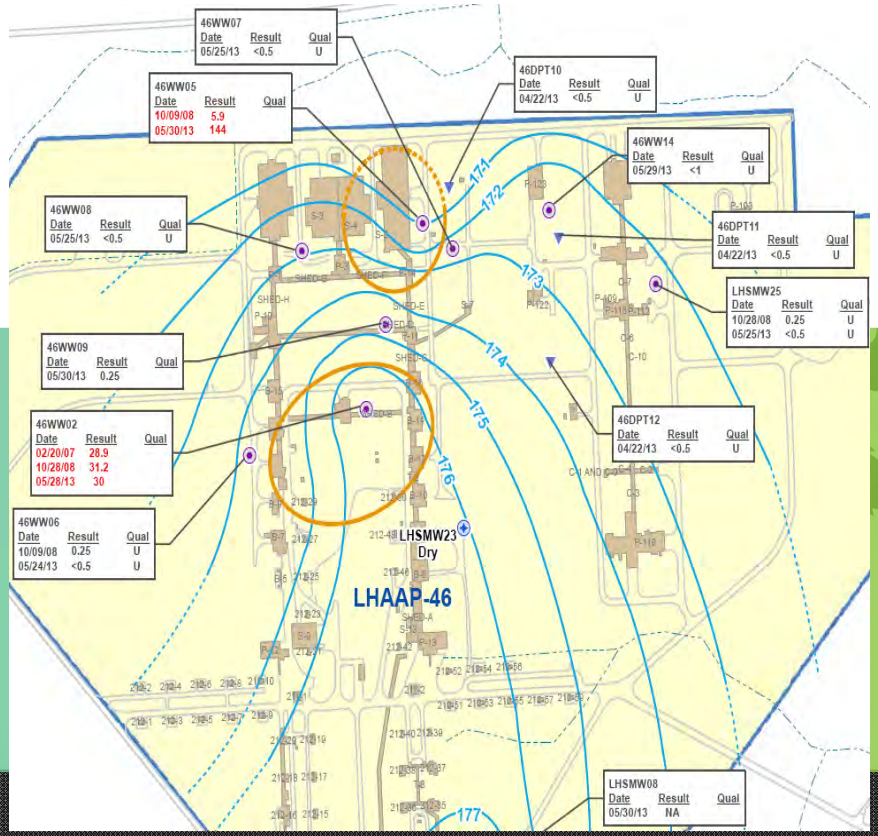
– LHAAP-46 – Plant Area 2
  - Final Remedy: Monitored Natural Attenuation (MNA) and Land Use Controls (LUCs)
  - Contaminants of Concern: Volatile Organic Compounds (VOCs, primarily TCE)



Status of Environmental Sites (cont)

- LHAAP-46 – Plant Area 2
  - TCE plumes below. Completion Report in Progress.
  - Three rounds of quarterly sampling for TCE completed, an annual report will be available in ~August documenting the first 4 quarters of sampling
  - Shallow on left, intermediate on right



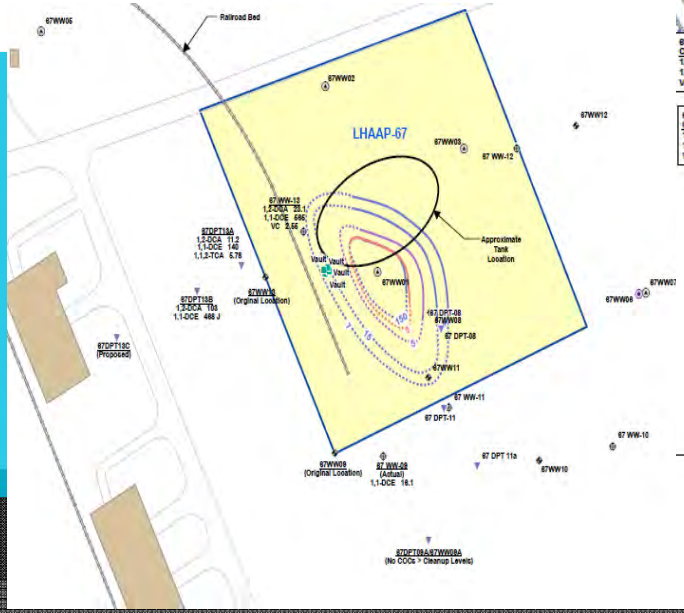


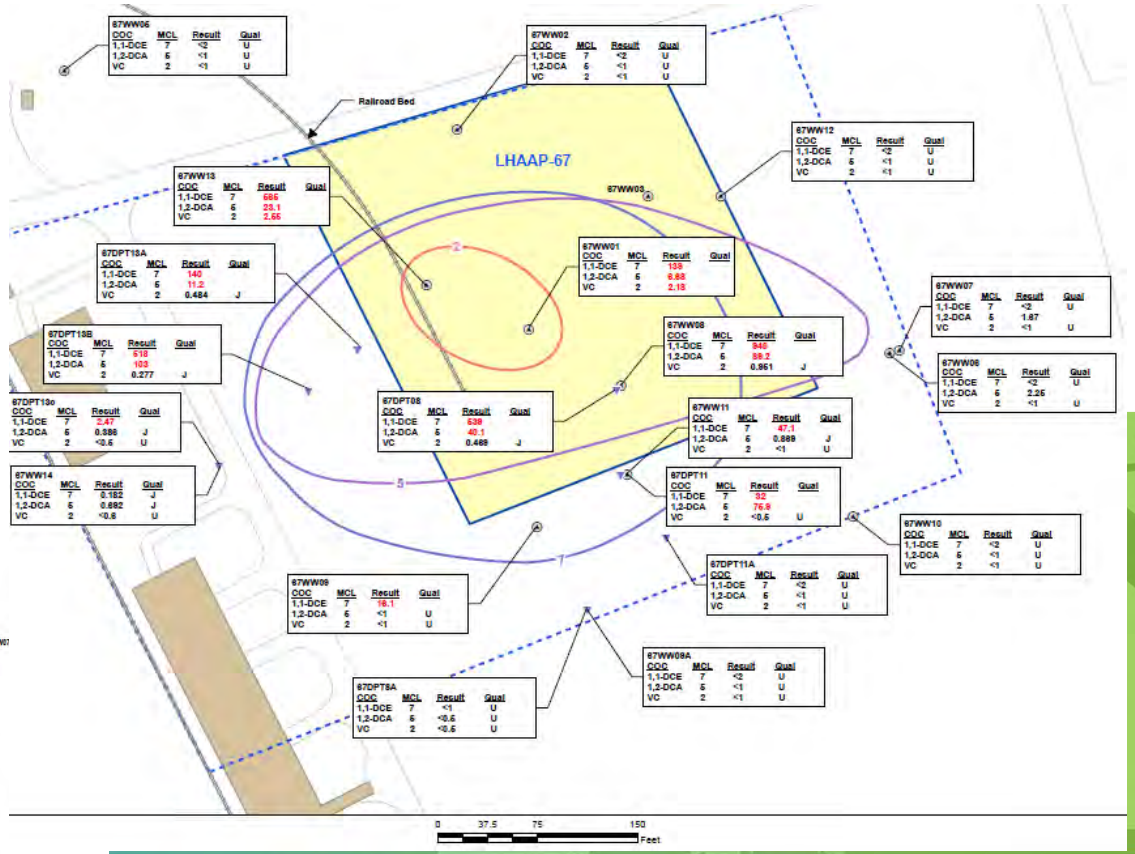
Status of Environmental Sites (cont)

– LHAAP-67 – Aboveground Storage Tank Farm
  - Final remedy: MNA, LUC
  - Contaminants of Concern: VOCs, Contaminants are confined to the upper shallow groundwater zone
  - Three rounds of quarterly sampling for TCE completed, an annual report will be available in ~August documenting the first 4 quarters of sampling

Status of Environmental Sites (cont)

- LHAAP-67 – Aboveground Storage Tank Farm
  - Changes in plume understanding with new data, former boundary map on left, current on right :



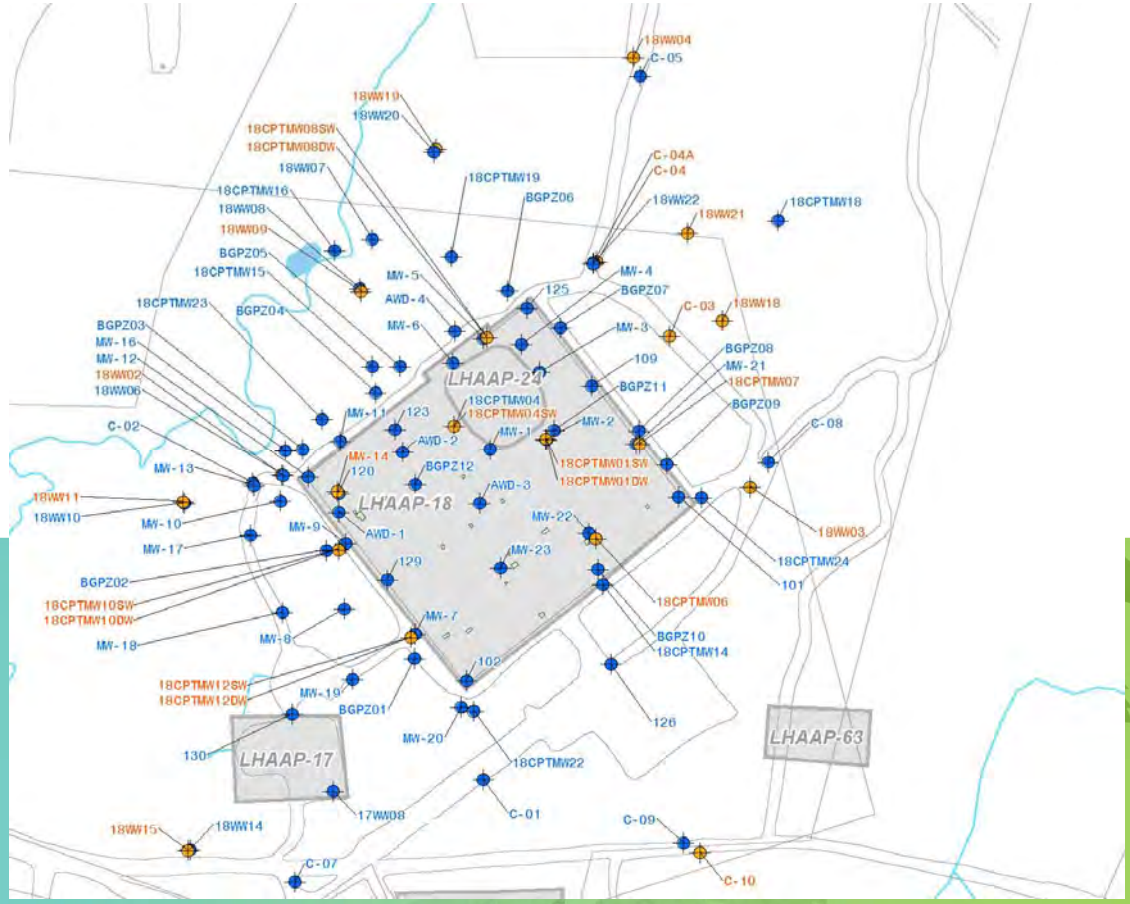


Status of Environmental Sites (cont)

– LHAAP-18/24 – Burning Grounds #3 and Unlined Evaporation Pond
  - Interim remedy: Continuous extraction and treatment of groundwater from collection trenches surrounding and within the site (green in image below)
  - Contaminants of concern: Perchlorate, VOCs (TCE, MC), Metals

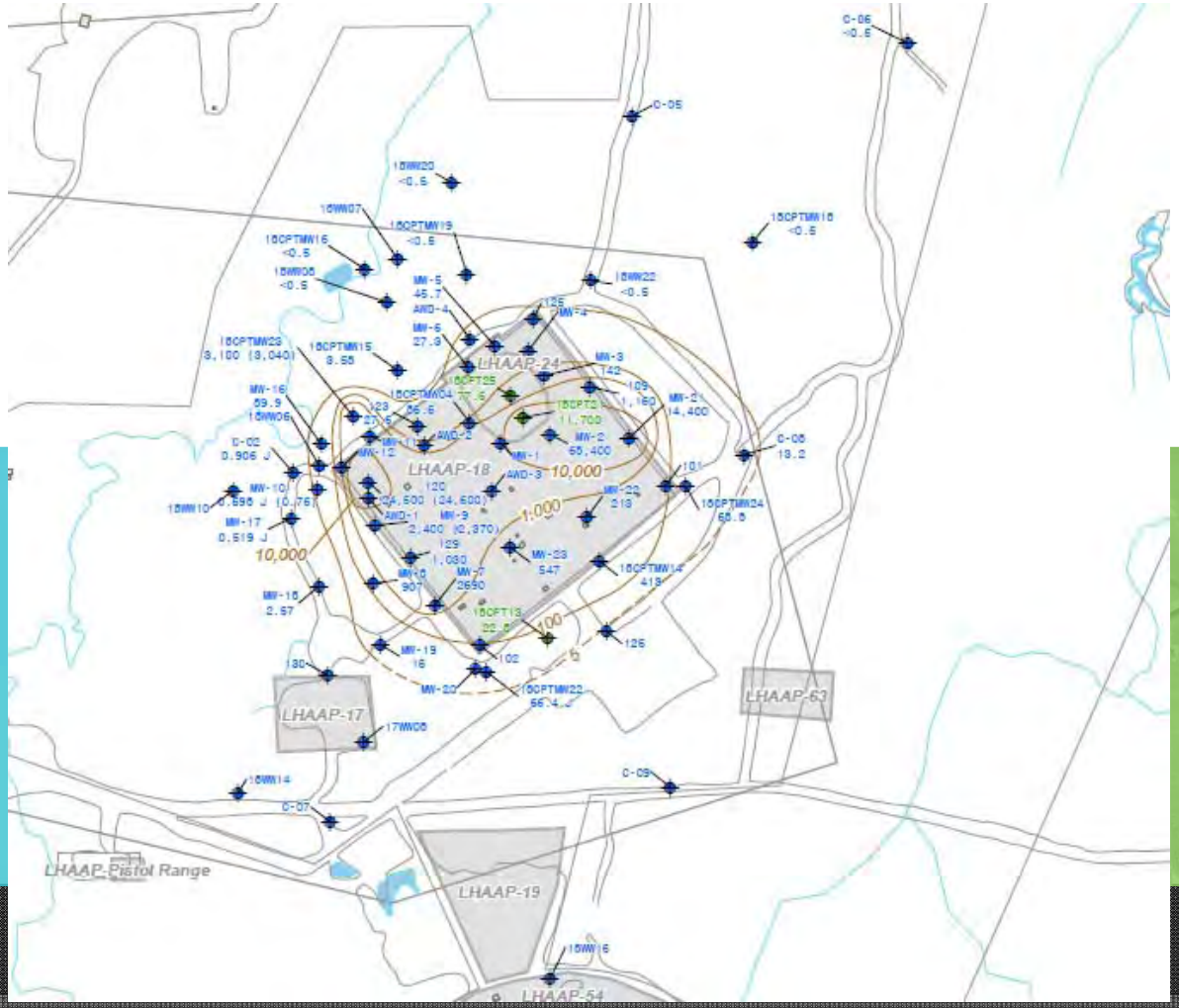
Status of Environmental Sites (cont)

– LHAAP-18/24
  - Revised Feasibility Study in-progress
  - Addenda to Current Work Plan under review to collect additional data based upon DNAPL and additional source material found from field activities completed six months ago.



Status of Environmental Sites (cont)

– LHAAP-18/24
  - DNAPL and Additional Source Material Locations



Status of Environmental Sites (cont)

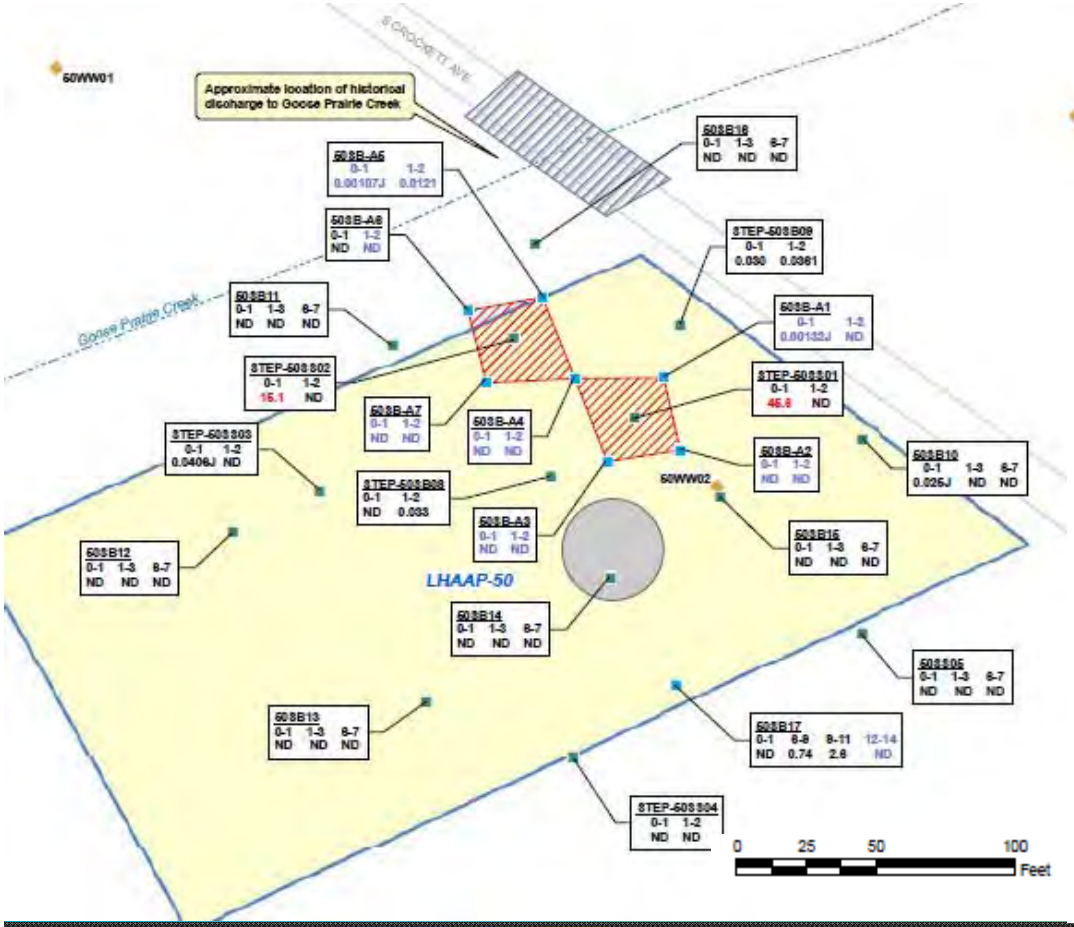
- LHAAP-35B (37) – Chemical Laboratory
  - Final remedy: Monitored Natural Attenuation and Land Use Controls
  - Contaminants of concern: VOCs (PCE and TCE)
    - Only present in the shallow groundwater zone
  - Bio-plug Study On-going Completion Report in progress

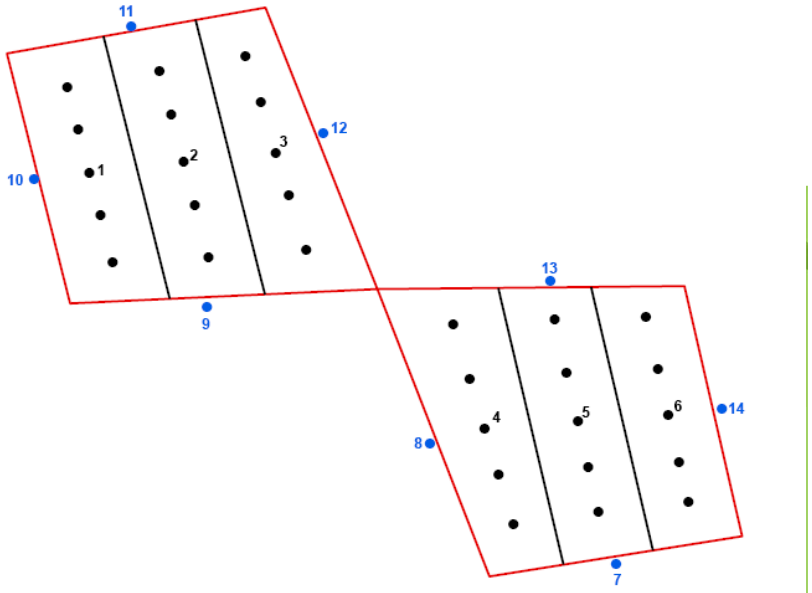
Status of Environmental Sites (cont)

– LHAAP-50 – Former Sump Water Tank
  - Final remedy: Soil excavation, Monitored Natural Attenuation and Land Use Controls for groundwater
  - Contaminants of concern: Perchlorate in soil, and Perchlorate and VOCs in groundwater

Status of Environmental Sites (cont)

– LHAAP-50 – See Photo Board for Excavation Photographs
  - Completion Report in Progress, quarterly sampling underway two rounds completed.





Status of Environmental Sites (cont)

- LHAAP-58 – Shops Area
  - Final remedy:
    - Eastern Plume: In-situ Bioremediation, MNA, LUCs
    - Western Plume: MNA, LUCs
  - Contaminants of concern: VOCs

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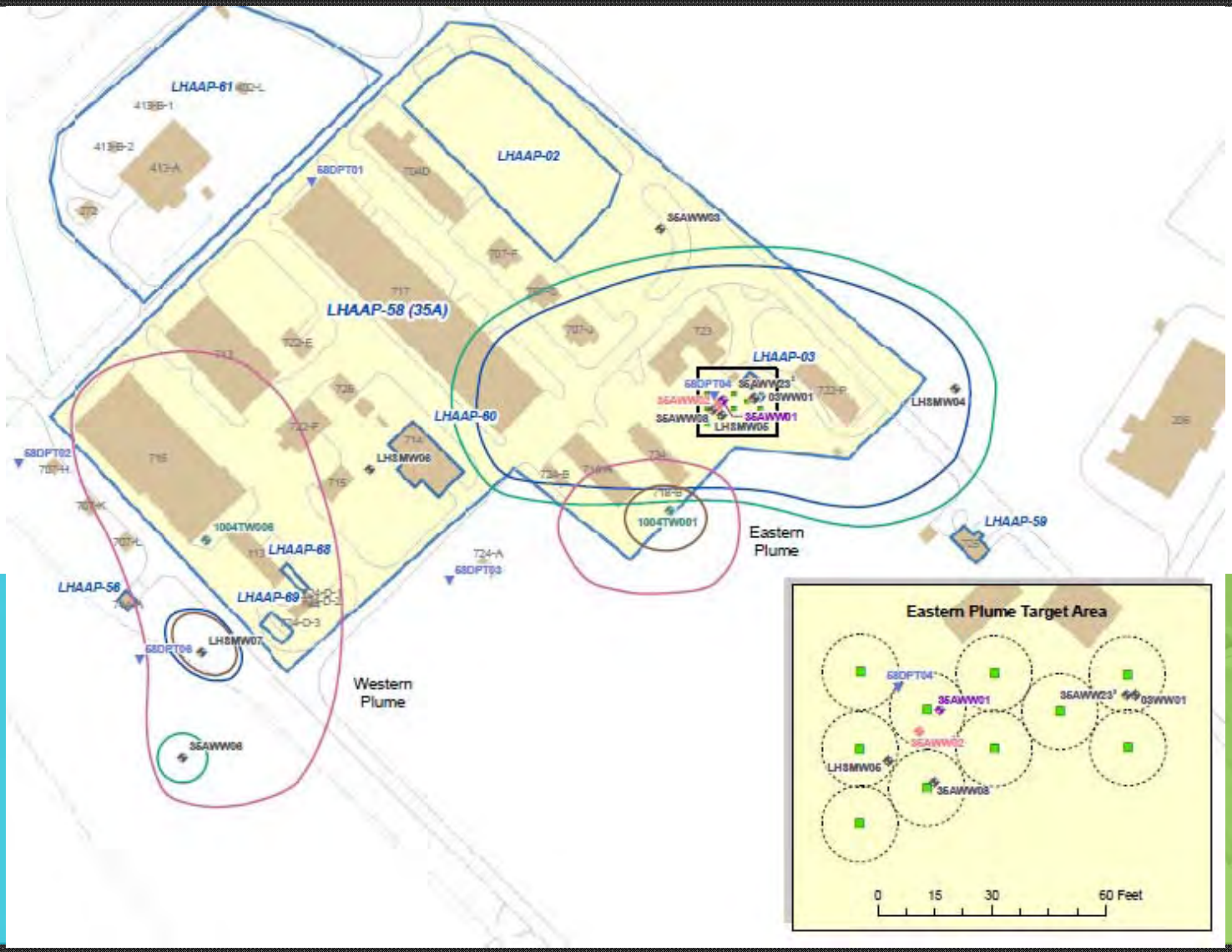
Status of Environmental Sites (cont)



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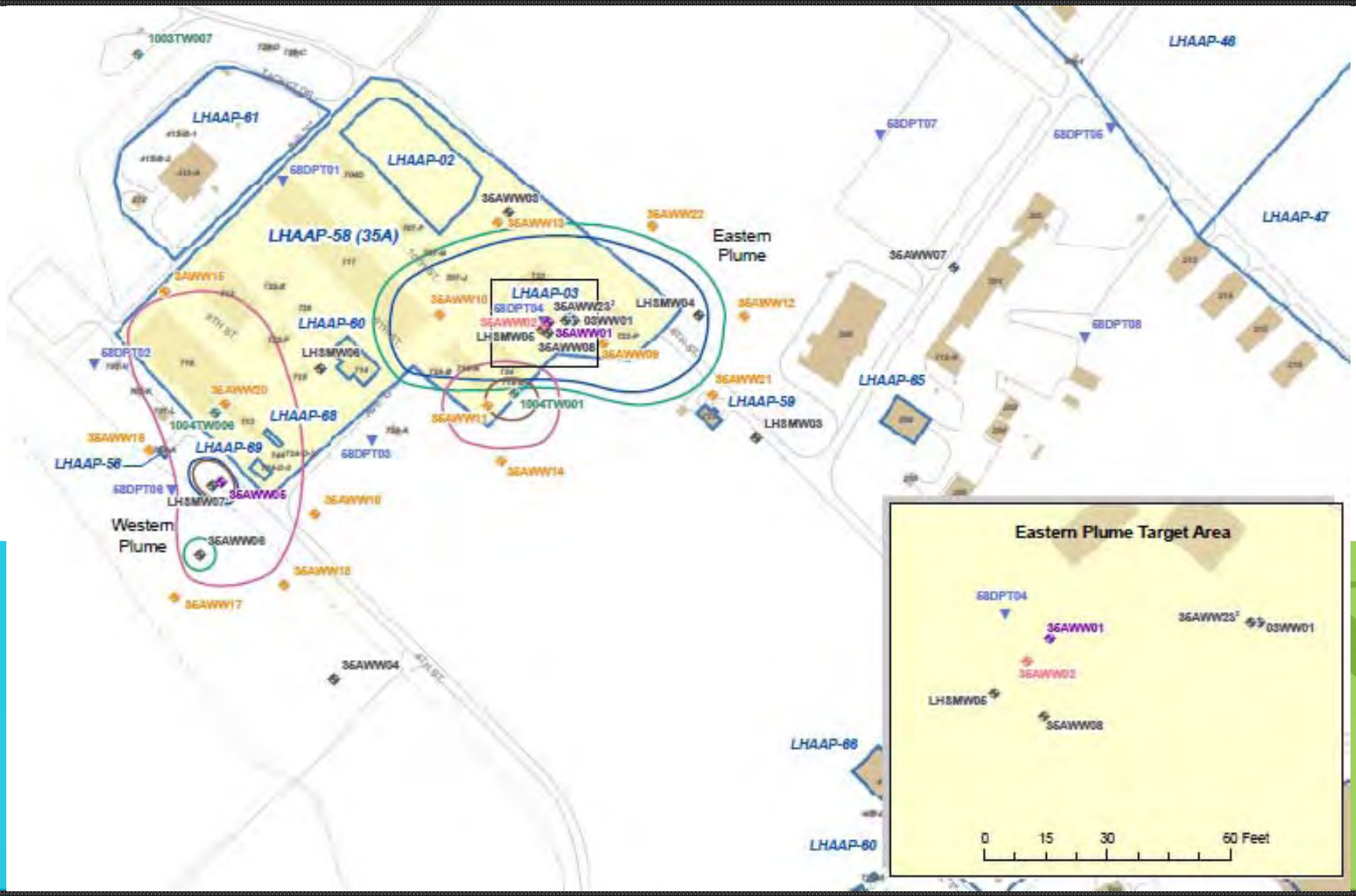
Status of Environmental Sites (cont)



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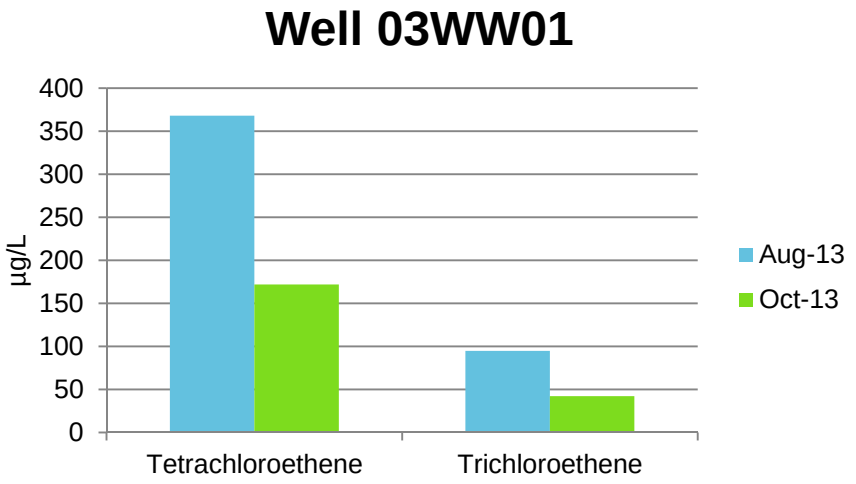
Status of Environmental Sites (cont)

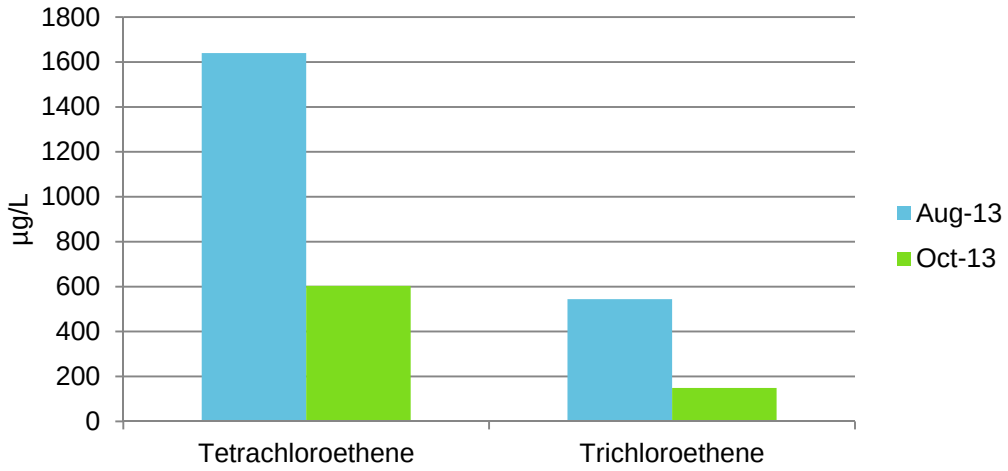
1. Comparison of Baseline to First Round Sampling Data After ISB at LHAAP-58

Monitoring Well	Tetrachloroethene (micrograms per liter)	Trichloroethene (micrograms per liter)
Well 03WW01		
Aug-13	368	94.8
Oct-13	172 J	42.1 J
Well 35AWW08		
Aug-13	1640	544
Oct-13	603 J	149 J
Well 35AWW09		
Aug-13	21.9	11.9
Oct-13	57.6 J	8.97 J
Well 35AWW10		
Aug-13	<0.5 U	<0.5 U
Oct-13	<0.5 U	<0.5 U

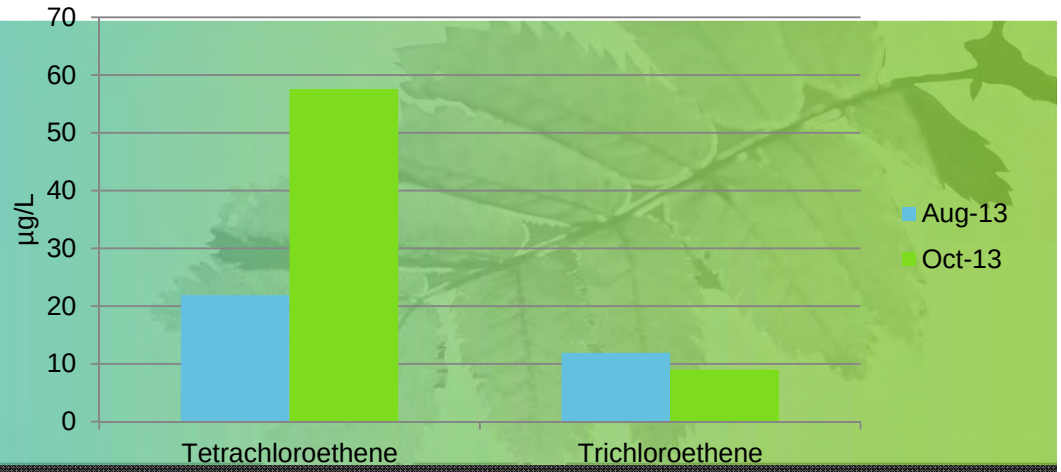


Status of Environmental Sites (cont)

Well 35AWW08



Well 35AWW09

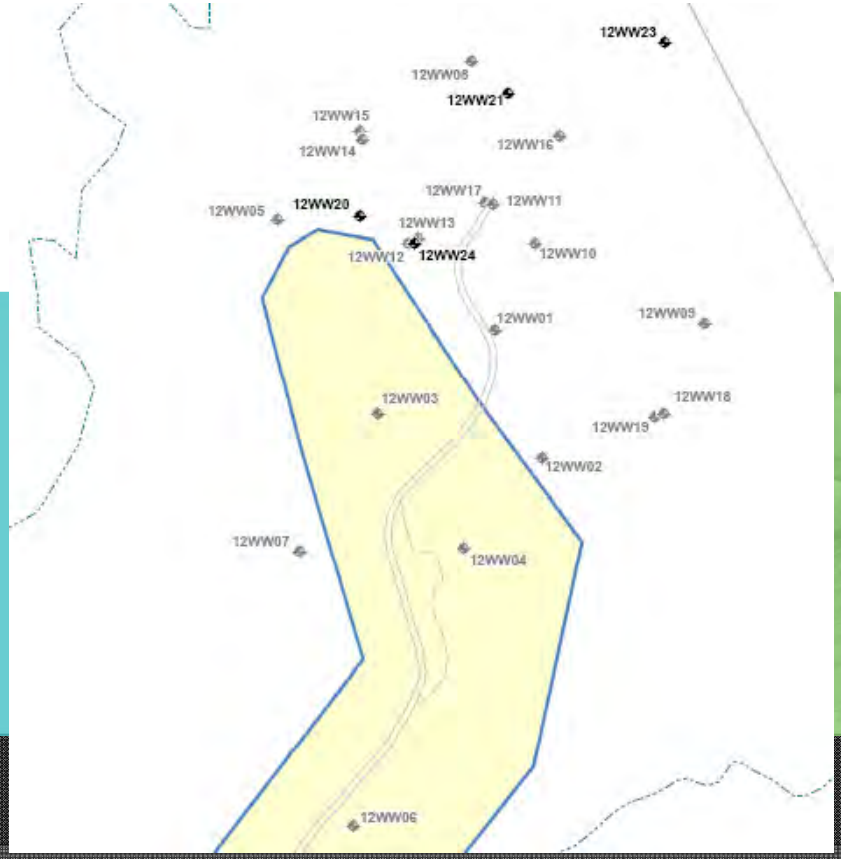


Status of Environmental Sites (cont)

- 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

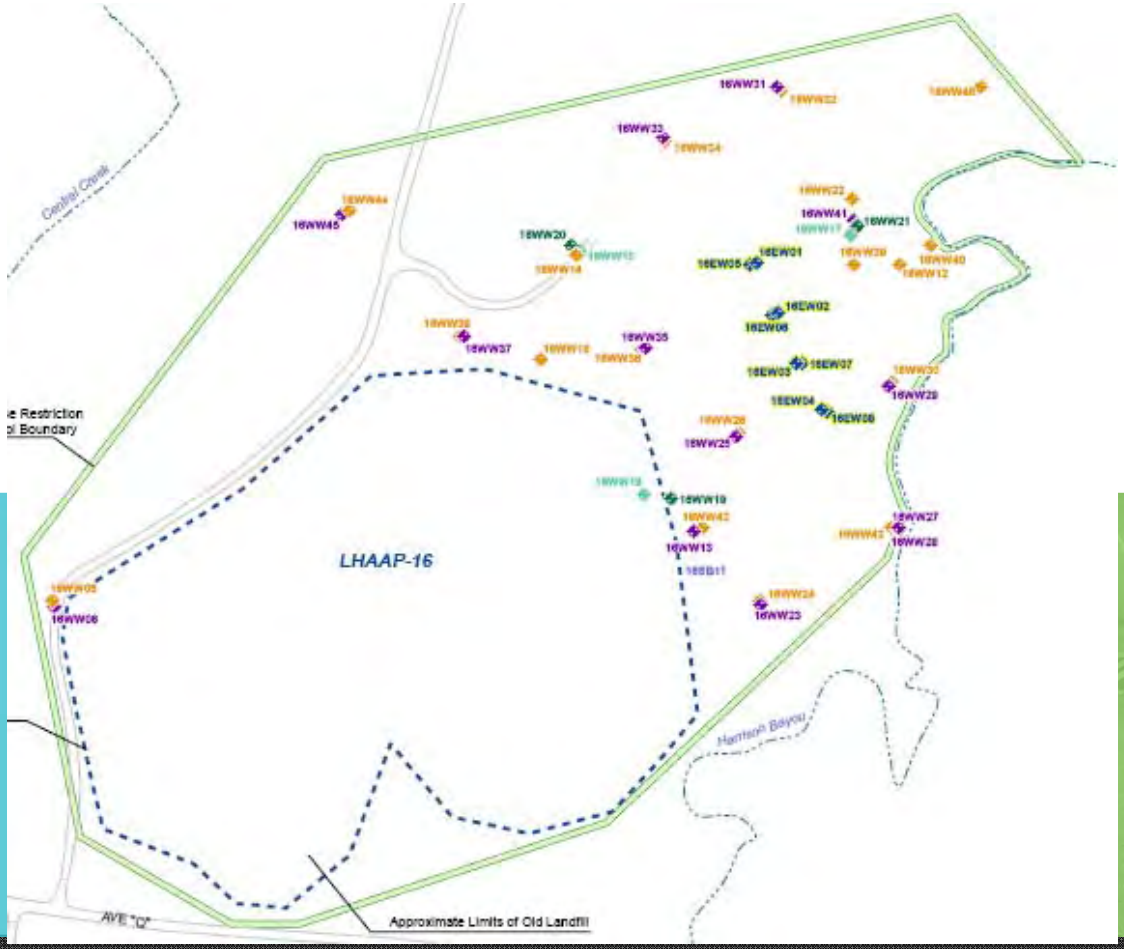
Status of Environmental Sites (cont)

– LHAAP-12 – Landfill 12
  - Completing Operations and Maintenance (mowing, signs, repairing sparse vegetation or subsidence areas)
  - Annual sampling completed in December
  - Evaluating MNA, potentially installing a new well within the plume area



Status of Environmental Sites (cont)

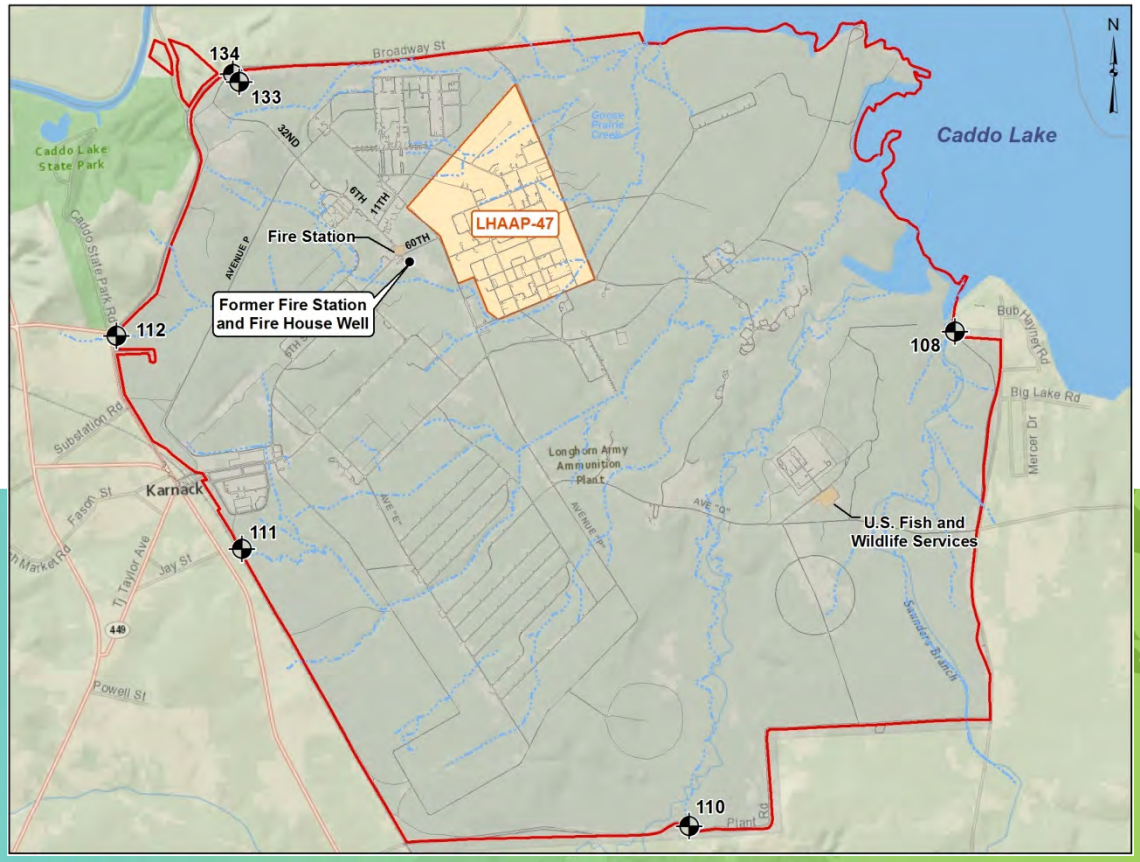
– LHAAP-16 – Landfill 16
  - Eight extraction wells sampled in February



Status of Environmental Sites (cont)

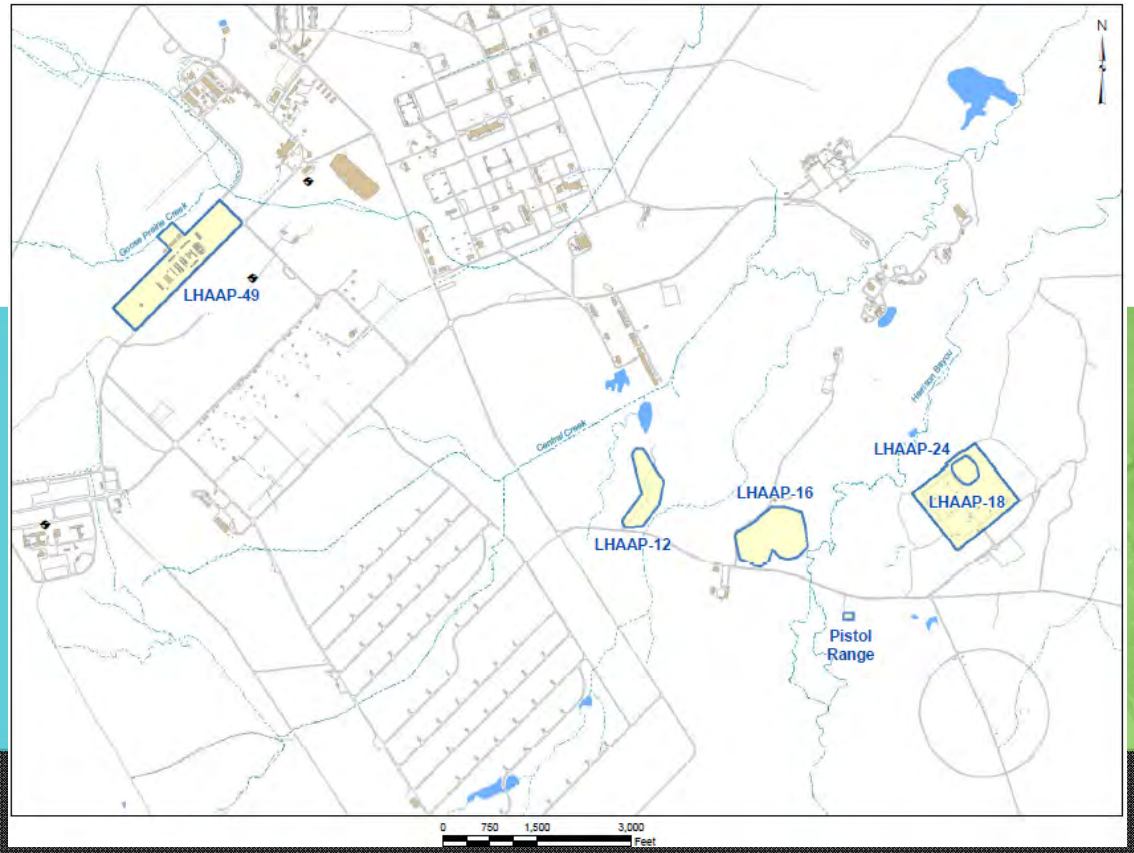
– Perimeter Wells

Well ID	Screen Depth (feet bgs)
108	5.5 - 20.5
110	5 - 20
111	5.4 - 20.4
112	5.25 - 20.25
133	64.5 - 84.5
134	90 -110

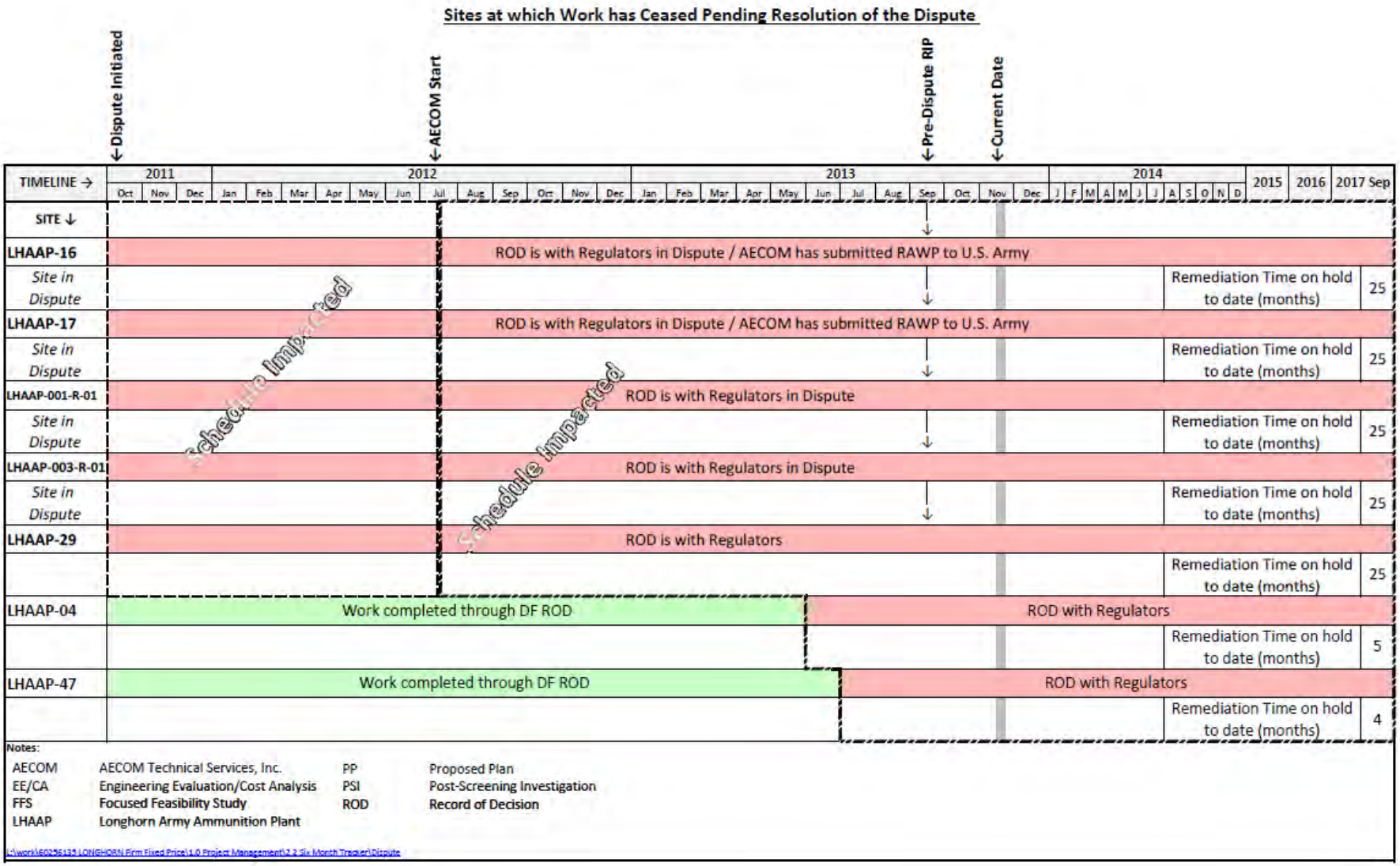


Status of Environmental Sites (cont)

- CERCLA Five-Year Review Process for Multiple Sites
  - Comment/Response to Comments on the Five-Year Review Report On-going
  - Review completed for LHAAP-12, LHAAP-16, LHAAP-18, LHAAP-24, LHAAP-49, and LHAAP-004-R-01



Dispute Status

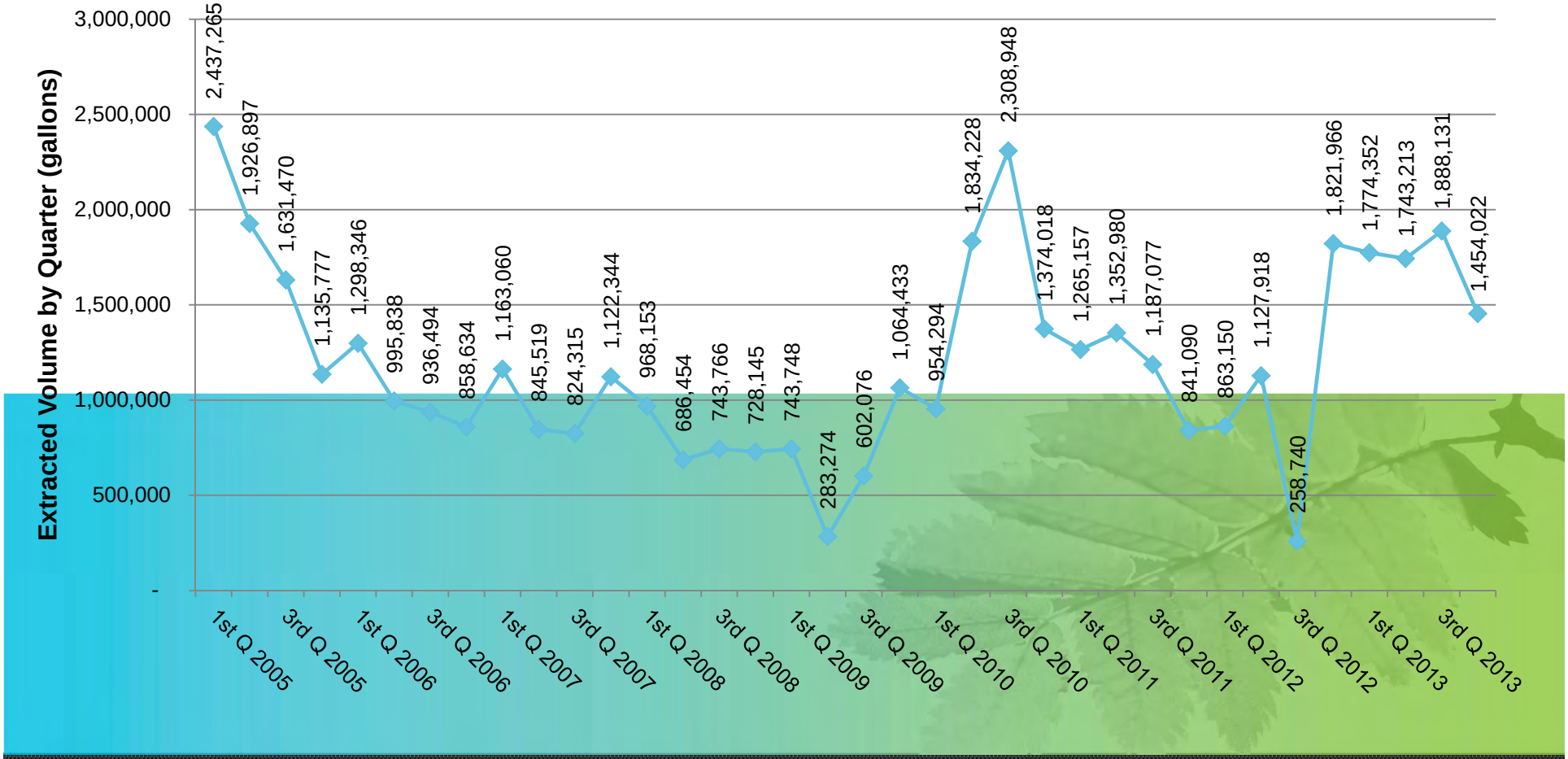


Groundwater Treatment Plant Operations and Management

- The Groundwater Treatment Plant continues to operate to contain the plume at LHAAP-18/24 and LHAAP-16.
- Water continues to be returned to LHAAP-18/24 or into Harrison Bayou, depending on the amount of water in the bayou.
- Compliance monitoring continues per existing sampling plan.
- Maintenance and repairs of wells, pumps, tanks, and ancillary equipment is on-going.

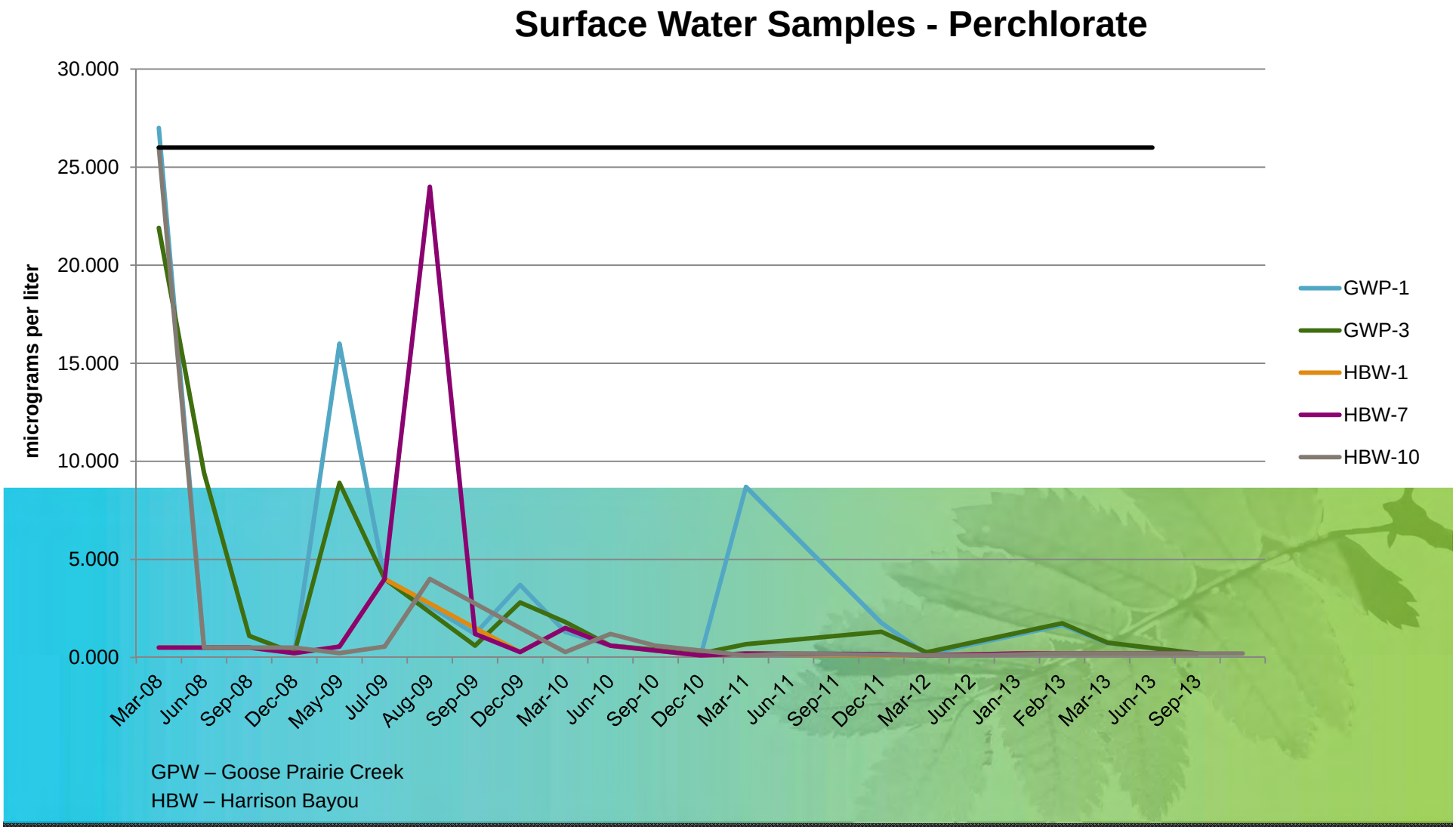
GWTP O&M (cont)

Quarterly Extraction Rate



AECOM

Surface Water Sample Results



AECOM

Upcoming Fieldwork, Meetings, and Documents

1. Continue quarterly groundwater sampling for recently completed monitoring networks at LHAAP-46, 50, 58, 67 in March, in addition to semi-annual compliance sampling at LHAAP-18/24 in May

2. CERCLA Five-Year Review: To be Signed in 2014

3. Final Completion Reports for LHAAP-37, 46, 50, 58, 67

4. LHAAP-18/24 and LHAAP-29 – Well Installation, Soil Sampling, Cone Penetrometer Testing/Membrane Interface Probe, Initial Treatability Testing

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

Bio Plug Study at LHAAP 35B (37)

– See separate slide presentation

Back-up Slides

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

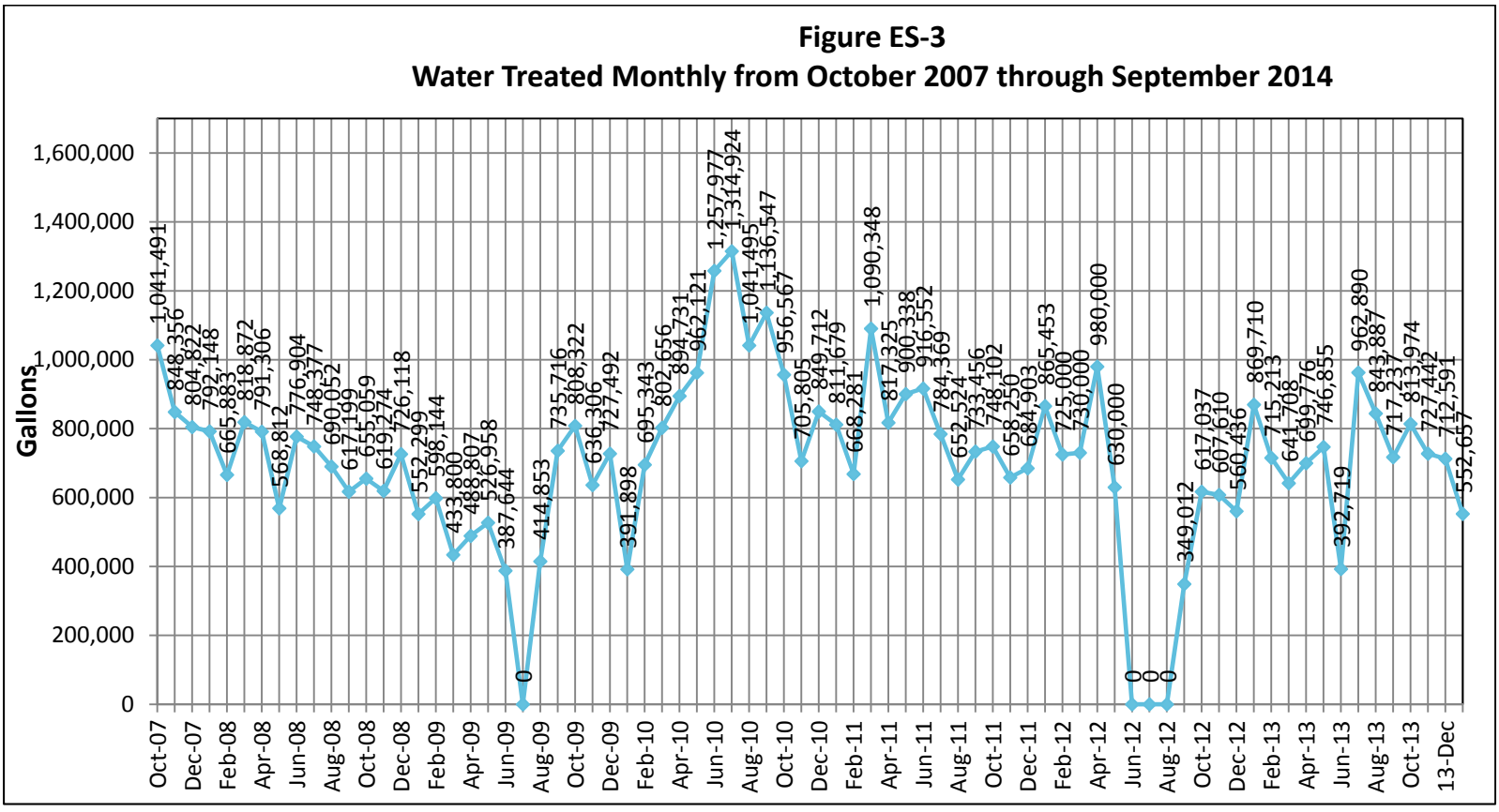
Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13
617,037	607,610	560,436	869,710	751,213	641,708	699,776	746,885	392,719	962,890	843,887	717,237

Oct-13	Nov-13	Dec-13	Jan-14
813,974	727,442	712,591	552,657

* Indicates estimate

Figure ES-3

Water Treated Monthly from October 2007 through September 2014

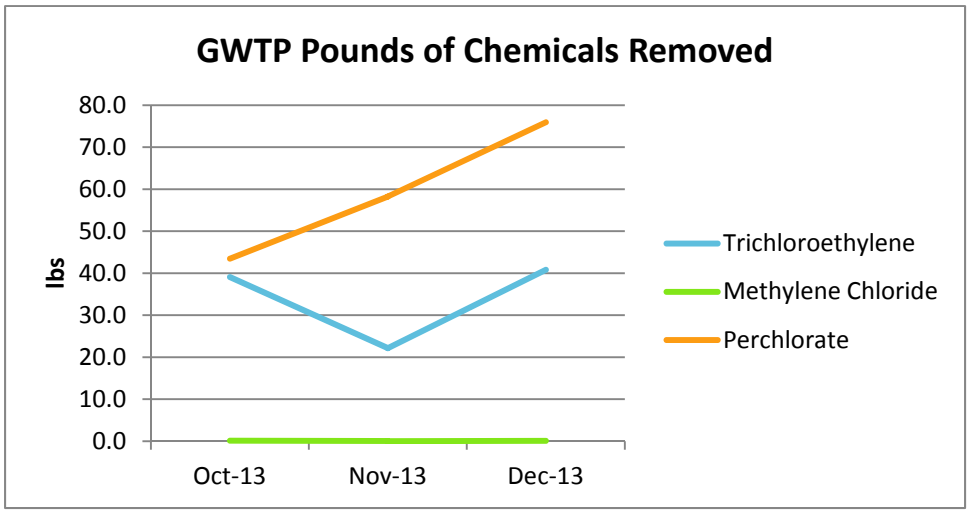


The pounds of chemicals removed for the 3rd Quarter of 2013 can be found below and are calculated by the following formula:

$$\frac{\text{(Concentration [µg/L] x Volume [gallons] x 3.785 [liters per gallon])}}{\text{(453,600,000 µg per pound)}}$$

Pounds of Chemicals Removed From LHAAP-18/24, 3rd Quarter 2013

	Trichloroethylene	Methylene Chloride	Perchlorate
Oct-13	39.1	0.11	43.5
Nov-13	22.2	0.03	58.3
Dec-13	40.8	0.11	76.0



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 they are dry.

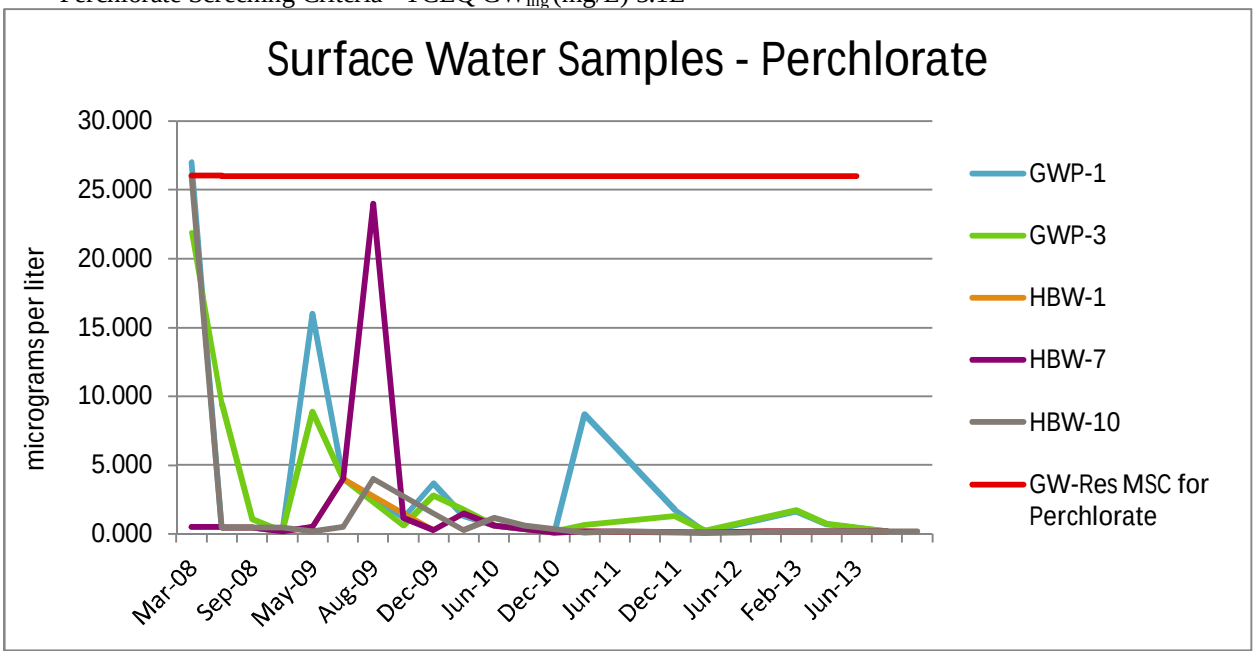
Historic Surface Water Sample Data
(in micrograms per liter)

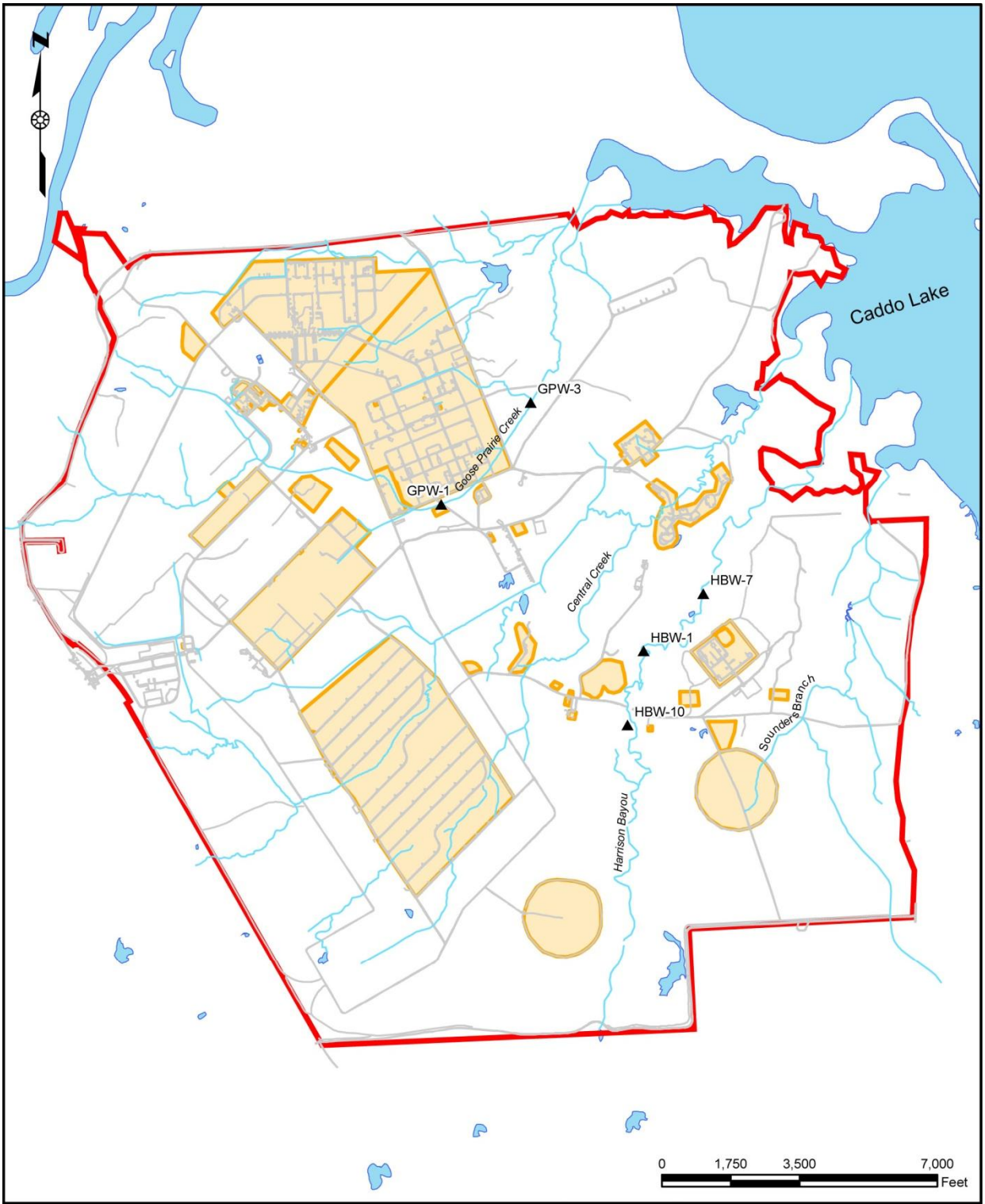
Creek Sample ID	Mar 2008	Jun 2008	Sep 2008	Dec 2008	May 2009	July 2009	Aug 2009	Sep 2009	Dec 2009	Mar 2010	Jun 2010
GPW-1	27	0.5U	0.5U	0.22U	16	4U	dry	1.2U	3.7	1.3J	0.6U
GPW-3	21.9	9.42	1.1	0.22U	8.9	4U	dry	0.6U	2.8	1.8J	0.6U
HBW-1	0.5U	0.5U	0.5U	0.22U	0.55U	4U	dry	1.5U	0.275U	1.5U	0.6U
HBW-7	0.5U	0.5U	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	dry	1.5U	0.275U	1.2U	0.6U

Creek Sample ID	Sep 2010	Dec 2010	Mar 2011	Jun 2011	Sep 2011	Dec 2011	Mar 2012	Jun 2012	Jan 2013	Feb 2013	Mar 2013
GPW-1	dry	0.1U	8.7	dry	dry	1.76	0.163J	dry	dry	1.65	0.735
GPW-3	dry	0.199J	0.673	dry	dry	1.31	0.261	dry	dry	1.74	0.754
HBW-1	dry	0.1U	0.2U	dry	dry	0.1U	0.1U	dry	<0.2U	dry	<0.2U
HBW-7	dry	0.1U	0.2U	dry	dry	0.171J	0.1U	dry	<0.2U	dry	<0.2U
HBW-10	dry	0.1U	0.2U	dry	dry	0.1U	0.1U	dry	<0.2U	dry	<0.2U

Creek Sample ID	Jun 2013	Sept 2013
GPW-1	dry	<0.2 U
GPW-3	dry	<0.2 U
HBW-1	<0.2U	<0.2 U
HBW-7	<0.2U	<0.2 U
HBW-10	<0.2U	<0.2 U

Notes:
Perchlorate Screening Criteria - TCEQ GW_{Ing} (mg/L) $5.1E^{-02}$





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