



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: July 27, 2017; 6:00 – 7:00 PM

Meeting Participants:

LHAAP/BRAC: Rose M. Zeiler

USACE: Aaron Williams

AECOM: Elspeth Sharp, Craig Holloway

USEPA Region 6: Rich Mayer, Kent Becher (USGS Liaison)

TCEQ: April Palmie

CLI (TAG): Laura-Ashley Overdyke

RAB: **Present:** Paul Fortune, Carol Fortune, Richard LeTourneau, Judy VanDeventer, Tom Walker, Terry Britt, Charles Dixon, John Pollard, Jr.
Absent: Nigel Shivers

Public: Keats Mullikin, Becky Mullikin, Dan Murphy, Patricia Clifton, W. Lee Guice, Carl D. Dunn, Kathy Dunn

An agenda for the RAB meeting, five handouts (Groundwater Treatment Plant [GWTP] – Processed Groundwater Volumes, LHAAP-04 ROD Fact Sheet, Harrison Bayou and Goose Prairie Creek – Perchlorate Data, LHAAP-04 ROD Responsiveness Summary, and a color copy of the AECOM slide presentation were provided for meeting attendees.

Welcome and Introduction

Mr. Paul Fortune, RAB Co-Chair, called the meeting to order. Mr. Fortune asked for introductions of new attendees. Ms. Laura-Ashley Overdyke, the Caddo Lake Institute (CLI) Executive Director and Technical Assistance Grant (TAG) point of contact, was introduced to the RAB.

Open Items - Dr. Rose M. Zeiler

RAB Administrative Issues

Dr. Zeiler opened the discussion of RAB Administrative Issues with the minutes from the January 2017 RAB meeting. Since the April RAB meeting was replaced with a site tour, this was the first opportunity to discuss the January 2017 minutes.

Minutes

Ms. Sharp said that the draft January 2017 RAB meeting minutes were sent to RAB members along with the July meeting agenda. Dr. Zeiler asked the RAB members if anyone wanted to make a motion to approve the minutes from the January 2017 RAB meeting. Ms. Judy VanDeventer made a motion to accept the draft January 2017 minutes as written and Mr. Terry Britt seconded the motion. The approved January 2017 RAB minutes will be posted on the LHAAP website.

Miscellaneous

Mr. Terry Britt asked if the new contractor for the next PBR had been selected yet. Mr. Aaron Williams said that the selection committee has met once and that the next PBR contract will be awarded prior to the end of period of performance for the current PBR contract, which ends September 30, 2017. Ms. Judy VanDeventer asked why the work was split into two contracts. Mr. Williams explained that sites that had Records of Decision (RODs) or Remedial Designs (RDs) were grouped together because the scope of work was well defined. Mr. Williams explained that the remaining sites were grouped together in another contract because their scope was less well defined.

Ongoing Outreach/Website

Ms. Sharp discussed the various methods used to notify the public about the RAB meetings (newspaper, radio stations, fliers posted, etc...). Ms. Overdyke asked for the address for the Longhorn environmental website. Ms. Sharp replied that the address is www.longhornaap.com which was also provided in the printed version of the presentation handout. Ms. Sharp mentioned that the website was recently updated with the LHAAP-16 RD Fact Sheet and Notice of Availability of Final Record of Decision for LHAAP-04.

Defense Environmental Restoration Program (DERP) Update – AECOM (Elspeth Sharp)

LHAAP-04 Final Record of Decision

Ms. Sharp discussed the site history for LHAAP-04 Former Pilot Wastewater Treatment Plant, the Remedial Action Objectives, and the selected remedy. The Final ROD was signed by Army BRAC and EPA with TCEQ concurrence. Ms. Judy VanDeventer asked why TCEQ didn't sign the ROD. Ms. April Palmie responded that CERCLA is a Federal program, and the EPA is the appropriate agency to sign the agreement. Ms. Palmie pointed out that the TCEQ concurred with the ROD before EPA signed.

LHAAP-16 Remedial Design

Ms. Sharp discussed the site history for LHAAP-16 Landfill and the final RD. The RD includes landfill cap maintenance, in-situ bioremediation (ISB), and four biobarriers. Mr. Charles Dixon asked what is a biobarrier and how is it different than mid-plume ISB. Ms. Sharp explained that the biobarriers are passive devices where contaminated water flows through a zone of injected

emulsified vegetable oil (EVO). Microorganisms in the soil are stimulated by eating the EVO and dechlorinating the dissolved solvents. Dr. Zeiler explained that the mid-plume ISB was targeting known contamination in the shallow and intermediate zone. The focused injections are active rather than passive like the biobarriers.

Ms. Overdyke asked how the effectiveness of the biobarriers is evaluated. Dr. Zeiler discussed how the RD was based upon data gathered during a pilot test where they evaluated various injection spacings, pressures, droplet sizes, etc...

Mr. Paul Fortune asked if LHAAP-16 is the most contaminated site at LHAAP. Dr. Zeiler said that LHAAP-18/24 was more contaminated primarily because of the unlined evaporation pond. Dr. Zeiler discussed how capping is a presumptive remedy for remediating landfills. The LHAAP-16 RD using ISB will be evaluated during the 2-year performance monitoring period. Ms. Overdyke asked why no biobarriers were planned along the southeast near Harrison Bayou. Dr. Zeiler explained that the biobarriers were designed to capture groundwater flow patterns immediately downgradient of the Landfill and just before Harrison Bayou to the north.

Mr. Carl Dunn asked why hotspots seem to occur at high elevations. Ms. Sharp explained that the shape of the contaminant plume is due to groundwater gradients and hydrogeologic conditions such as aquitards. Mr. Dunn asked how directly injected material forms a picket fence. Dr. Zeiler explained that EVO, the treatment, is injected directly through rods that are pushed into the subsurface at spaced intervals (boreholes) that might resemble a picket fence in cross section. The material is injected at sufficient pressure to cause the material to expand and migrate between boreholes. The material from individual boreholes will blend together to form a permeable barrier wall that will intercept groundwater.

Groundwater Treatment Plant Update

Mr. Craig Holloway discussed the acid spill that occurred in December 2016 and the steps taken to bring the GWTP back on-line. After the spill, the GWTP was put into recycle mode until perchlorate discharge limits were met. In April 2017, the number of extraction wells was slowly increased to gradually ramp up the flow and ensure compliance. By May 2017, the GWTP was extracting, treating, and discharging at full flow rates.

Site-wide Environmental Restoration Issues – Dr. Zeiler and Ms. Sharp

Environmental Contract Ending

Ms. Sharp explained that AECOM's contract ends on September 30, 2017. AECOM's remaining responsibilities include LHAAP-29 Feasibility Study (FS), LHAAP-12 2016 Remedial Action Operation (RA-O) report, and GWTP operation and reporting. Mr. Paul Fortune asked if future GWTP operations will fall under the small business contract. Mr. Williams confirmed that future GWTP operation is part of the Small Business MATOC Environmental Remediation Services Contract.

Surface Water Sampling

Ms. Sharp showed the locations for periodic surface water samples. A summary of perchlorate results for Harrison Bayou and Goose Prairie Creek were provided in the handouts.

Perimeter Well Sampling

Dr. Zeiler discussed that the perimeter well sampling was discontinued after December 2016. A decision was made by the Federal Facility Agreement (FFA) representatives on January 31, 2017 regarding the perimeter well sampling that has been taking place as a requirement of the 1999 Unanimous Decision of the Dispute Resolution Committee. FFA representatives agreed that perimeter well sampling should be discontinued.

Next RAB Meeting Schedule and Closing Remarks

Dr. Zeiler proposed the next RAB meeting be held on **October 19, 2017** at the **Karnack Community Center at 6:00 p.m.**, as long as there were no other conflicting meetings. Mr. Fortune said that date should be fine. Dr. Zeiler asked the RAB members to think about topics of discussion for the next meeting because the new contractor will have just started.

Adjourn

Motion to adjourn was made by Ms. Fortune and seconded by Ms. VanDeventer.

July 2017 Meeting Handouts:

- Meeting Agenda
- PowerPoint Presentation Slides
- Groundwater Treatment Plant [GWTP] – Processed Groundwater Volumes Handout
- LHAAP-04 Record of Decision Fact Sheet
- LHAAP-04 ROD Responsiveness Summary
- Harrison Bayou and Goose Prairie Creek – Perchlorate Data

Acronyms

AECOM	AECOM Technical Services, Inc.
BRAC	Base Realignment and Closure
CLI	Caddo Lake Institute
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DERP	Defense Environmental Response Program
EVO	Emulsified Vegetable Oil
FFA	Federal Facility Agreement
FS	Feasibility Study
GWTP	Groundwater Treatment Plant
ISB	In-situ Bioremediation
LHAAP	Longhorn Army Ammunition Plant
MATOC	Multiple Award Task Order Contract
PBR	Performance-Based Remediation
RAB	Restoration Advisory Board
RA-O	Remedial Action Operation
RD	Remedial Design
ROD	Record of Decision
TAG	Technical Assistance Grant
TCEQ	Texas Commission on Environmental Quality
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency



LONGHORN ARMY AMMUNITION PLANT
RESTORATION ADVISORY BOARD

Karnack, Texas
(479) 635-0110

AGENDA

DATE: Thursday, July 27, 2017
TIME: 6:00 – 7:00 PM
PLACE: Karnack Community Center, Karnack, Texas

- 06:00** Welcome and Introduction
- 06:05** Open Items {RMZ}
- RAB Administrative Issues
 - Minutes (January 2017 RAB Meeting)
 - Ongoing Outreach/Website
- 06:15** Defense Environmental Restoration Program (DERP) Update {AECOM}
- LHAAP-04 ROD
 - LHAAP-16 RD
 - Groundwater Treatment Plant (GWTP) Update
- 06:40** Sitewide Environmental Restoration Issues {RMZ}
- Environmental Contract Ending
 - Surface Water Sampling Update
 - Termination of perimeter well sampling
- 06:50** Next RAB Meeting Schedule and Closing Remarks
- 07:00** Adjourn {RMZ}

Longhorn Army Ammunition Plant Restoration Advisory Board Meeting July 27, 2017

A faint, light green background image of a plant branch with several leaves is visible on the right side of the slide, extending from the top right towards the center.

AECOM

Agenda

DATE: Thursday, July 27, 2017
TIME: 6:00 – 7:00 PM
PLACE: Karnack Community Center, Karnack, Texas

- 06:00** Welcome and Introduction
- 06:05** Open Items {RMZ}
- RAB Administrative Issues
- Minutes (January 2017 RAB Meeting)
- Ongoing Outreach/Website
- 06:15** Defense Environmental Restoration Program (DERP) Update {AECOM}
- LHAAP-04 ROD
- LHAAP-16 RD
- Groundwater Treatment Plant (GWTP) Update
- 06:40** Sitewide Environmental Restoration Issues {RMZ}
- Environmental Contract Ending
- Surface Water Sampling Update
- Termination of perimeter well sampling
- 06:50** Next RAB Meeting Schedule and Closing Remarks
- 07:00** Adjourn {RMZ}

Ongoing Outreach - Notifications for October RAB Meeting

- “ Published RAB meeting announcement in Marshall News Messenger on July 13, 2017
- “ Requested the following radio stations to air January RAB Meeting Public Service Announcement (PSA):
 - . KMHT Radio 103.9 (Karnack)
 - . 98 Rocks (Alpha Media, Shreveport) and
 - . Kiss Country 93.7 (Town Square Media, Shreveport)
- “ Requested PSA to be placed on KTBS Channel 3, KTAL Channel 6 TV, KSLA Channel 12 Community/Local Events Calendar
- “ Sent RAB announcement/agenda by email or USPS to individual RAB members and other interested parties
- “ Mailed RAB announcement to churches in Karnack on July 13, 2017
- “ Posted RAB Meeting Fliers at multiple locations in the community:
 - . Shady Glade Café, Caddo Grocery, Fyffes Corner Store, Circle S Grocery, Run In Grocery, Family Dollar Store, Convenience Store at FM9 and FM199

The Army Wants You to be Informed!

“ The Army is committed to protecting human health and the environment; key to that commitment is engaging the community and increasing public participation in environmental restoration at LHAAP.

“ You are encouraged to:

- . Attend RAB meetings and/or become a member of the RAB
- . Visit the Longhorn environmental website at www.longhornaap.com
- . Make suggestions for improving communication . the Army welcomes and appreciates community feedback

Minutes from Past RAB Meetings

“ Discussion of January 2017 RAB Meeting Minutes/Motion to accept

Website Update



Longhorn Army Ammunition Plant

Environmental Restoration Program

The next RAB meeting will be held on Thursday, July 27, 2017 at 6:00 PM at the Karnack Community Center. [Click on Calendar for Meeting Agenda and Details.](#)

Website Update

Environmental Restoration Program

LHAAP Fact Sheets

- LHAAP-16 RD Fact Sheet – July 14, 2016
- LHAAP-17 RD Fact Sheet – July 14, 2016
- LHAAP-16 RD Fact Sheet – April 2017

Get Involved Links

- Restoration Advisory Board
- Meeting Schedule
- Meeting Minutes
- CERCLA Investigation and Remediation Process
- **LHAAP Fact Sheets «**
- Final Record of Decisions (RODs) Approved

Website Update

HOME BACKGROUND SITES ▾ REMEDIAL TECHNOLOGIES PLUME MAPS ADMIN RECORD GET INVOLVED ▾

Longhorn Army Ammunition Plant Environmental Restoration Program

Final Record of Decisions (RODs) Approved

- ~~Notice of Availability of Final Records of Decision for LHAAP-16, LHAAP-17, LHAAP-001-R, and LHAAP-003-R~~
- Notice of Availability of Final Record of Decision for LHAAP-04

Get Involved Links

- Restoration Advisory Board
- Meeting Schedule
- Meeting Minutes
- CERCLA Investigation and Remediation Process
- LHAAP Fact Sheets
- **Final Record of Decisions (RODs) Approved «**

Longhorn Army Ammunition Plant Environmental
Restoration Program

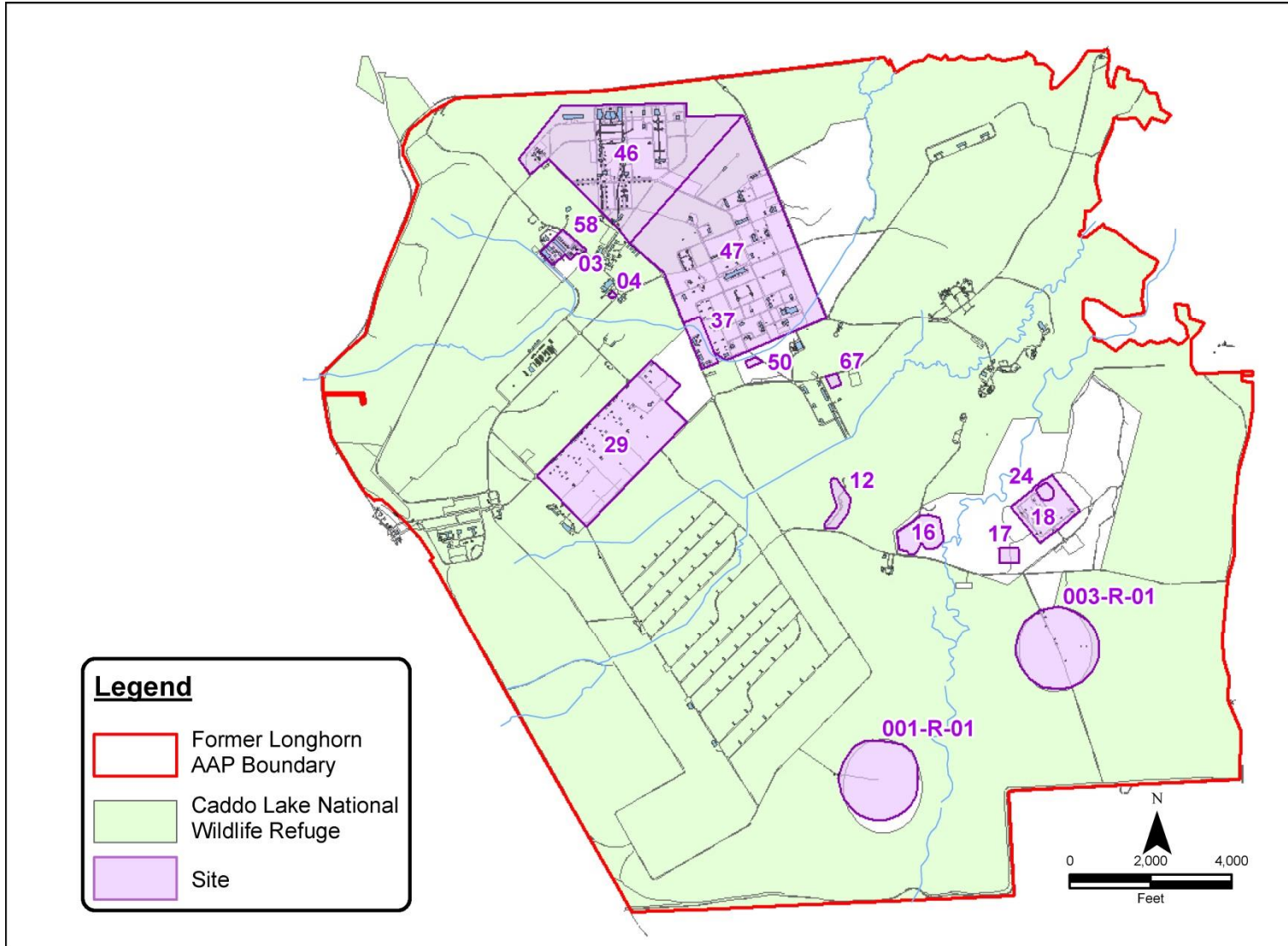


Site-wide Environmental Restoration Issues

Active LHAAP Performance-Based Remediation Sites

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	South Test Area/Bomb Test Area
LHAAP-003-R	Ground Signal Test Area

Longhorn Performance-Based Remediation Sites Map



LHAAP-04 – Final Record of Decision

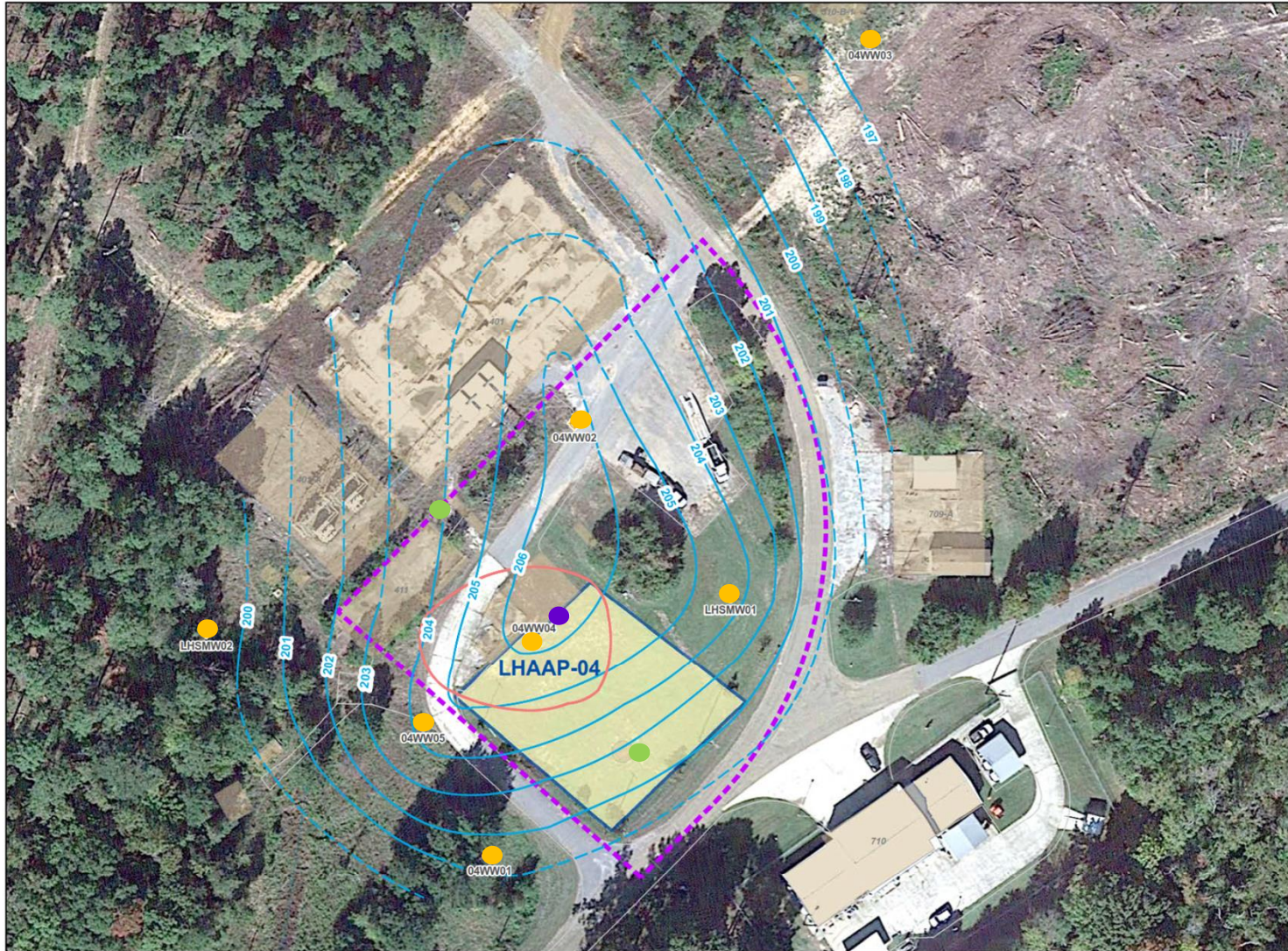
“ LHAAP-04 . Former Pilot Wastewater Treatment Plant

- 0.5 acres
- Wastewater treatment began in 1984
- Plant demolished in 1997
- Mercury and perchlorate contaminated soil excavated and disposed off-site in 2009
- Perchlorate detected in shallow zone groundwater at concentrations exceeding the TRRP Tier 1 residential groundwater PCL

“ Final Record of Decision (ROD)

- Signed by Army BRAC December 15, 2017
- Concurrence by TCEQ February 7, 2017
- Signed by EPA March 30, 2017

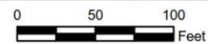
LHAAP-04 – Final Record of Decision



Legend

- Shallow Monitoring Well
- Proposed Shallow Monitoring Well
- Proposed Intermediate Monitoring Well
- Groundwater Contour Interval 2010 (Dashed Where Inferred)
- Perchlorate Plume Extent (PCL - 17 µg/L)
- - - Stream
- Road
- Building
- LHAAP-04 Site Boundary
- Preliminary Land Use Control Boundary

Source:
 Final Record of Decision LHAAP-04 for Longhorn
 Army Ammunition Plant, Karnack Texas (AECOM,
 2016).



LHAAP-04 – Final Record of Decision

“ Remedial Action Objectives (RAOs)

- Protect human health by preventing ingestion of groundwater contaminated with perchlorate;
- Return groundwater to its potential beneficial use, wherever practicable, within a reasonable time period given the particular site circumstances; and
- Prevent groundwater contaminated with perchlorate from migrating into nearby surface water.

“ Selected Remedy:

- In-Situ Bioremediation (ISB);
- Long-Term Monitoring (LTM) of Groundwater; and
- Land Use Controls (LUCs):
 - Maintain integrity of remedial or monitoring systems
 - Prevent use of groundwater as potable water source
 - Restrict land use to nonresidential

LHAAP-04 – Final Record of Decision

- “ Initial Notice of Land Use Controls to Public Officials sent June 26, 2017
- “ Public Notice of Availability of ROD
 - Marshall Newspaper publication
 - Mailouts via USPS to local officials
 - LHAAP Website
- “ Copy of the Final ROD is available to the public at the Marshall Public Library, 300 S. Alamo, Marshall, Texas, 75670
 - Library hours are 10:00 A.M. to 8:00 P.M. Monday through Thursday, and 10:00 A.M. to 5:30 P.M. Friday and Saturday.
- “ Copies of Responsiveness Summaries and Fact Sheets at sign-in table.
- “ For more information, contact Dr. Rose M. Zeiler, Longhorn Army Ammunition Plant, P.O. Box 220, Ratcliff, Arkansas, 72951; phone number 479-635-0110; e-mail rose.m.zeiler.civ@mail.mil.

LHAAP-04 – Post-ROD Schedule

” Post ROD Schedule

- Draft Remedial Design . March 2018
- Draft Remedial Action Work Plan . August 2018

LHAAP-16 – Remedial Design

“ LHAAP-16 Landfill

- Landfill received solid and industrial waste until 1980s
- Harrison Bayou located along northeastern edge of site
- COCs are trichloroethene [TCE], cis-1,2-dichloroethene [DCE], vinyl chloride [VC]), perchlorate, and five metals
- In 1996 and 1997 a groundwater extraction system was installed as a treatability study to prevent the groundwater plume from migrating to Harrison Bayou
- Final ROD issued September 2016
- Selected remedy: cap maintenance, ISB, Biobarriers, Monitored Natural Attenuation (MNA), and LUCs

“ LHAAP-16 Remedial Design finalized January 2017

LHAAP-16 – Remedial Design

“ LHAAP-16 Remedial Design

- Landfill Cap Maintenance
 - Monitor, maintain, and repair the existing landfill cap, as necessary.
 - Perform cap inspections annually or as needed to evaluate vegetation, erosion, settlement, and drainage system.
- In-Situ Bioremediation (ISB)
 - Emulsified vegetable oil will be used to reduce contaminant concentration in most contaminated portion of Shallow and Intermediate Zone groundwater (referred to as Mid-Plume ISB).
- Biobarriers (ISB)
 - Three (3) biobarriers installed in shallow zone groundwater immediately downgradient of landfill (Biobarriers #1, #2, #3).
 - One (1) biobarrier near Harrison Bayou in Shallow Zone groundwater to prevent contaminated groundwater from seeping into the bayou.

LHAAP-16 – Remedial Design

“ LHAAP-16 Remedial Design (continued)

- Performance Monitoring/MNA
 - First two years:
 - Monitor groundwater in the areas of active ISB to evaluate its effectiveness and to assess changes in groundwater geochemistry, concentrations of COCs, and their degradation products.
 - Perform quarterly groundwater monitoring to evaluate changes in concentrations of COCs and their degradation products in the areas outside the influence of active ISB. The eight quarters will be used to evaluate if MNA is effective, or if contingency action should be initiated.
 - If MNA is shown to be effective based on the first two years of data, implement LTM on a semiannual frequency for three years, then annually until the next five-year review.

LHAAP-16 – Remedial Design

“ LHAAP-16 Remedial Design (continued)

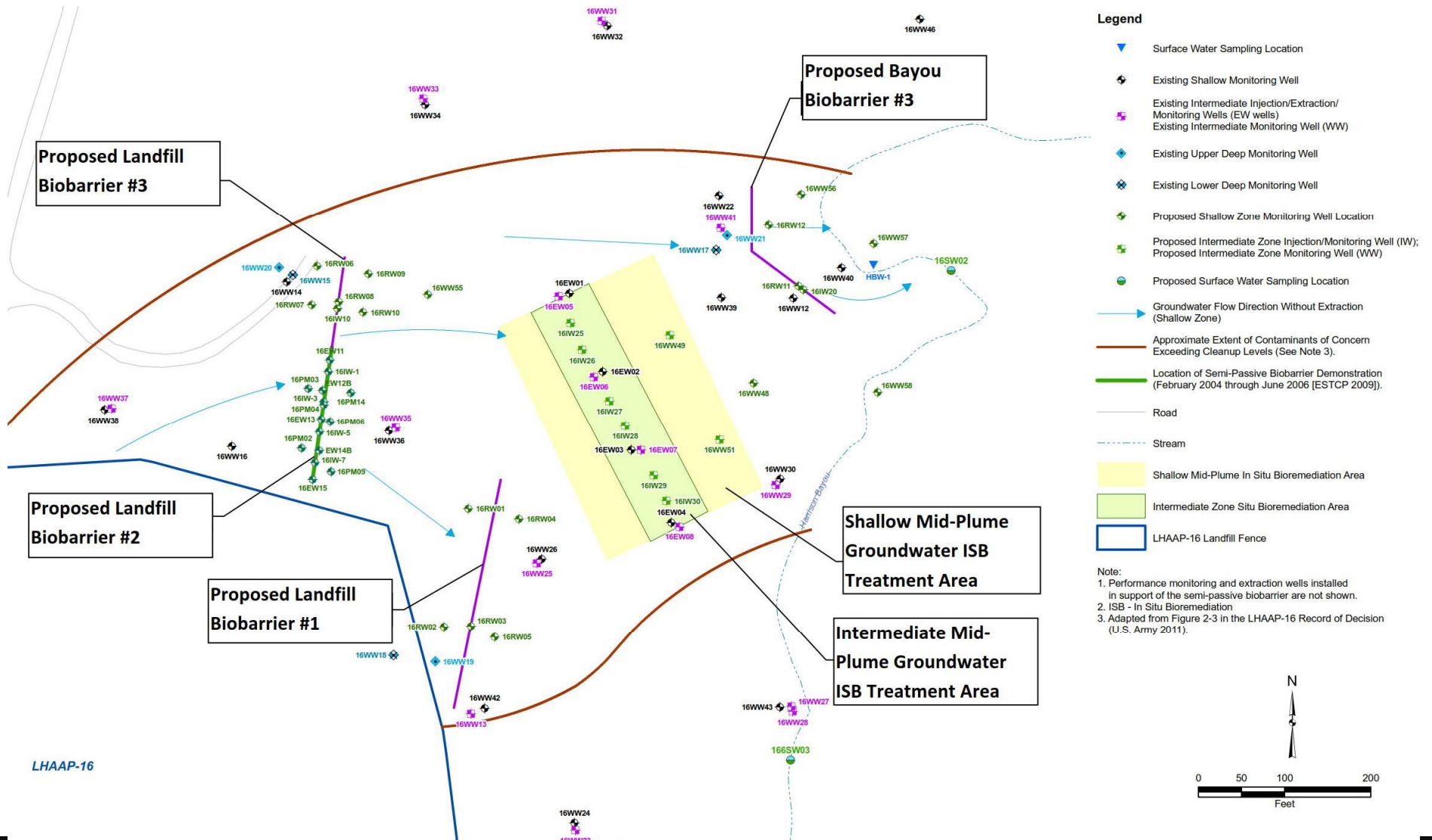
- Land Use Controls
 - Prohibit access to contaminated groundwater except for environmental monitoring and testing;
 - Preserve the integrity of the landfill cap and restrict intrusive activities (e.g., digging) that would degrade or alter the cap;
 - Restrict land use to nonresidential; and
 - Maintain the integrity of any current or future remedial or monitoring systems.
 - LUCs will remain in place as long as the landfill waste remains at the site or until the levels of COCs and COC by-products (i.e., including all hazardous substances, pollutants, and contaminants found at the site at cleanup levels) allow for unlimited use and unrestricted exposure.

LHAAP-16 – Remedial Design

“ LHAAP-16 Remedial Design (continued)

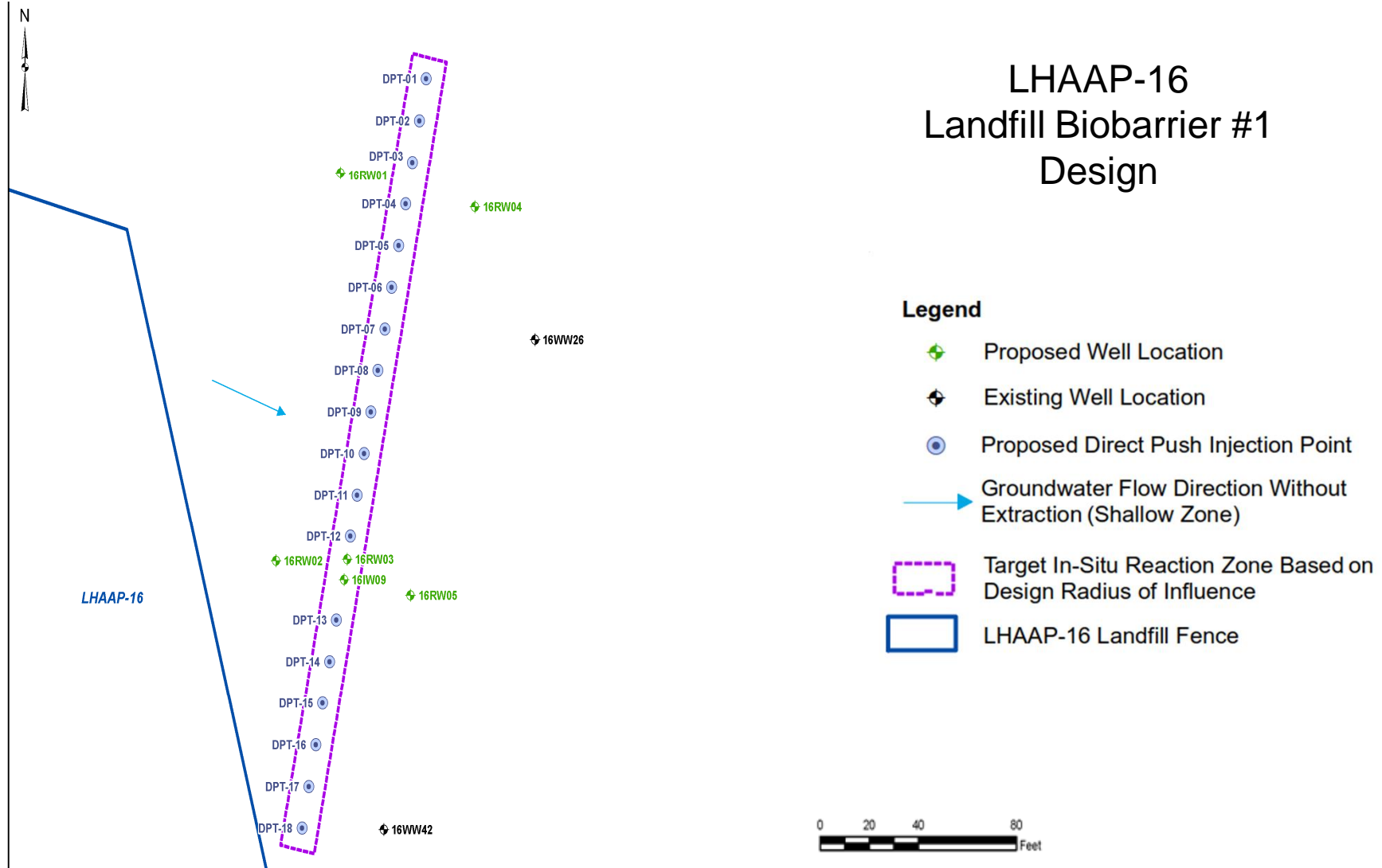
- Land Use Controls Implementation
 - Initial Notice: Initial notices of soil and groundwater contamination and land use restrictions were submitted to federal, state and local governments involved, and owners and occupants of properties subject to LUCs.
 - Finalizing LUC Boundaries: LUC boundaries will be finalized, approved by TCEQ and EPA, and a legal description appended to the survey plat.
 - Recording: LUCs will be recorded in Harrison County records.
 - Notification: The Texas Department of Licensing and Regulation will be notified of the LUCs.

LHAAP-16 – Remedial Design



LHAAP-16

LHAAP-16 – Remedial Design



LHAAP-16 Landfill Biobarrier #1 Design

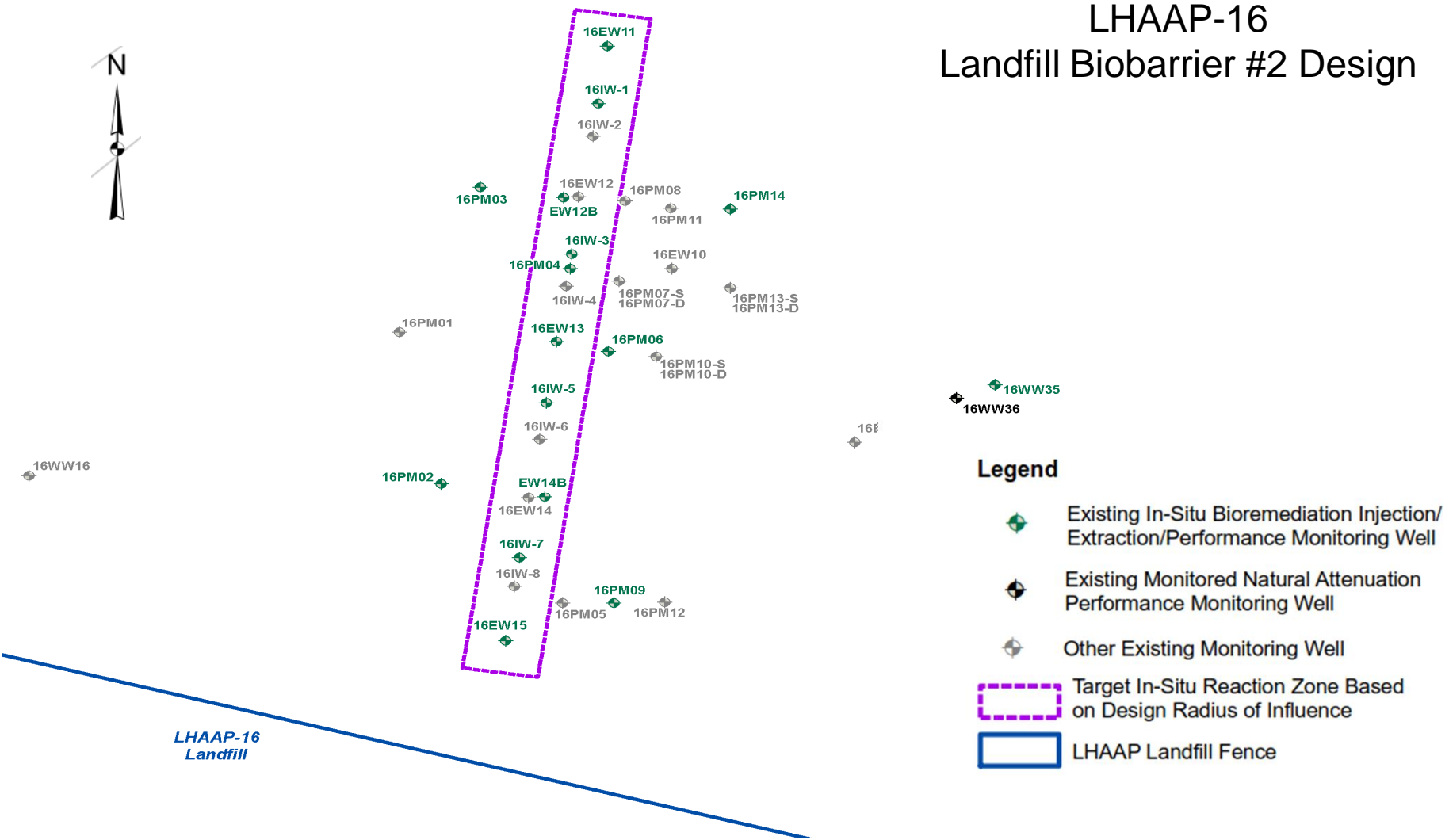
Legend

- ◆ Proposed Well Location
- ◆ Existing Well Location
- Proposed Direct Push Injection Point
- Groundwater Flow Direction Without Extraction (Shallow Zone)
- Target In-Situ Reaction Zone Based on Design Radius of Influence
- LHAAP-16 Landfill Fence



LHAAP-16 – Remedial Design

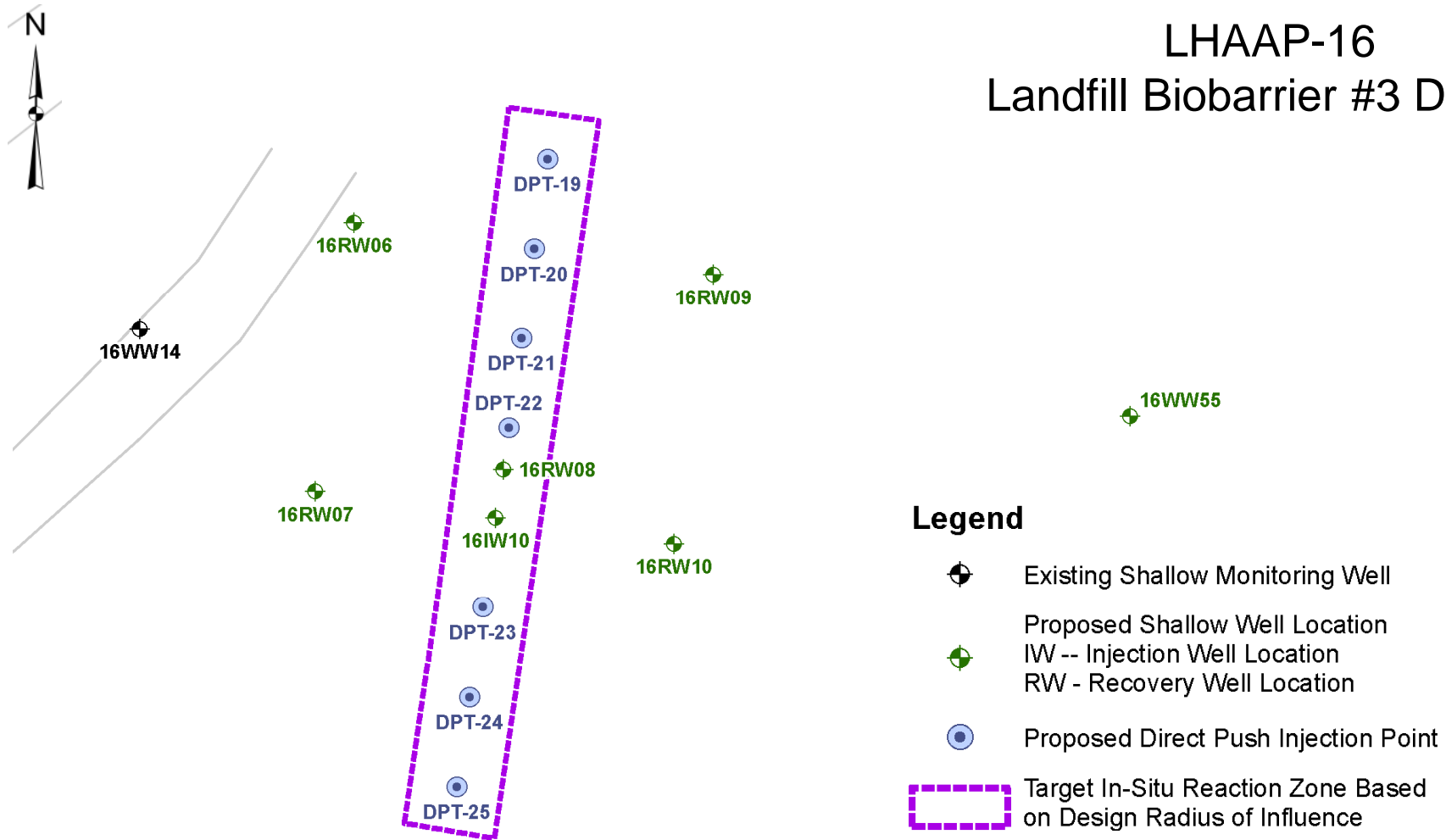
LHAAP-16 Landfill Biobarrier #2 Design



- Legend**
- Existing In-Situ Bioremediation Injection/Extraction/Performance Monitoring Well
 - Existing Monitored Natural Attenuation Performance Monitoring Well
 - Other Existing Monitoring Well
 - Target In-Situ Reaction Zone Based on Design Radius of Influence
 - LHAAP Landfill Fence

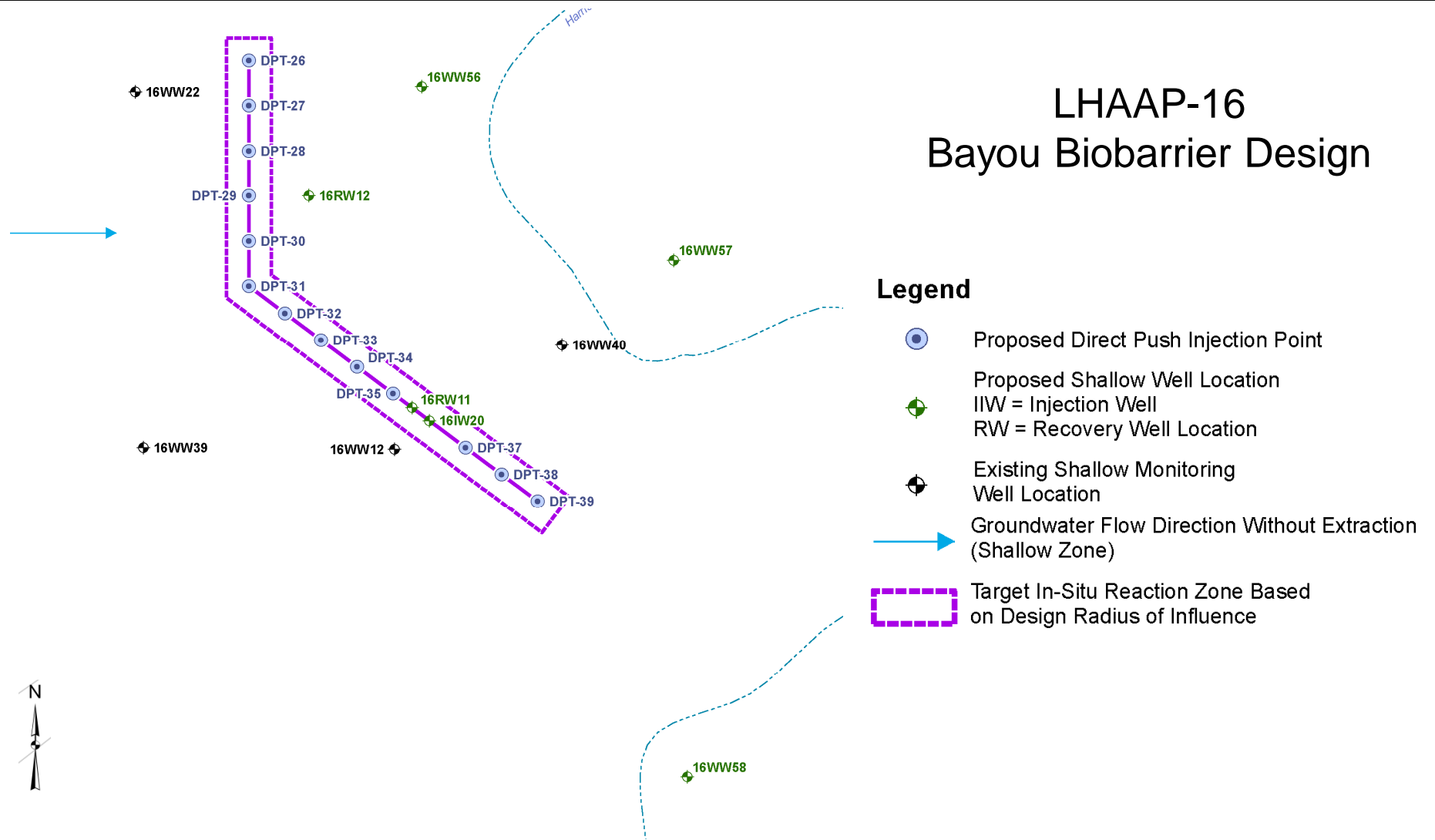
LHAAP-16 – Remedial Design

LHAAP-16 Landfill Biobarrier #3 Design








LHAAP-16 – Remedial Design

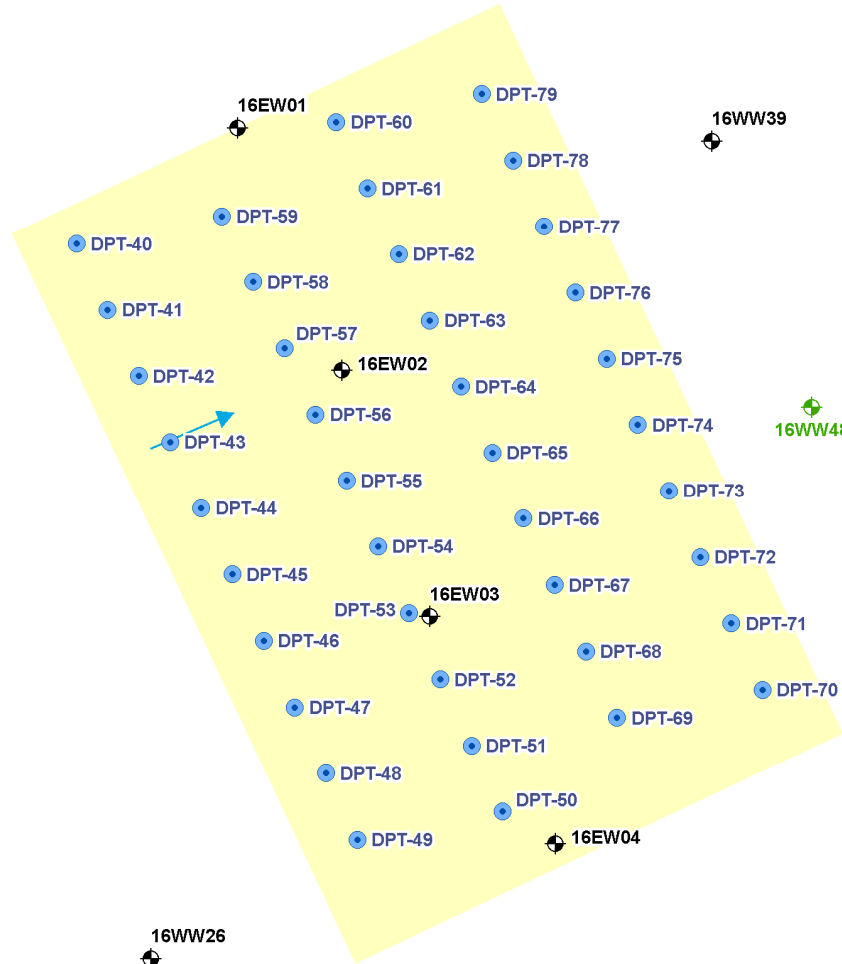
LHAAP-16 Bayou Biobarrier Design



Legend








-  Proposed Direct Push Injection Point
-  Proposed Shallow Well Location
IIW = Injection Well
RW = Recovery Well Location
-  Existing Shallow Monitoring Well Location
-  Groundwater Flow Direction Without Extraction (Shallow Zone)
-  Target In-Situ Reaction Zone Based on Design Radius of Influence

LHAAP-16 – Remedial Design



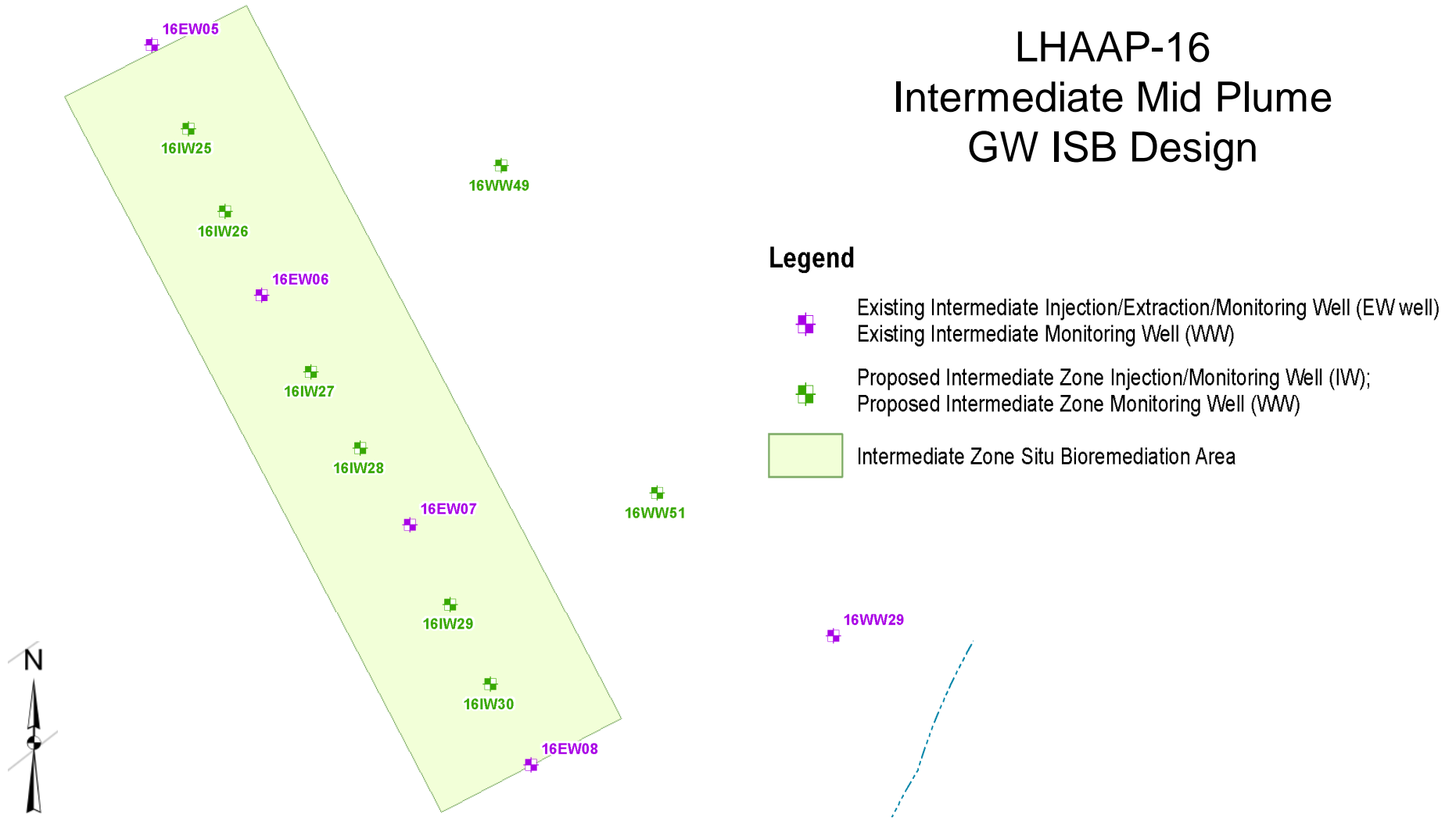
LHAAP-16 Shallow Mid Plume GW ISB Design

Legend

-  Existing Shallow Monitoring Well (VW) or Extraction Well (EW) Location
-  Proposed Shallow Monitoring Well Location
-  Proposed Direct Push Injection Point
-  Stream
-  Groundwater Flow Direction Without Extraction (Shallow Zone)
-  Shallow In Situ Bioremediation Area
-  LHAAP-16 Landfill Fence

LHAAP-16 – Remedial Design

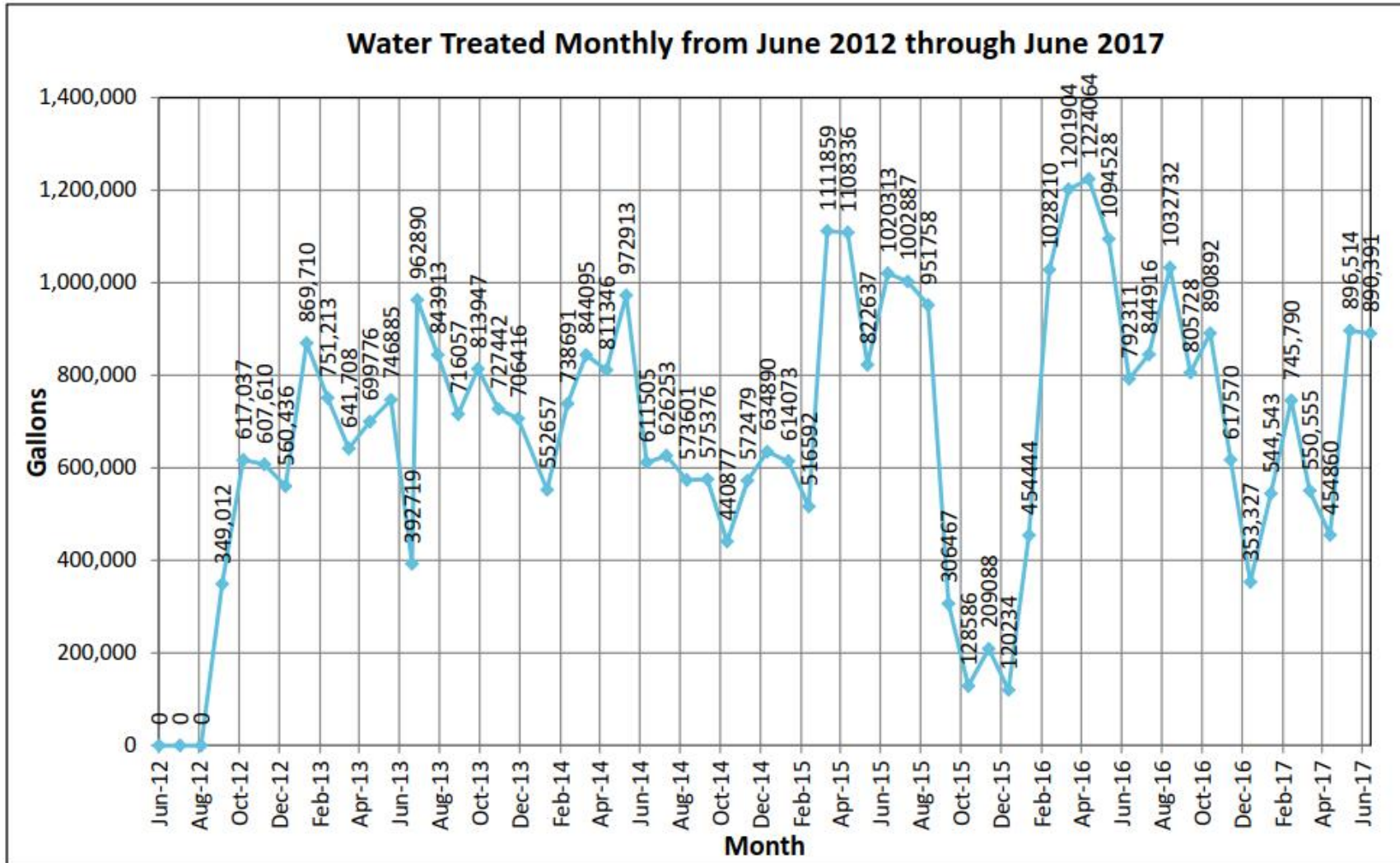
LHAAP-16 Intermediate Mid Plume GW ISB Design



Groundwater Treatment Plant (GWTP) Update

- “ Acid spill occurred in December 2016. Spilled materials were contained and neutralized within the GWTP
- “ GWTP was put into internal recycle mode (limited extraction, limited discharge) until perchlorate levels were below discharge limits in March 2017
- “ Extraction and discharge rates were gradually increased in April 2017 with increased monitoring to ensure compliance
- “ Ion exchange scavenger system was installed in May 2017
- “ Since May 2017, the GWTP has been extracting, treating, and discharging water at normal flow rates

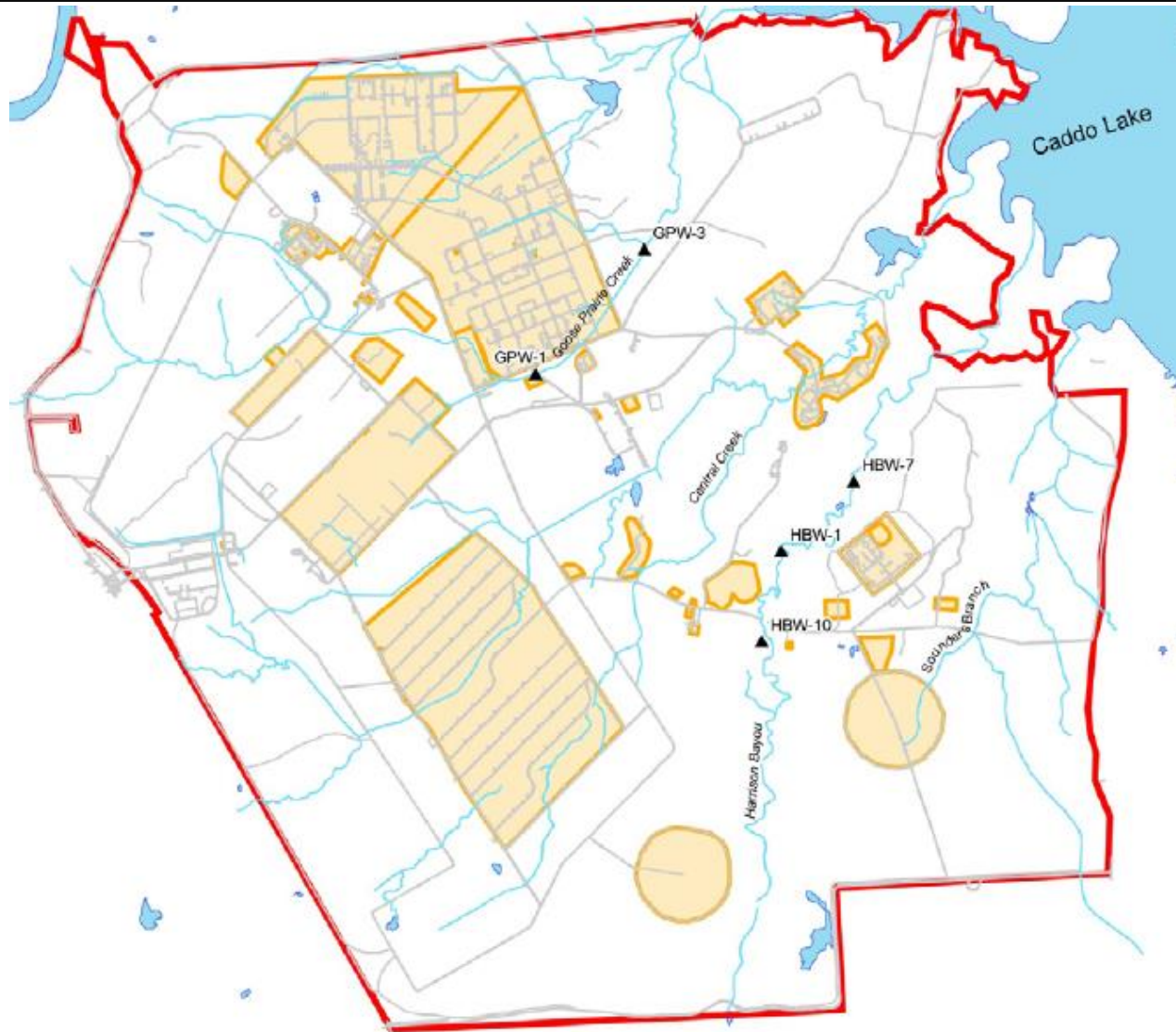
GWTP Update (continued)



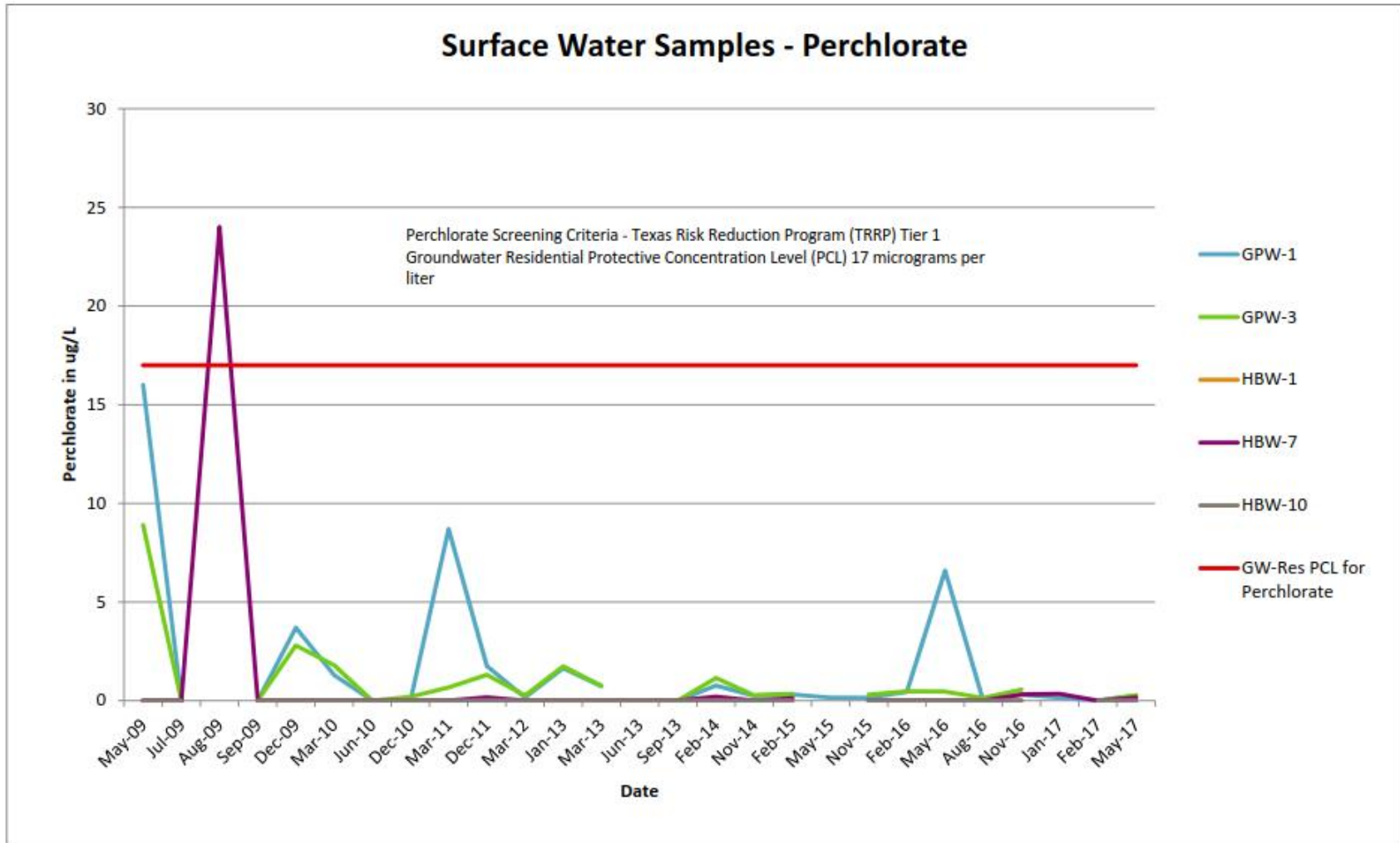
Deliverables, Environmental Contract Ending

- “ Current AECOM PBR contract ends September 30, 2017
- “ The remaining AECOM contract deliverables (reports and plans) are:
 - Final LHAAP-29 Feasibility Study (FS)
 - Final LHAAP-12 2016 RAO
 - Groundwater Treatment Plant Operation and Reporting

Surface Water Sampling Locations



Surface Water Sampling



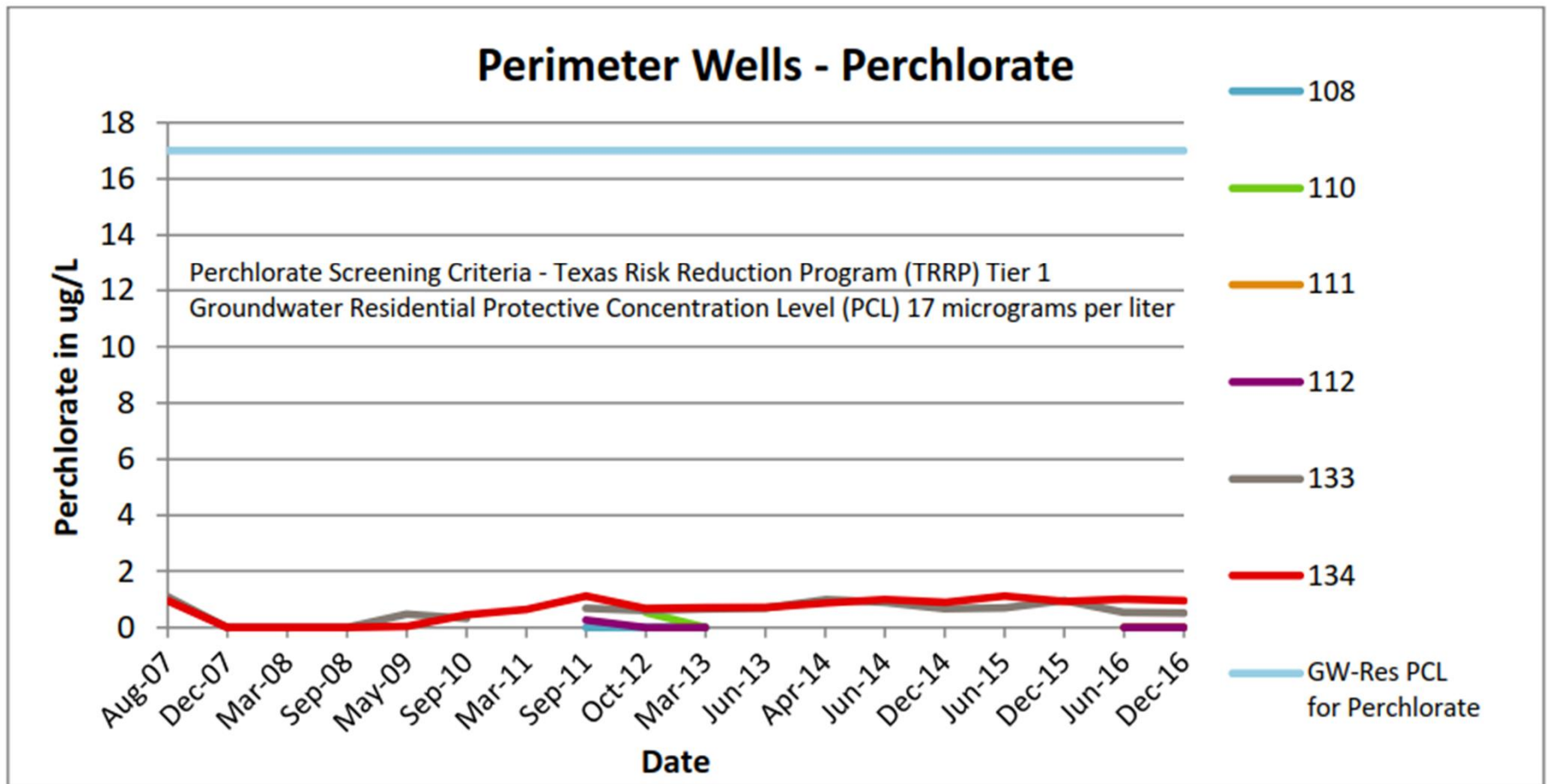
GPW . Goose Prairie Creek
HBW . Harrison Bayou

Perimeter Well Sampling

- “ A decision was made by the FFA representatives on January 31, 2017 regarding the perimeter well sampling that has been taking place as a requirement of the 1999 Unanimous Decision of the Dispute Resolution Committee.
- “ FFA representatives agreed that perimeter well sampling should be discontinued.

Perimeter Well Sampling

Perimeter sampling discontinued. Last samples collected Nov/Dec 2016.



Next RAB Meeting Schedule and Closing Remarks

- " Schedule October 2017 RAB Meeting
- " Other Issues/Remarks?

Questions?



LHAAP-04, Former Pilot Wastewater Treatment Plant

SELECTED REMEDY In-Situ Bioremediation, Groundwater Long-Term Monitoring, and Land Use Controls

Site History

LHAAP-04, known as Site 04 or the former pilot wastewater treatment plant, is approximately 0.5 acres and is located in the central portion of LHAAP at the northwest corner of 6th and 60th Streets near the former fire station. LHAAP-04 is surrounded by light duty roads. Wastewater treatment operations began at LHAAP-04 in 1984. The demolition of the former pilot wastewater treatment facility structures, tanks, and piping, and the disposal of the associated wastes were completed in the summer of 1997 as part of the Resource Conservation and Recovery Act (RCRA) closure of the plant. Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) program, excavation of soil impacted with mercury and perchlorate at the LHAAP-04 site was completed in 2009 along the southern edge of the slab, which formerly housed storage tanks for the former pilot wastewater treatment facility. The Final ROD was issued in March 2017 with a selected remedy of in-situ bioremediation (ISB), long-term monitoring (LTM) of groundwater, and land use controls (LUCs).

Site Characteristics

Goose Prairie Creek runs approximately 700 feet to the south of LHAAP-04. The site consists of soils with mixed layers of mostly silts and clay with some thin layers of sands. The shallow zone water bearing sand at monitoring well 04WW04 appears to be only one to two feet thick with the surrounding monitoring wells mostly showing clay or silt layers at the same depth. No monitoring wells have been completed in the intermediate or deep saturated zones at LHAAP-04. Based on 2010 groundwater measurements, the groundwater flow direction in the shallow saturated zone below LHAAP-04 flows away from monitoring well 04WW02 in all directions. The regional groundwater flow direction beneath the facility is generally east-northeast towards Caddo Lake.

Chemical of Concern (COC)

The COC is perchlorate in groundwater.

Description of the Selected Remedy

In-Situ Bioremediation (ISB)

ISB in the groundwater next to monitoring well 04WW04 will be performed. ISB involves the addition of a carbon source into the shallow zone to promote naturally occurring biological processes to reduce perchlorate concentrations to below its cleanup level. In addition, subsurface injections of microorganisms in the shallow zone will also be conducted as needed to reduce the perchlorate levels.

Long-Term Monitoring (LTM)

LTM will be conducted to confirm that perchlorate concentrations in groundwater are declining through treatment to attain the groundwater cleanup level.

LUCs include:

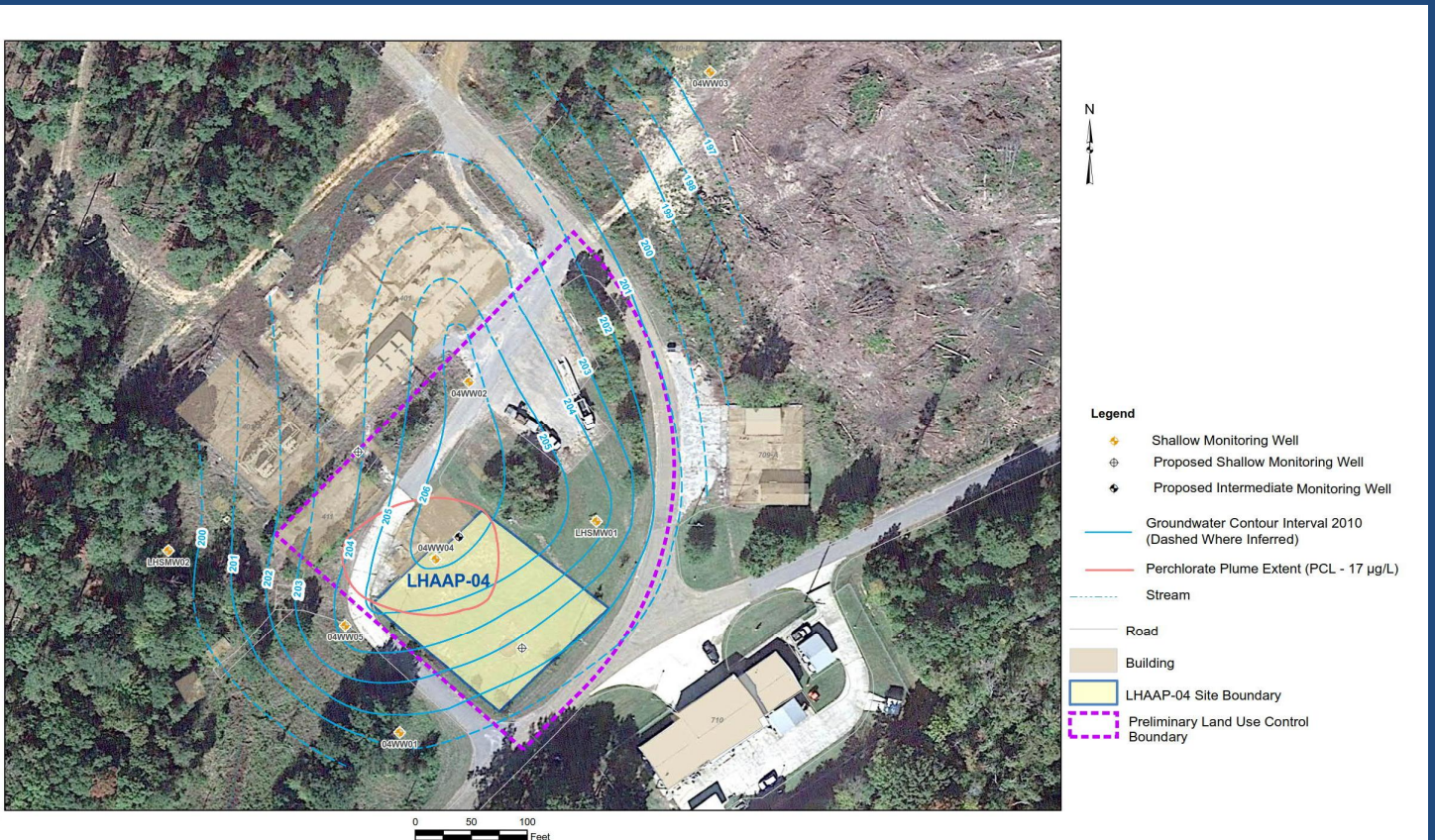
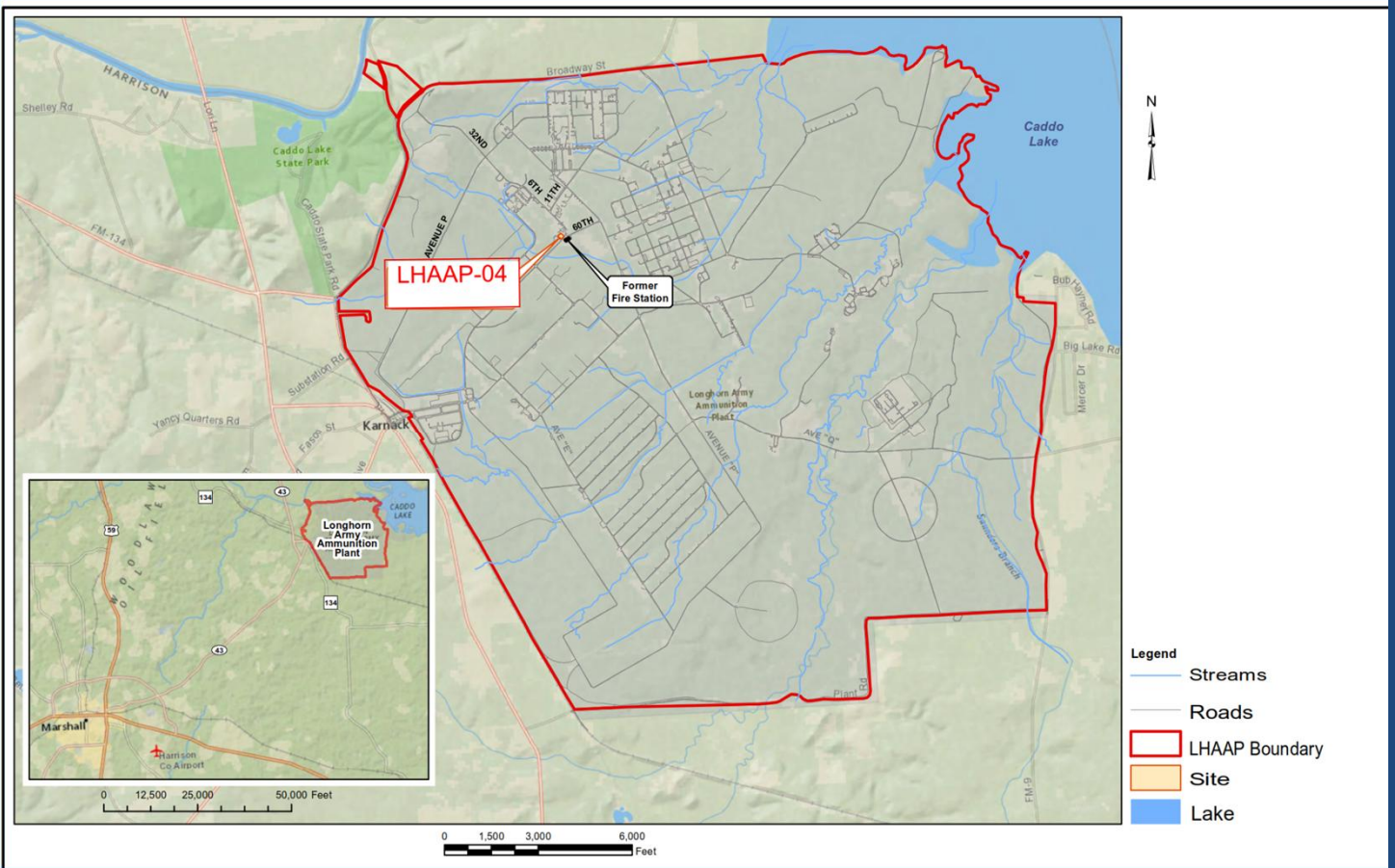
- Maintain the integrity of any current or future remedial or monitoring systems until these components of the remedy are no longer needed to achieve the groundwater cleanup levels.
- Prohibit the use of groundwater as a drinking water source until the levels of COCs in the soil and groundwater allow for unlimited use and unrestricted exposure.
- Restrict the land to nonresidential usage until the levels of COCs in surface and subsurface soil and groundwater allow for unlimited use and unrestricted exposure.

CERCLA Five Year Reviews

Five-Year reviews will be performed to document that the remedy remains protective of human health and the environment.

LHAAP-04, Former Pilot Wastewater Treatment Plant

SELECTED REMEDY In-Situ Bioremediation, Groundwater Long-Term Monitoring, and Land Use Controls



Groundwater Treatment Plant - Processed Groundwater Volumes

The amount of groundwater treated is determined by measuring the number of gallons of processed water.

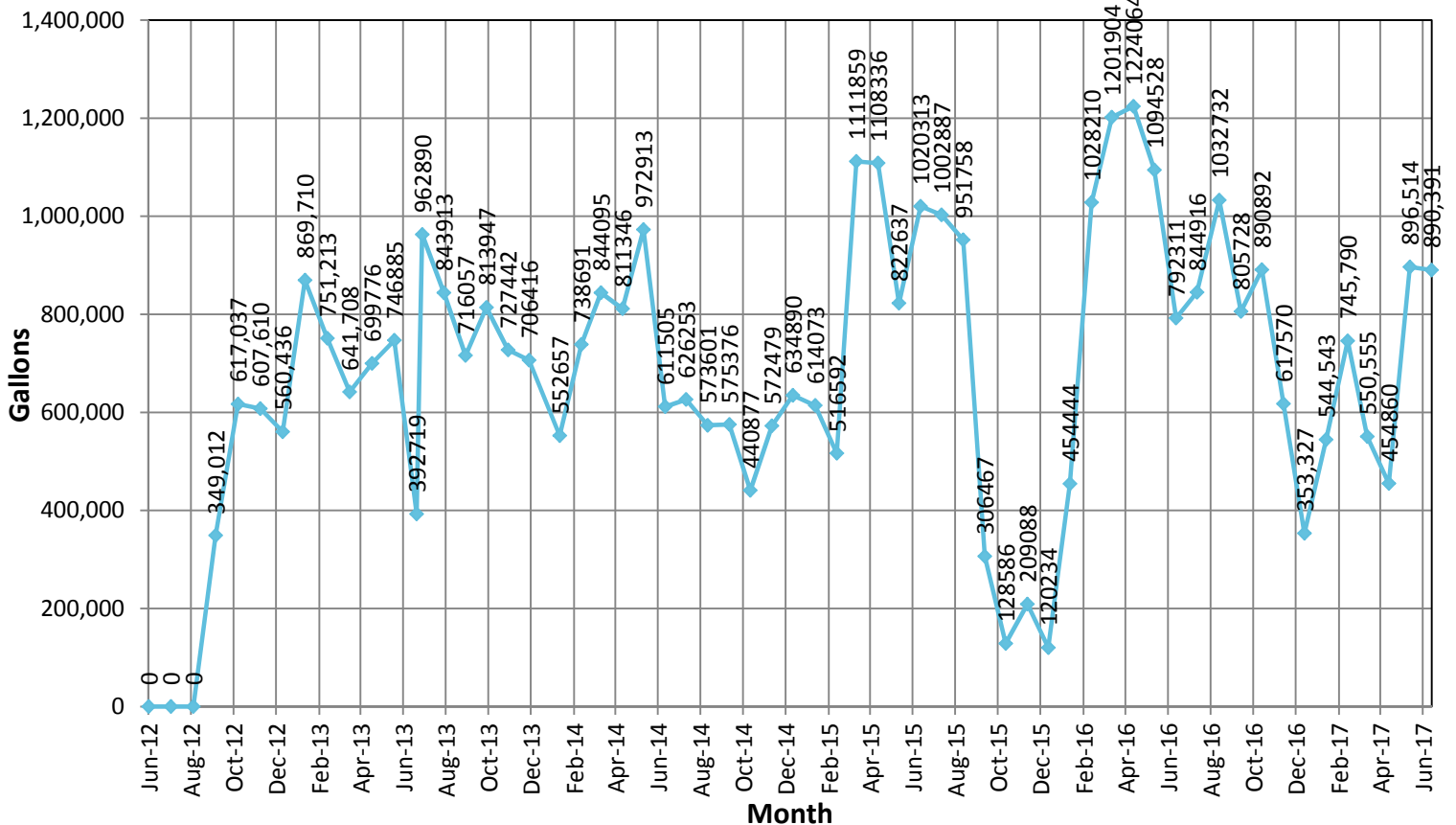
Processed Water Data

(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	843,913	716,057
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	706,416	552,657	738,691	844,095	811,346	972,913	611,505	626,253	573,601	575,376
Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15
440,877	572,479	634,890	614,073	516,592	1,111,859	1,108,336	822,637	1,020,313	1,002,887	951,758	306,467
Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16
128,586	209,088	120,234	454,444	1,028,210	1,201,904	1,224,064	1,094,528	792,311	844,916	1,032,732	805,728
Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17			
890,892	617,570	353,327	544,543	745,790	550,555	454,860	896,514	890,391			

*Indicates Estimate

Water Treated Monthly from June 2012 through June 2017



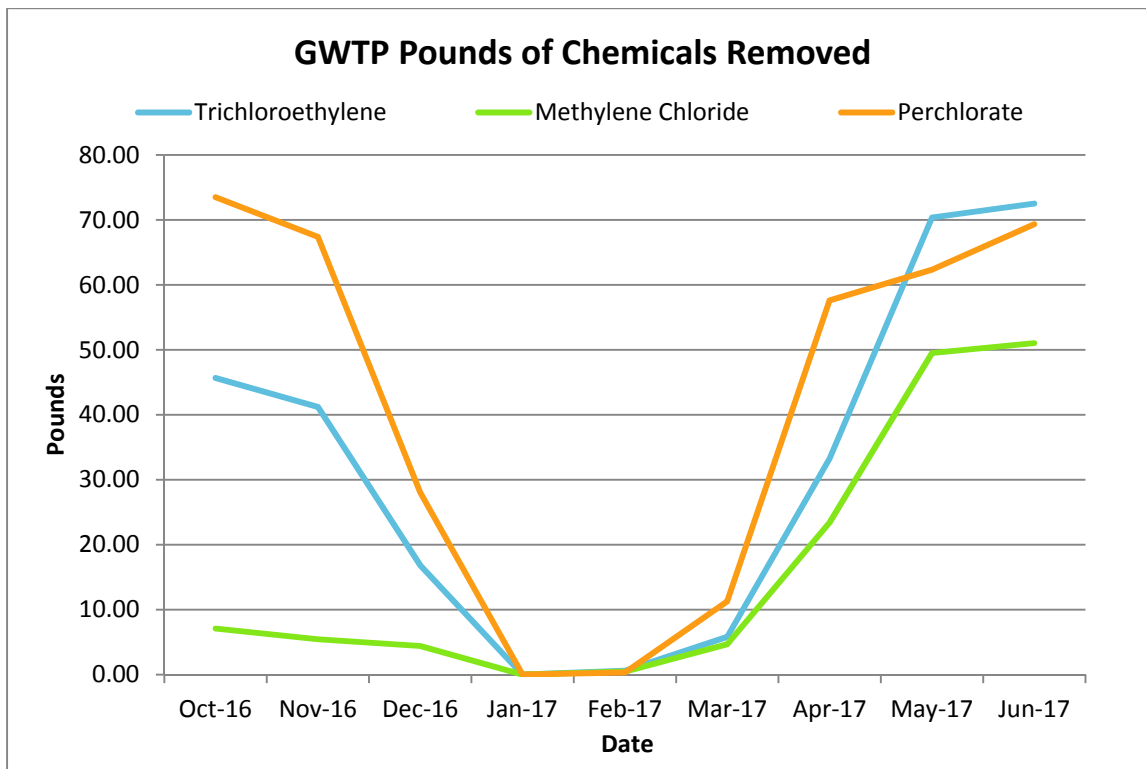
The pounds of chemicals removed for the 4th Quarter of 2016 and 1st and 2nd Quarters of 2017 can be found below and are calculated by the following formula:

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

Approximate Amount of Pounds of Chemicals Removed From LHAAP-18/24

	Trichloroethylene	Methylene Chloride	Perchlorate
Oct-16	45.65	7.08	73.49
Nov-16	41.21	5.44	67.39
Dec-16	16.85	4.40	28.05
Jan-17	0.00	0.00	0.00
Feb-17	0.59	0.47	0.32
Mar-17	5.82	4.67	11.28
Apr-17	33.28	23.41	57.60
May-17	70.38	49.51	62.35
Jun-17	72.52	51.02	69.34

ND – no data available



Water Discharge Location and Volume (Gallons)

Month	Harrison Bayou	LHAAP-18/24 Sprinklers	INF Pond	INF Pond to Harrison Bayou	Contract Hauled Off-Site
Oct-16	0	642,876	0	0	0
Nov-16	0	576,898	0	0	0
Dec-16	0	236,688	0	0	0
Jan-17	0	0	0	0	0
Feb-17	0	0	0	0	14,355
Mar-17	127,242	0	0	0	14,400
Apr-17	113,038	0	236,821	0	0
May-17	205,665	0	534,155	0	0
Jun-17	467,830	0	294,550	490,574	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.

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

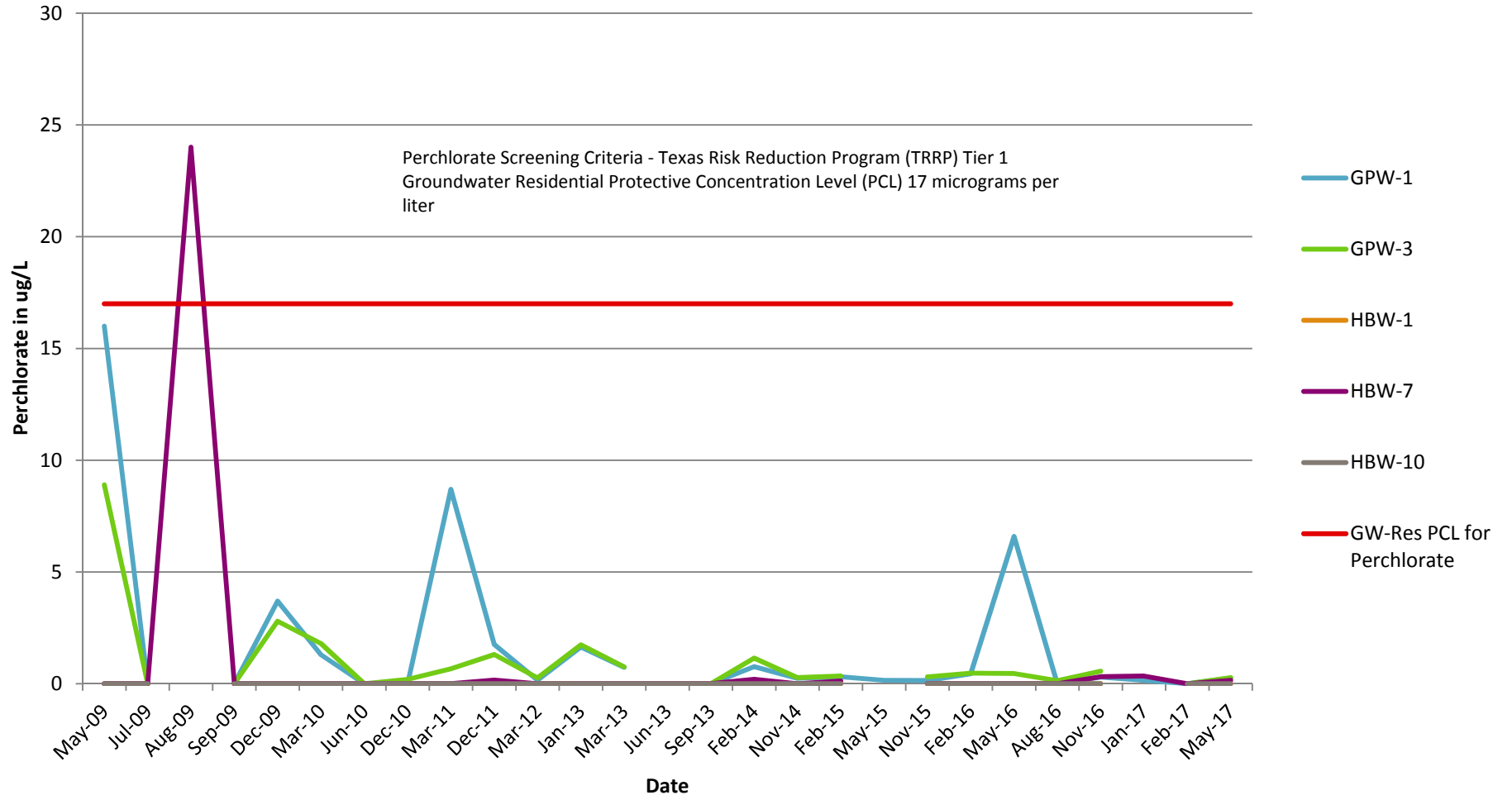
Quarter	3 rd	4 th	1 st	2 nd	3 rd	4 th	1 st	2 nd	3 rd	4 th	1 st
Creek Sample ID	Sep 2010	Dec 2010	Mar 2011	Jun 2011	Sep 2011	Dec 2011	Mar 2012	Jun 2012	Not Applicable	Jan & Feb 2013	Mar 2013
GPW-1	dry	<0.1U	8.7	dry	dry	1.76	0.163J	dry	NS	1.65	0.735
GPW-3	dry	0.199J	0.673	dry	dry	1.31	0.261	dry	NS	1.74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

Quarter	2 nd	3 rd	4 th	1 st	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	Feb 2015	May 2015	Aug 2015	Nov 2015
GPW-1	dry	<0.2 U	dry	0.766	dry	dry	0.244 J	0.311 J	0.156J	dry	0.142 J
GPW-3	dry	<0.2 U	dry	1.15	dry	dry	0.276 J	0.344 J	dry	dry	0.311 J
HBW-1	<0.2U	<0.2 U	dry	<0.2 U	dry	dry	<0.2 U	<0.2 U	dry	dry	<0.2 U
HBW-7	<0.2U	<0.2 U	dry	0.201 J	dry	dry	<0.2 U	0.124 J	dry	dry	<0.2 U
HBW-10	<0.2U	<0.2 U	dry	<0.2 U	dry	dry	<0.2 U	<0.2 U	dry	dry	<0.2 U

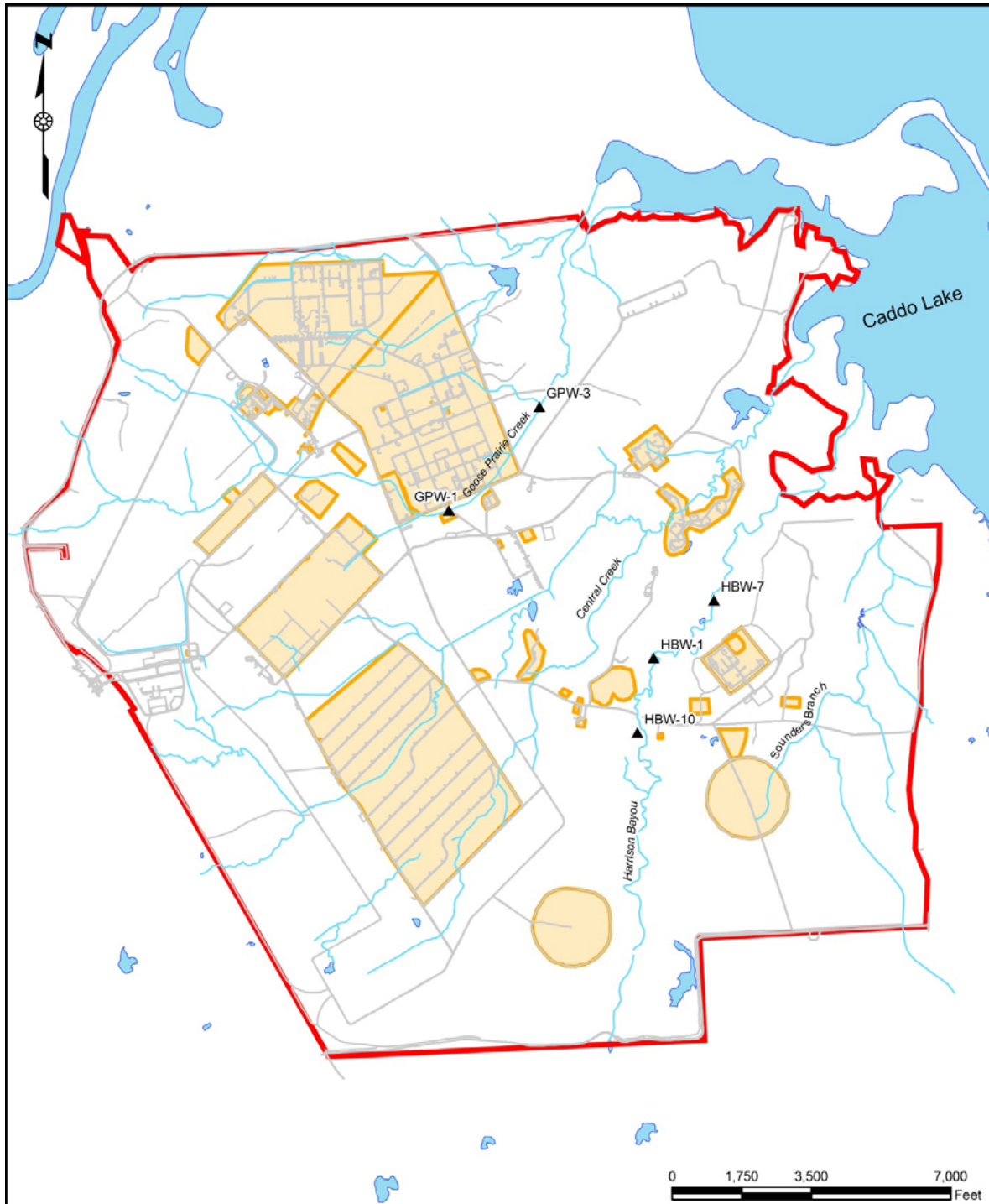
Quarter	1 st	2 nd	3 rd	4 th	1 st	2 nd
Creek Sample ID	Feb 2016	May 2016	Aug 2016	Nov 2016	Feb 2017	May 2017
GPW-1	0.447	6.59	<0.2 U	0.301 J	<1 U	0.263
GPW-3	0.474	0.457	0.141	0.563	<1 U	0.274
HBW-1	<0.2 U	<0.2 U	<0.2 U	<0.2 U	<1 U	<0.2 U
HBW-7	<0.2 U	<0.2 U	<0.2 U	0.318 J	<1 U	0.155
HBW-10	<0.2 U	<0.2 U	<0.2 U	<0.2 U	<1 U	<0.2 U

NS – not sampled U – non-detect J – Estimated Dry – no surface water

Surface Water Samples - Perchlorate



Longhorn Army Ammunition Plant Creek Sampling Locations



Legend <ul style="list-style-type: none">▲ 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	

LHAAP-04 Record of Decision Responsiveness Summary

RESPONSI ENESS SUMMARY

The Responsiveness Summary serves three purposes. First, it provides the U. S. Army, USEPA, and the TCEQ with information about community concerns with the Preferred Alternative at LHAAP-04 as presented in the Proposed Plan. Second, it shows how the public's comments were considered in the decision-making process for selection of the remedy. Third, it provides a formal mechanism for the U.S. Army to respond to public comments

The U.S. Army, the USEPA, and the TCEQ provide information regarding LHAAP-04 through public meetings, the Administrative Record for the facility, and announcements published in the Marshall News Messenger newspapers. **Section 2.3** discusses community participation on LHAAP-04, including the dates for the public comment period, the date, location, and time of the public meetings, and the location of the Administrative Record. The following documents related to community involvement were added to the Administrative Record:

- Transcript of the public meeting on January 9, 2013
- Presentation slides from the January 9, 2013 public meeting
- Written questions and comments from the public during the public comment period, and the U.S. Army response to those comments.

1 Stakeholder Issues and Lead Agency Responses

This section responds to significant issues raised by stakeholders including the public and community groups that were received in written or verbal form.

1 1 Question Recommendation No 1

Extent of groundwater contamination: The only monitor well at the site, well 04WW04, contains high concentrations of perchlorate. This well is only 18 feet deep. A single well is insufficient. Both the lateral and vertical extent of groundwater contamination are unknown.

Recommendation: The three additional monitor wells the U.S. Army plans to install will better define the extent of contamination.

Response – The LHAAP-04 site is currently monitored by a total of seven wells, although only one well is technically within the very small area of the site (approximately 150 feet by 150 feet). The site is well-monitored as the remainder of the wells are within 250 feet of the impacted well. Three additional wells planned for installation as part of the RD will help further refine the perchlorate plume footprint and depth of contamination..

1 2 Question Recommendation No 2

Groundwater Contaminants: Samples from well 04WW04 do not appear to have been analyzed for contaminants other than perchlorate. Other groundwater contaminants may be present.

Recommendation: The U.S. Army should sample all monitor wells and the fire station well for all contaminants that might reasonably be expected to occur at the site. In addition to perchlorate, this would include volatile organic compounds (VOCs) (e.g., methylene chloride, trichloroethylene, explosives (e.g., TNT, DNT), and metals (e.g., arsenic, thallium). If

contaminants are found that are not amenable to restoration under the Proposed Plan (e.g., metals), the U.S. Army should modify the plan to ensure that all the contaminants will be cleaned up.

Response – Groundwater samples from three shallow monitoring wells (04WW01, 04WW02, and 04WW03) were analyzed for VOCs, SVOCs, metals, pesticides, PCBs, explosives, perchlorate, and dioxins/furans during the RI (Jacobs, 2003). No VOCs, SVOCs, perchlorate, pesticides, explosives, and PCBs were detected in the samples. Inorganic constituent concentrations were detected at or lower than the protective concentration level (PCL) or background comparison levels. Eight dioxin/furan compounds (with no established MCL or PCL) were detected in groundwater samples (Jacobs, 2003). Subsequently, perchlorate was identified as the only groundwater COC at the site with its source being historical perchlorate impacts in soil. Parameters, other than those discussed in the Proposed Plan and the ROD, will not be added to the monitoring program.

1 Question Recommendation No

Residual soil contamination: The U.S. Army has stated that contaminated soil probably remains beneath some portions of the site.

Recommendation: The U.S. Army should either perform an assessment to determine whether the contaminated soil is likely to be a source of groundwater contamination, or explain why such an assessment is not necessary.

Response – Residual contaminated soil, if any, is likely to be restricted to the two grid areas FL09 and FL11 (where confirmation samples could not be collected due to groundwater infiltration). Contaminated soil was removed from these two areas up to depths of 14 ft bgs. However, samples collected from the remaining north side wall just above the groundwater interface indicated perchlorate concentrations less than cleanup levels. Residual soil contamination, if any, is likely to be in the saturated zone and will be addressed as part of groundwater remedy.

1 4 Question Recommendation No 4

Concrete slab: The U.S. Army does not appear to have investigated the soil or groundwater beneath the concrete slab.

Recommendation: The U.S. Army should either perform an investigation, or explain why it is not necessary.

Response –The concrete slab was penetrated in six locations near the tank pad/foundations. See **Figure 2-2** of the Final Removal Action Work Plan (Shaw, 2009c). Based on perchlorate results from soil samples taken from under the slab, a section of the concrete was removed. See **Figure 2-1** and **Figure 2-8** of the Final Completion Report (Shaw, 2011). Soil was excavated to a depth of five feet below top of concrete in section FL08 and to a depth of twelve feet below top of concrete in section FL07. Perchlorate concentrations in final floor confirmation samples from FL07 and FL08 were less than the GWP-Ind MSC. Monitoring well 04WW04 is located adjacent to the concrete slab and soil removal at section FL07. Therefore, further investigation beneath the concrete slab is not warranted.

1 Question Recommendation No

Perchlorate cleanup standard: The U.S. Army's cleanup standard for perchlorate in groundwater is the same as the State of Texas' standard for industrial use (GWP-Ind): 72 µg/L. However, the USEPA has decided to regulate perchlorate under the SDWA and has established an Interim Drinking Water Health Advisory of 15 µg/L. The USEPA and the Army are currently discussing this issue.

Recommendation: Pending the outcome of discussions with the USEPA, the Army should assume that the perchlorate cleanup will be 15 µg/L, and plan accordingly.

Note – The purpose of excavating the perchlorate contaminated soils was to protect the underlying groundwater. A more stringent perchlorate groundwater standard may mean that the cleanup standards for soils will also have to be more stringent.

Response – The cleanup level for perchlorate is 17 µg/L, which is the TRRP Tier 1 Groundwater Residential PCL. The cleanup level for perchlorate was revised as a result of dispute resolution between the Army and the EPA.

1 6 Question Recommendation No 6

Surface water modeling: The U.S. Army has concluded that contaminated groundwater will not adversely affect surface water in Goose Prairie Creek. This conclusion is based on modeling performed in 2007. However, in its Proposed Plan for LHAAP-47, the U.S. Army stated that the uncertainties associated with the model were unacceptable, and it would not be used to assess the effect of groundwater contaminants on Goose Prairie Creek.

Recommendation: The U.S. Army should explain why it is using the model at LHAAP-04 but not at LHAAP-47.

Response – References to use of surface water modeling for LHAAP-04 will be removed from this and the future documents. Surface water directly overlies the LHAAP-47 plume and surface water monitoring is planned in conjunction with the final remedy for that site. At LHAAP-04 surface water is not located on the site directly on top of the groundwater plume. It is located ~700 feet from the site and based upon the localized, small nature of the plume, no impact to surface water is anticipated. Surface water data from 2010 and 2011 indicates perchlorate concentrations below TRRP Tier 1 Groundwater Residential PCL.

1 7 Question No 7

Public Comment Period: What is the duration of the public comment period? When does the public comment period end?

Response – The duration of the public comment period is 30 days. The period began on January 1, 2013, and was extended through January 31, 2013.

1 Question No

Cleanup Level for Perchlorate in Groundwater: The U.S. Army proposes that the cleanup level for perchlorate in groundwater be 72 µg/L whereas the USEPA states that the cleanup level for perchlorate shall be 15 µg/L. The U.S. Army may have to switch over and use 15 µg/L as the cleanup level.

Response – The cleanup level for perchlorate is 17 µg/L, which is the TRRP Tier 1 Groundwater Residential PCL. The cleanup level for perchlorate was revised as a result of dispute resolution between the Army and the EPA.

1 Question No

Growth of Microorganisms during ISB: How do you encourage the growth of microorganisms? What is the relationship between microorganisms' growth and reduction in contaminants?

Response – The material (substrate) that is injected into the aquifer during ISB provides the food source for the growth of native microorganisms in the aquifer. These microorganisms increase in population (via reproduction) and during the corresponding metabolism, they break down the contaminants in groundwater.

Perchlorate, the COC in groundwater at LHAAP-04 site is more amenable to ISB than some other contaminants found at the LHAAP. Evaluation of data collected quarterly in the first two years of the ISB implementation will help determine need for additional injections (additional substrate into the aquifer), or bioaugmentation culture (to add/enhance the right type of microbes into the aquifer). Providing the substrate (food source) to the microbes helps sustain and grow their population with corresponding decrease in the COC levels until the cleanup level is attained.

1 10 Question No 10

Submittal of Questions and Appropriate Response: If someone sends in written comments to the U.S. Army, who does it go to, who actually reads them, who responds, do they respond to all comments?

Response – Dr. Rose Zeiler, with the U.S. Army is the point of contact for correspondence associated with comments/responses. Dr. Zeiler's official contact information (mail, email, and telephone no.) is provided in the Proposed Plan. Formal comments are accepted verbally at the public meeting or via email or mail sent to the attention of Dr. Zeiler. All written comments on the Proposed Plan should be submitted to her. Verbal comments asked during the public meeting are captured by the court reporter. A concerted response from the team is provided to the comments and included in the Responsiveness Summary of the ROD. Similar questions are grouped together and a comprehensive answer is provided to that group of questions.

2 Technical and Legal Issues

This section is used to expand on technical and legal issues. However, there are no issues of that nature beyond the technical issues already discussed in **Section 3.1**.



LONGHORN ARMY AMMUNITION PLANT
RESTORATION ADVISORY BOARD

Karnack, Texas
(479) 635-0110

AGENDA

DATE: Thursday, October 19, 2017
TIME: 6:00 – 7:00 PM
PLACE: Karnack Community Center, Karnack, Texas

- 06:00** Welcome and Introduction
- 06:05** Open Items {RMZ}
- RAB Administrative Issues
 - Minutes (July 2017 RAB Meeting)
 - Ongoing Outreach/Website (2017 Volumes 1-6 loaded)
- 06:15** Community Relations Plan/Community Involvement Plan Update
{Cathy Kropp (AEC PAO)}
- 06:25** Sitewide Environmental Restoration Issues {RMZ}
- New Environmental contract awarded September 29, 2017
 - Surface Water Sampling Update
- 06:35** Defense Environmental Restoration Program (DERP) Update {Bhate}
- Introduction of Team
 - Work at LHAAP under the new contract
 - Synopsis of first three month activities
 - Groundwater Treatment Plant (GWTP) Update
- Next RAB Meeting Schedule and Closing Remarks
- 07:00** Adjourn {RMZ}

Longhorn Army Ammunition Plant Restoration Advisory Board Meeting July 27, 2017

A faint, stylized green leaf graphic is positioned on the right side of the slide, partially overlapping the text area. The leaf is composed of several smaller leaflets on a central stem, rendered in a light green color.

AECOM

Agenda

DATE: Thursday, July 27, 2017
TIME: 6:00 – 7:00 PM
PLACE: Karnack Community Center, Karnack, Texas

- 06:00** Welcome and Introduction
- 06:05** Open Items {RMZ}
- RAB Administrative Issues
 - Minutes (January 2017 RAB Meeting)
 - Ongoing Outreach/Website
- 06:15** Defense Environmental Restoration Program (DERP) Update {AECOM}
- LHAAP-04 ROD
 - LHAAP-16 RD
 - Groundwater Treatment Plant (GWTP) Update
- 06:40** Sitewide Environmental Restoration Issues {RMZ}
- Environmental Contract Ending
 - Surface Water Sampling Update
 - Termination of perimeter well sampling
- 06:50** Next RAB Meeting Schedule and Closing Remarks
- 07:00** Adjourn {RMZ}

Ongoing Outreach - Notifications for October RAB Meeting

- Published RAB meeting announcement in Marshall News Messenger on July 13, 2017
- Requested the following radio stations to air January RAB Meeting Public Service Announcement (PSA):
 - KMHT Radio 103.9 (Karnack)
 - 98 Rocks (Alpha Media, Shreveport) and
 - Kiss Country 93.7 (Town Square Media, Shreveport)
- Requested PSA to be placed on KTBS Channel 3, KTAL Channel 6 TV, KSLA Channel 12 Community/Local Events Calendar
- Sent RAB announcement/agenda by email or USPS to individual RAB members and other interested parties
- Mailed RAB announcement to churches in Karnack on July 13, 2017
- Posted RAB Meeting Fliers at multiple locations in the community:
 - Shady Glade Café, Caddo Grocery, Fyffes Corner Store, Circle S Grocery, Run In Grocery, Family Dollar Store, Convenience Store at FM9 and FM199

The Army Wants You to be Informed!

- The Army is committed to protecting human health and the environment; key to that commitment is engaging the community and increasing public participation in environmental restoration at LHAAP.
- You are encouraged to:
 - Attend RAB meetings and/or become a member of the RAB
 - Visit the Longhorn environmental website at www.longhornaap.com
 - Make suggestions for improving communication – the Army welcomes and appreciates community feedback

Minutes from Past RAB Meetings

- Discussion of January 2017 RAB Meeting Minutes/Motion to accept



Longhorn Army Ammunition Plant

Environmental Restoration Program

The next RAB meeting will be held on Thursday, July 27, 2017 at 6:00 PM at the Karnack Community Center. [Click on Calendar for Meeting Agenda and Details.](#)

Environmental Restoration Program

LHAAP Fact Sheets

- LHAAP-16 RD Fact Sheet – July 14, 2016
- LHAAP-17 RD Fact Sheet – July 14, 2016
- LHAAP-16 RD Fact Sheet – April 2017

Get Involved Links

- Restoration Advisory Board
- Meeting Schedule
- Meeting Minutes
- CERCLA Investigation and Remediation Process
- **LHAAP Fact Sheets «**
- Final Record of Decisions (RODs) Approved

Longhorn Army Ammunition Plant Environmental Restoration Program

Final Record of Decisions (RODs) Approved

- Notice of Availability of Final Records of Decision for LHAAP-16, LHAAP-17, LHAAP-001-R, and LHAAP-003-R
- Notice of Availability of Final Record of Decision for LHAAP-04

Get Involved Links

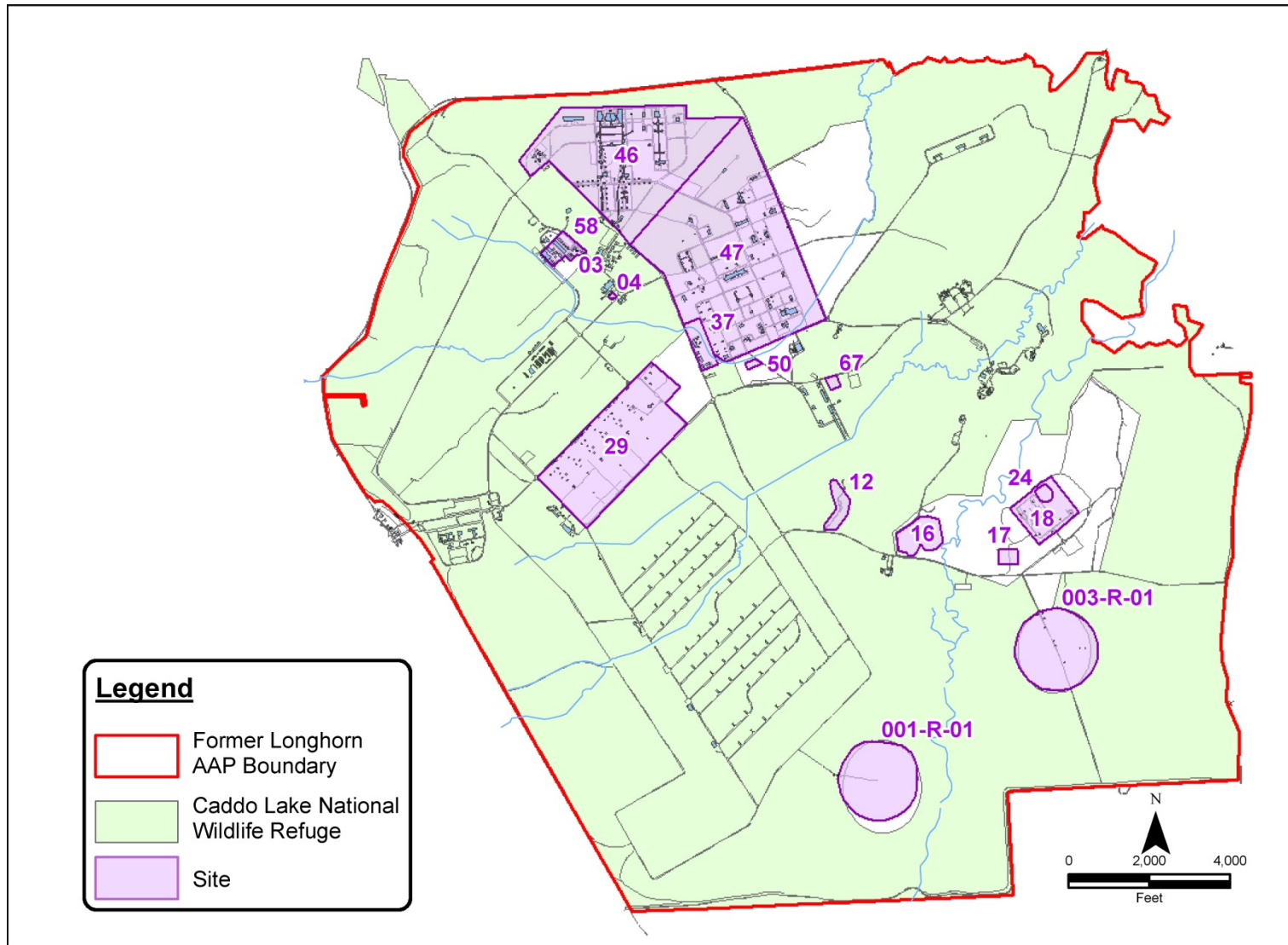
- Restoration Advisory Board
- Meeting Schedule
- Meeting Minutes
- CERCLA Investigation and Remediation Process
- LHAAP Fact Sheets
- **Final Record of Decisions (RODs) Approved «**

Site-wide Environmental Restoration Issues

Active LHAAP Performance-Based Remediation Sites

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	South Test Area/Bomb Test Area
LHAAP-003-R	Ground Signal Test Area

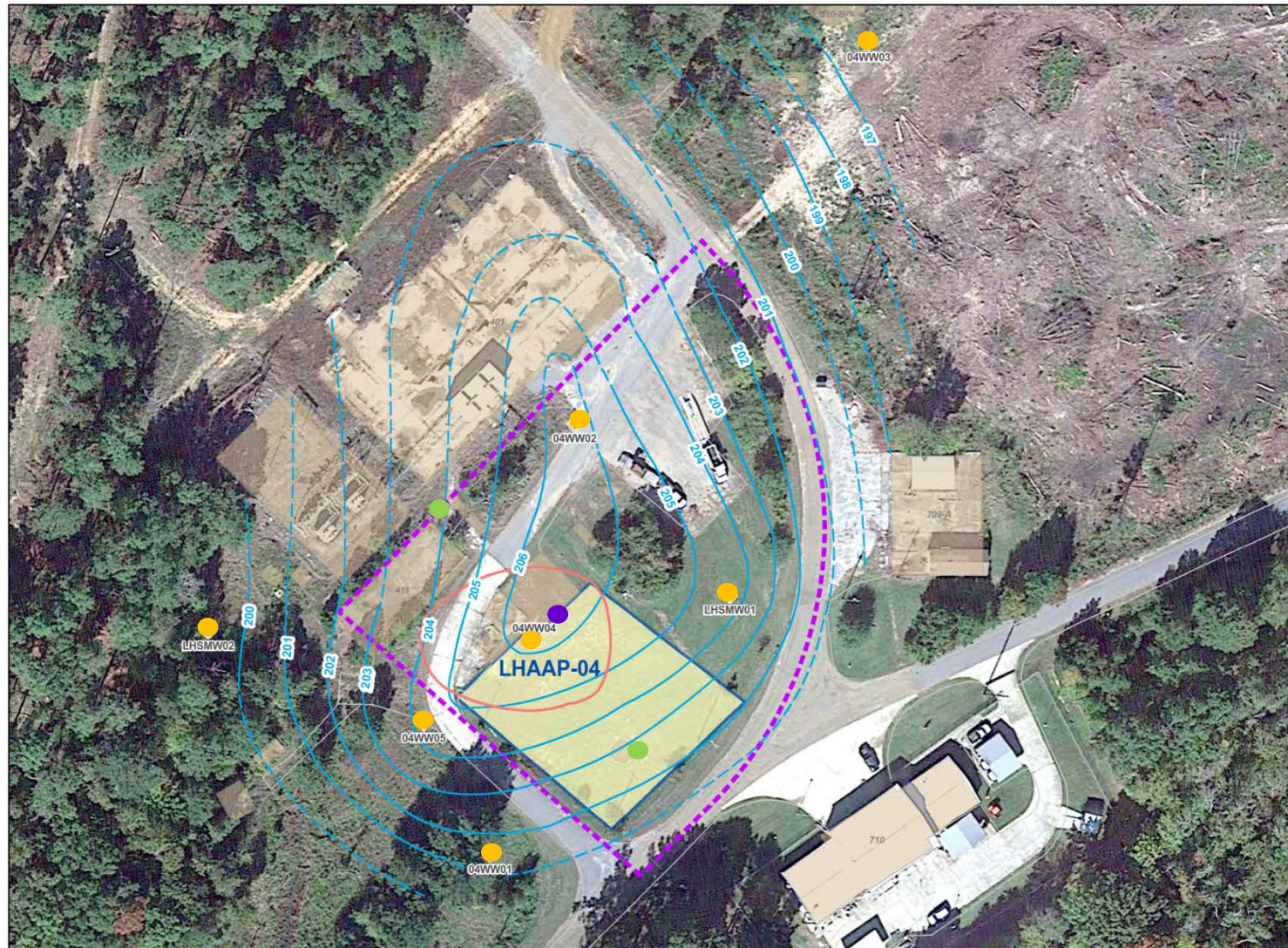
Longhorn Performance-Based Remediation Sites Map



LHAAP-04 – Final Record of Decision

- LHAAP-04 – Former Pilot Wastewater Treatment Plant
 - 0.5 acres
 - Wastewater treatment began in 1984
 - Plant demolished in 1997
 - Mercury and perchlorate contaminated soil excavated and disposed off-site in 2009
 - Perchlorate detected in shallow zone groundwater at concentrations exceeding the TRRP Tier 1 residential groundwater PCL
- Final Record of Decision (ROD)
 - Signed by Army BRAC December 15, 2017
 - Concurrence by TCEQ February 7, 2017
 - Signed by EPA March 30, 2017

LHAAP-04 – Final Record of Decision



Legend

- Shallow Monitoring Well
- Proposed Shallow Monitoring Well
- Proposed Intermediate Monitoring Well
- Groundwater Contour Interval 2010 (Dashed Where Inferred)
- Perchlorate Plume Extent (PCL - 17 µg/L)
- - - Stream
- Road
- Building
- LHAAP-04 Site Boundary
- Preliminary Land Use Control Boundary

Source:
 Final Record of Decision LHAAP-04 for Longhorn
 Army Ammunition Plant, Karnack Texas (AECOM,
 2016).



LHAAP-04 – Final Record of Decision

- Remedial Action Objectives (RAOs)
 - Protect human health by preventing ingestion of groundwater contaminated with perchlorate;
 - Return groundwater to its potential beneficial use, wherever practicable, within a reasonable time period given the particular site circumstances; and
 - Prevent groundwater contaminated with perchlorate from migrating into nearby surface water.
- Selected Remedy:
 - In-Situ Bioremediation (ISB);
 - Long-Term Monitoring (LTM) of Groundwater; and
 - Land Use Controls (LUCs):
 - Maintain integrity of remedial or monitoring systems
 - Prevent use of groundwater as potable water source
 - Restrict land use to nonresidential

LHAAP-04 – Final Record of Decision

- Initial Notice of Land Use Controls to Public Officials sent June 26, 2017
- Public Notice of Availability of ROD
 - Marshall Newspaper publication
 - Mailouts via USPS to local officials
 - LHAAP Website
- Copy of the Final ROD is available to the public at the Marshall Public Library, 300 S. Alamo, Marshall, Texas, 75670
 - Library hours are 10:00 A.M. to 8:00 P.M. Monday through Thursday, and 10:00 A.M. to 5:30 P.M. Friday and Saturday.
- Copies of Responsiveness Summaries and Fact Sheets at sign-in table.
- For more information, contact Dr. Rose M. Zeiler, Longhorn Army Ammunition Plant, P.O. Box 220, Ratcliff, Arkansas, 72951; phone number 479-635-0110; e-mail rose.m.zeiler.civ@mail.mil.

LHAAP-04 – Post-ROD Schedule

- Post ROD Schedule
 - Draft Remedial Design – March 2018
 - Draft Remedial Action Work Plan – August 2018

LHAAP-16 – Remedial Design

- LHAAP-16 Landfill
 - Landfill received solid and industrial waste until 1980s
 - Harrison Bayou located along northeastern edge of site
 - COCs are trichloroethene [TCE], cis-1,2-dichloroethene [DCE], vinyl chloride [VC]), perchlorate, and five metals
 - In 1996 and 1997 a groundwater extraction system was installed as a treatability study to prevent the groundwater plume from migrating to Harrison Bayou
 - Final ROD issued September 2016
 - Selected remedy: cap maintenance, ISB, Biobarriers, Monitored Natural Attenuation (MNA), and LUCs
- LHAAP-16 Remedial Design finalized January 2017

LHAAP-16 – Remedial Design

- LHAAP-16 Remedial Design

- Landfill Cap Maintenance

- Monitor, maintain, and repair the existing landfill cap, as necessary.
 - Perform cap inspections annually or as needed to evaluate vegetation, erosion, settlement, and drainage system.

- In-Situ Bioremediation (ISB)

- Emulsified vegetable oil will be used to reduce contaminant concentration in most contaminated portion of Shallow and Intermediate Zone groundwater (referred to as Mid-Plume ISB).

- Biobarriers (ISB)

- Three (3) biobarriers installed in shallow zone groundwater immediately downgradient of landfill (Biobarriers #1, #2, #3).
 - One (1) biobarrier near Harrison Bayou in Shallow Zone groundwater to prevent contaminated groundwater from seeping into the bayou.

LHAAP-16 – Remedial Design

- LHAAP-16 Remedial Design (continued)
 - Performance Monitoring/MNA
 - First two years:
 - Monitor groundwater in the areas of active ISB to evaluate its effectiveness and to assess changes in groundwater geochemistry, concentrations of COCs, and their degradation products.
 - Perform quarterly groundwater monitoring to evaluate changes in concentrations of COCs and their degradation products in the areas outside the influence of active ISB. The eight quarters will be used to evaluate if MNA is effective, or if contingency action should be initiated.
 - If MNA is shown to be effective based on the first two years of data, implement LTM on a semiannual frequency for three years, then annually until the next five-year review.

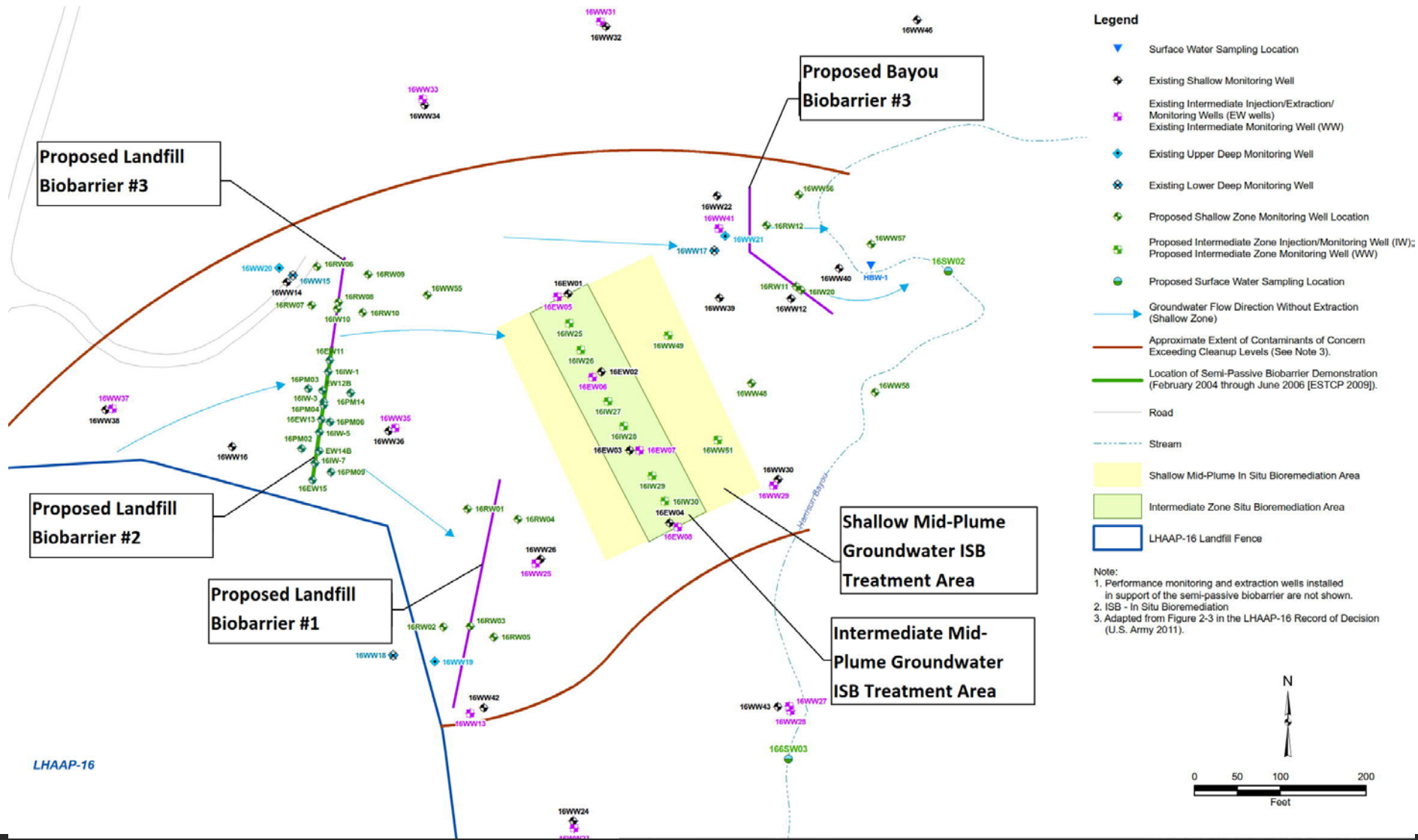
LHAAP-16 – Remedial Design

- LHAAP-16 Remedial Design (continued)
 - Land Use Controls
 - Prohibit access to contaminated groundwater except for environmental monitoring and testing;
 - Preserve the integrity of the landfill cap and restrict intrusive activities (e.g., digging) that would degrade or alter the cap;
 - Restrict land use to nonresidential; and
 - Maintain the integrity of any current or future remedial or monitoring systems.
 - LUCs will remain in place as long as the landfill waste remains at the site or until the levels of COCs and COC by-products (i.e., including all hazardous substances, pollutants, and contaminants found at the site at cleanup levels) allow for unlimited use and unrestricted exposure.

LHAAP-16 – Remedial Design

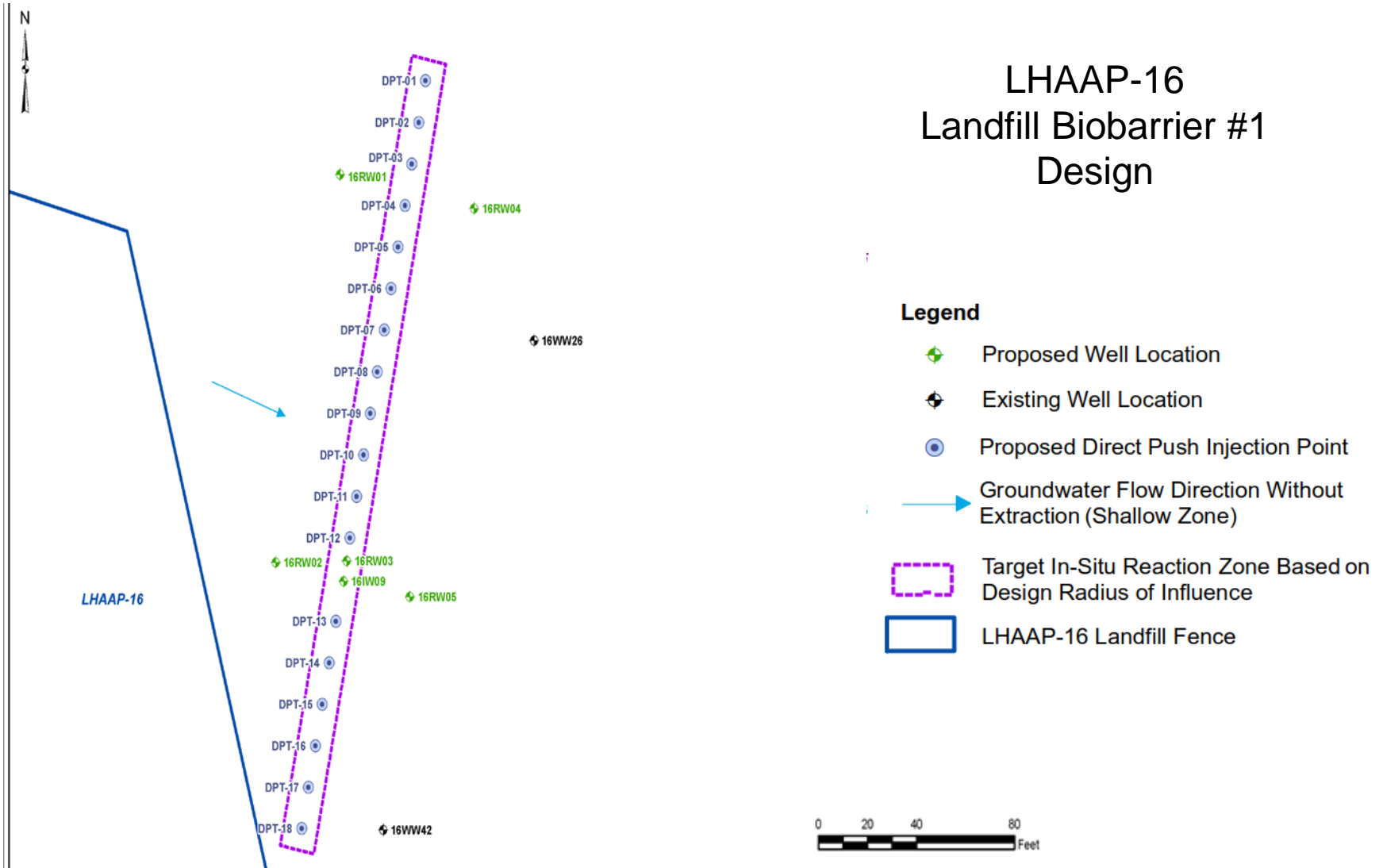
- LHAAP-16 Remedial Design (continued)
 - Land Use Controls Implementation
 - Initial Notice: Initial notices of soil and groundwater contamination and land use restrictions were submitted to federal, state and local governments involved, and owners and occupants of properties subject to LUCs.
 - Finalizing LUC Boundaries: LUC boundaries will be finalized, approved by TCEQ and EPA, and a legal description appended to the survey plat.
 - Recording: LUCs will be recorded in Harrison County records.
 - Notification: The Texas Department of Licensing and Regulation will be notified of the LUCs.

LHAAP-16 – Remedial Design



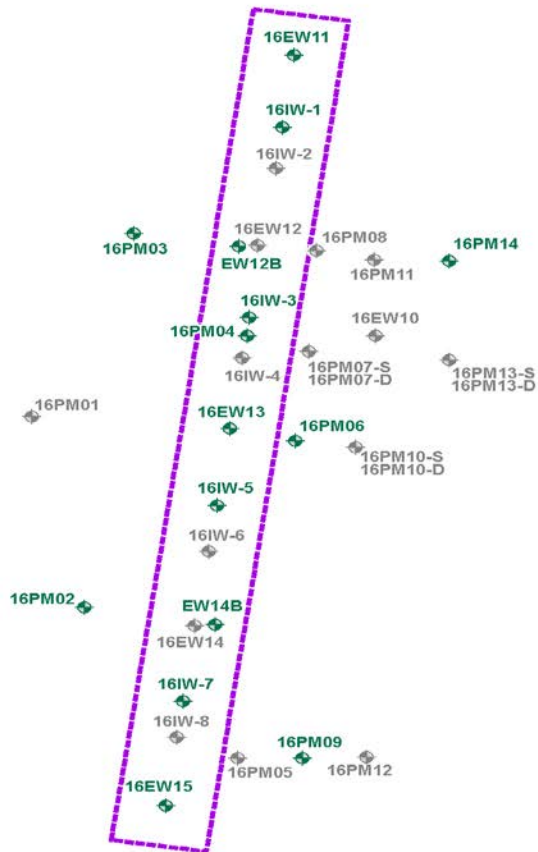
LHAAP-16

LHAAP-16 – Remedial Design








LHAAP-16 – Remedial Design

LHAAP-16 Landfill Biobarrier #2 Design



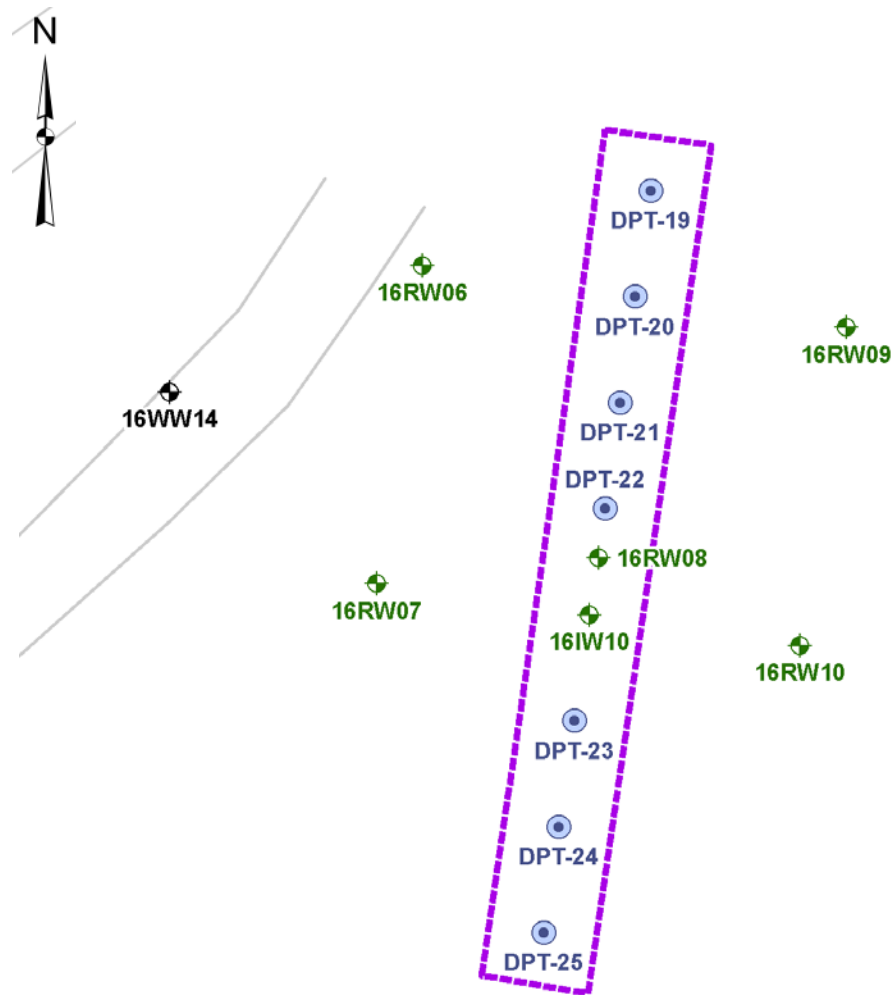
Legend

-  Existing In-Situ Bioremediation Injection/Extraction/Performance Monitoring Well
-  Existing Monitored Natural Attenuation Performance Monitoring Well
-  Other Existing Monitoring Well
-  Target In-Situ Reaction Zone Based on Design Radius of Influence
-  LHAAP Landfill Fence





LHAAP-16
Landfill

LHAAP-16 – Remedial Design

LHAAP-16 Landfill Biobarrier #3 Design

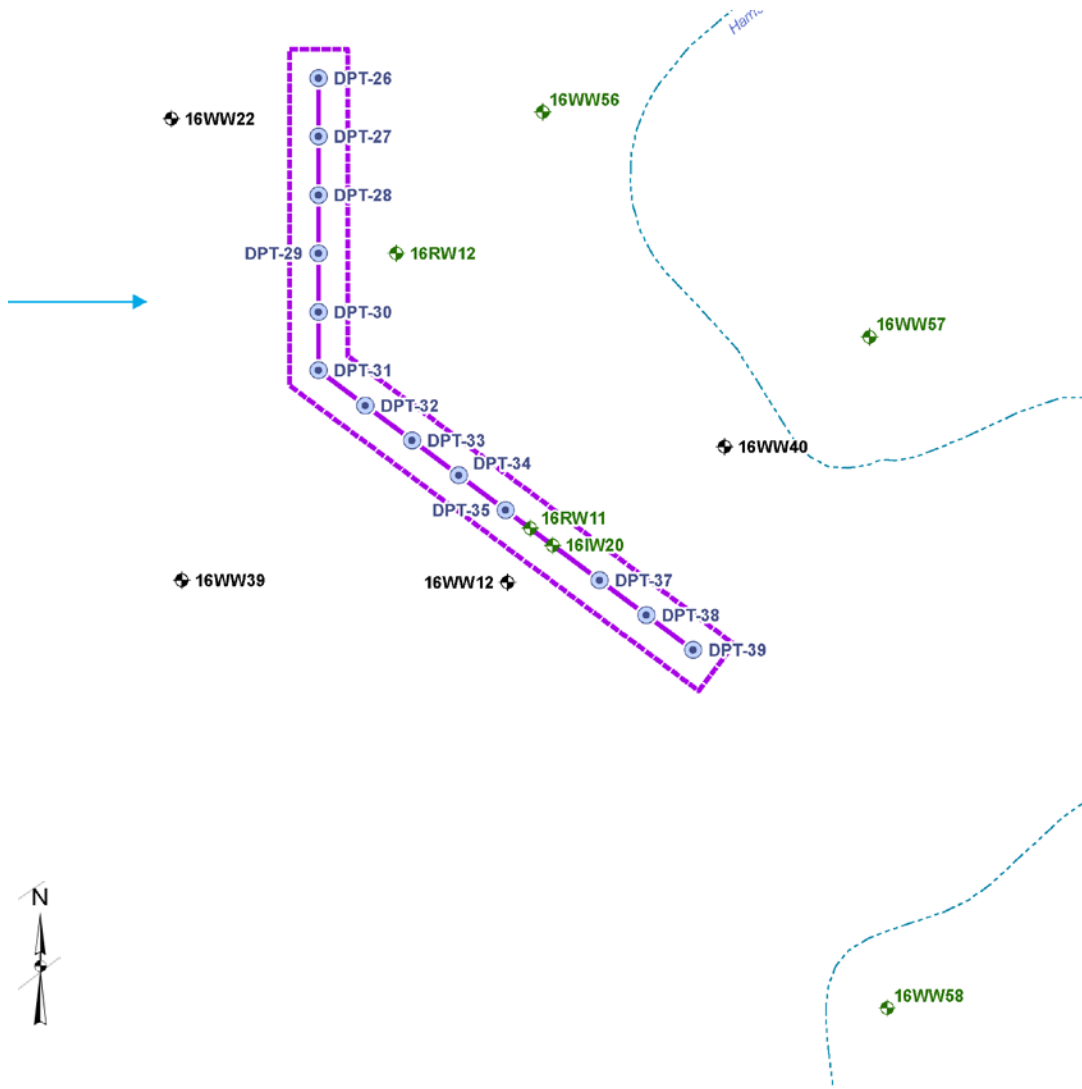


Legend






-  Existing Shallow Monitoring Well
-  Proposed Shallow Well Location
IW -- Injection Well Location
RW - Recovery Well Location
-  Proposed Direct Push Injection Point
-  Target In-Situ Reaction Zone Based on Design Radius of Influence

LHAAP-16 – Remedial Design

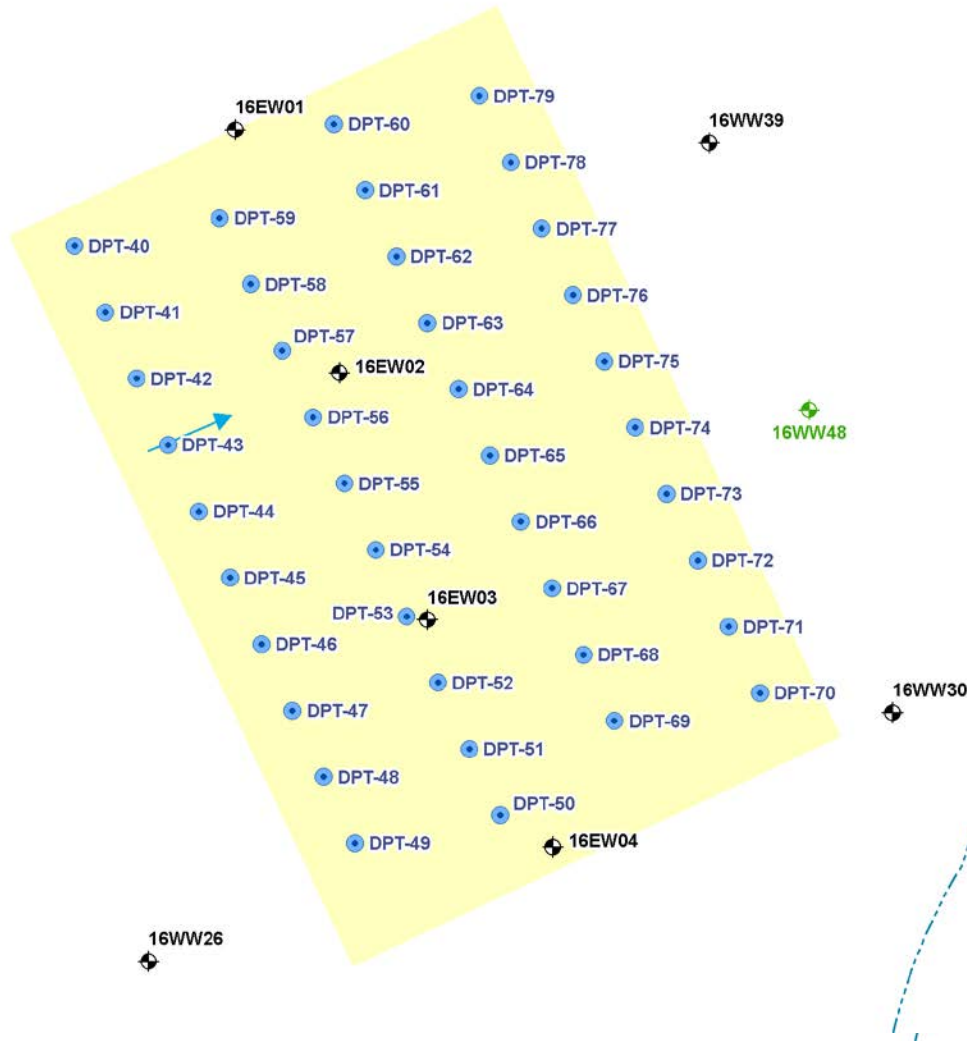
LHAAP-16 Bayou Biobarrier Design



Legend

-  Proposed Direct Push Injection Point
-  Proposed Shallow Well Location
IIW = Injection Well
RW = Recovery Well Location
-  Existing Shallow Monitoring Well Location
-  Groundwater Flow Direction Without Extraction (Shallow Zone)
-  Target In-Situ Reaction Zone Based on Design Radius of Influence

LHAAP-16 – Remedial Design



LHAAP-16 Shallow Mid Plume GW ISB Design

Legend

- Existing Shallow Monitoring Well (WW) or Extraction Well (EW) Location
- Proposed Shallow Monitoring Well Location
- Proposed Direct Push Injection Point
- Stream
- Groundwater Flow Direction Without Extraction (Shallow Zone)
- Shallow In Situ Bioremediation Area
- LHAAP-16 Landfill Fence

LHAAP-16 – Remedial Design

LHAAP-16 Intermediate Mid Plume GW ISB Design

Legend



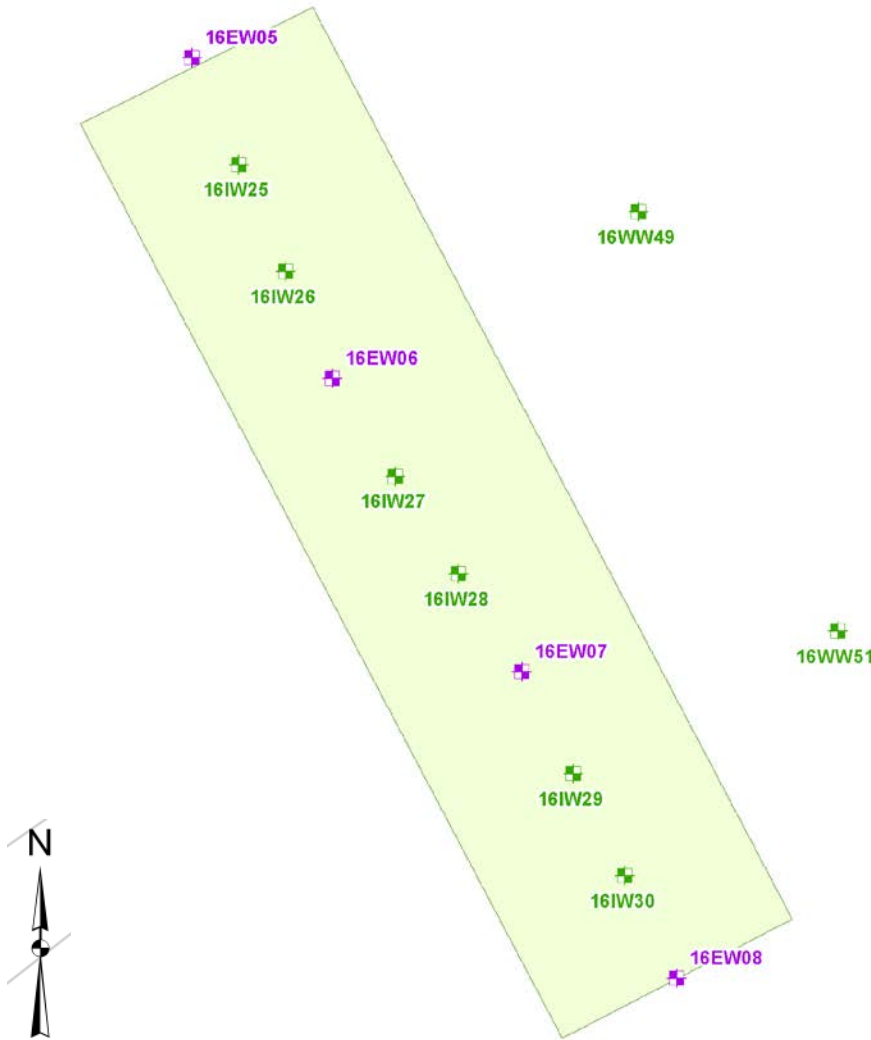
Existing Intermediate Injection/Extraction/Monitoring Well (EW well)
Existing Intermediate Monitoring Well (WW)



Proposed Intermediate Zone Injection/Monitoring Well (IW);
Proposed Intermediate Zone Monitoring Well (WW)



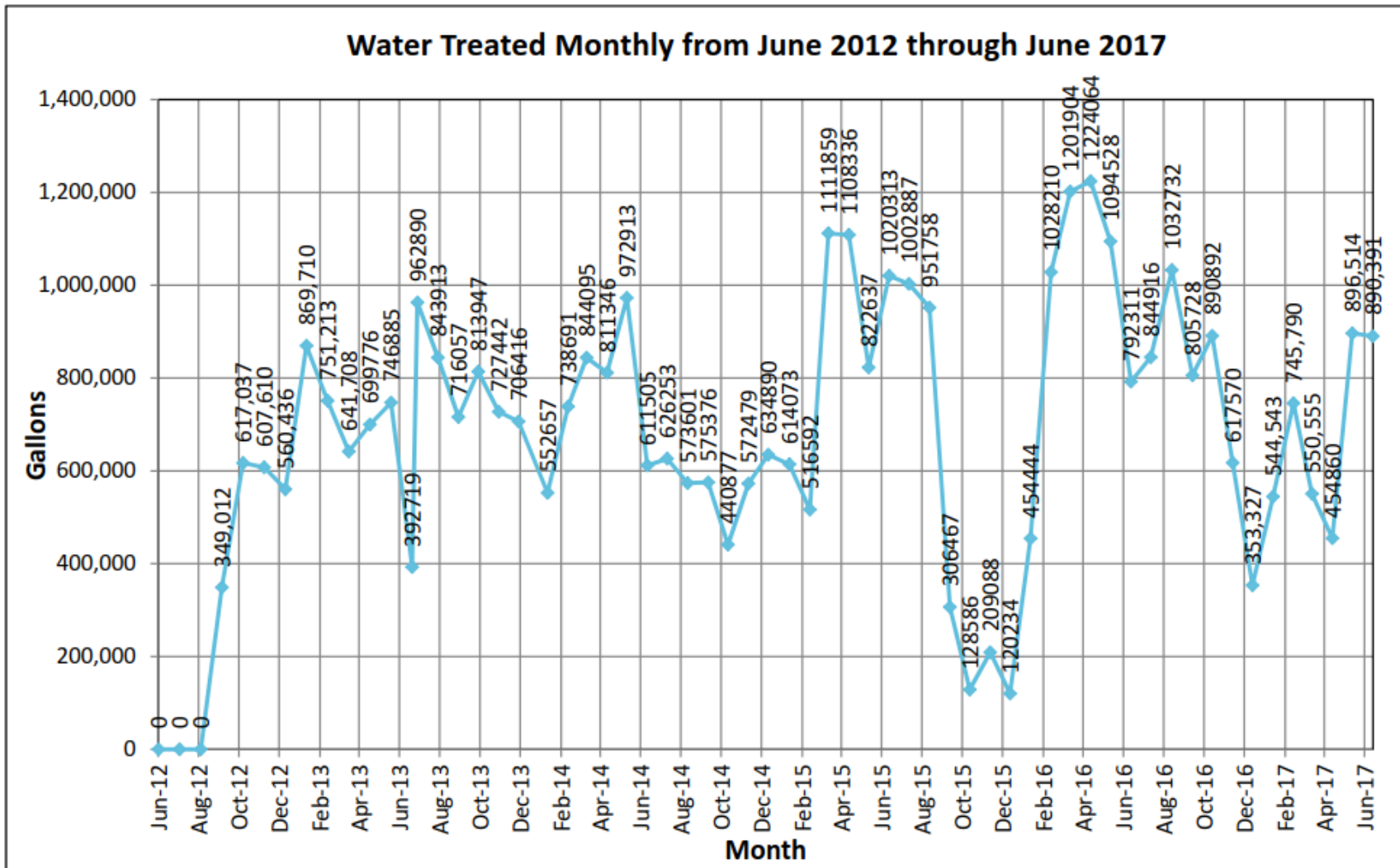
Intermediate Zone Situ Bioremediation Area



Groundwater Treatment Plant (GWTP) Update

- Acid spill occurred in December 2016. Spilled materials were contained and neutralized within the GWTP
- GWTP was put into internal recycle mode (limited extraction, limited discharge) until perchlorate levels were below discharge limits in March 2017
- Extraction and discharge rates were gradually increased in April 2017 with increased monitoring to ensure compliance
- Ion exchange scavenger system was installed in May 2017
- Since May 2017, the GWTP has been extracting, treating, and discharging water at normal flow rates

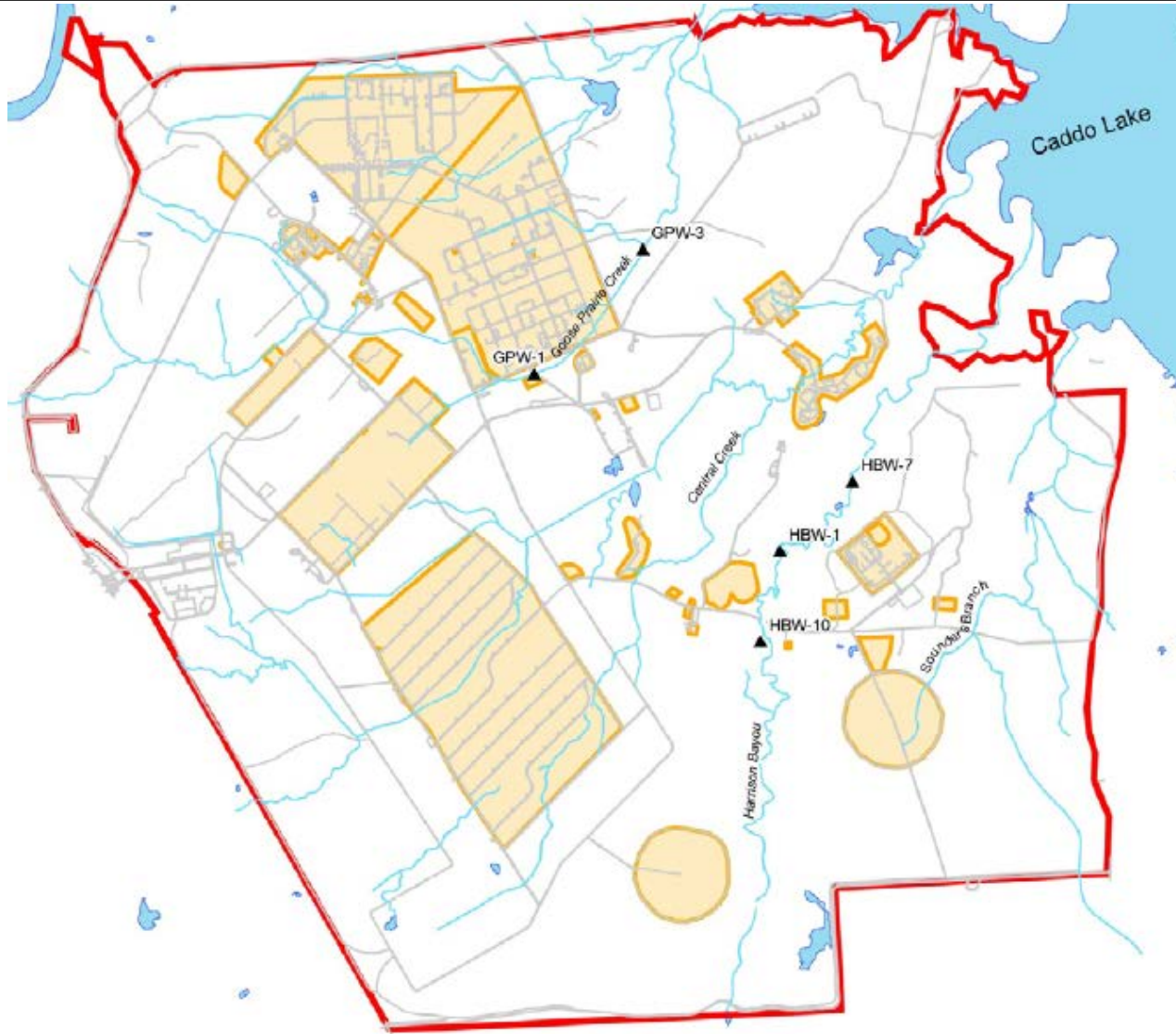
GWTP Update (continued)



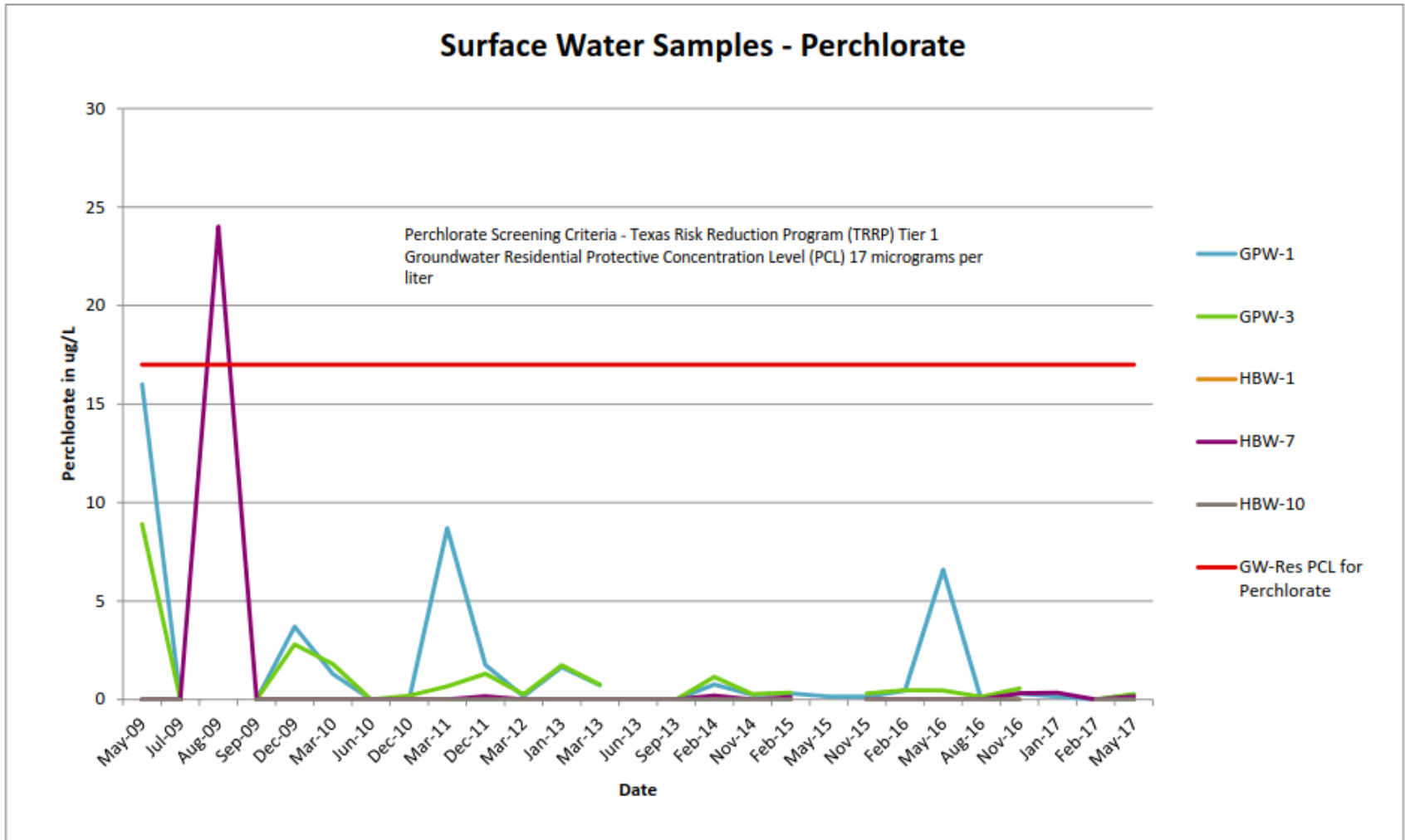
Deliverables, Environmental Contract Ending

- Current AECOM PBR contract ends September 30, 2017
- The remaining AECOM contract deliverables (reports and plans) are:
 - Final LHAAP-29 Feasibility Study (FS)
 - Final LHAAP-12 2016 RAO
 - Groundwater Treatment Plant Operation and Reporting

Surface Water Sampling Locations



Surface Water Sampling



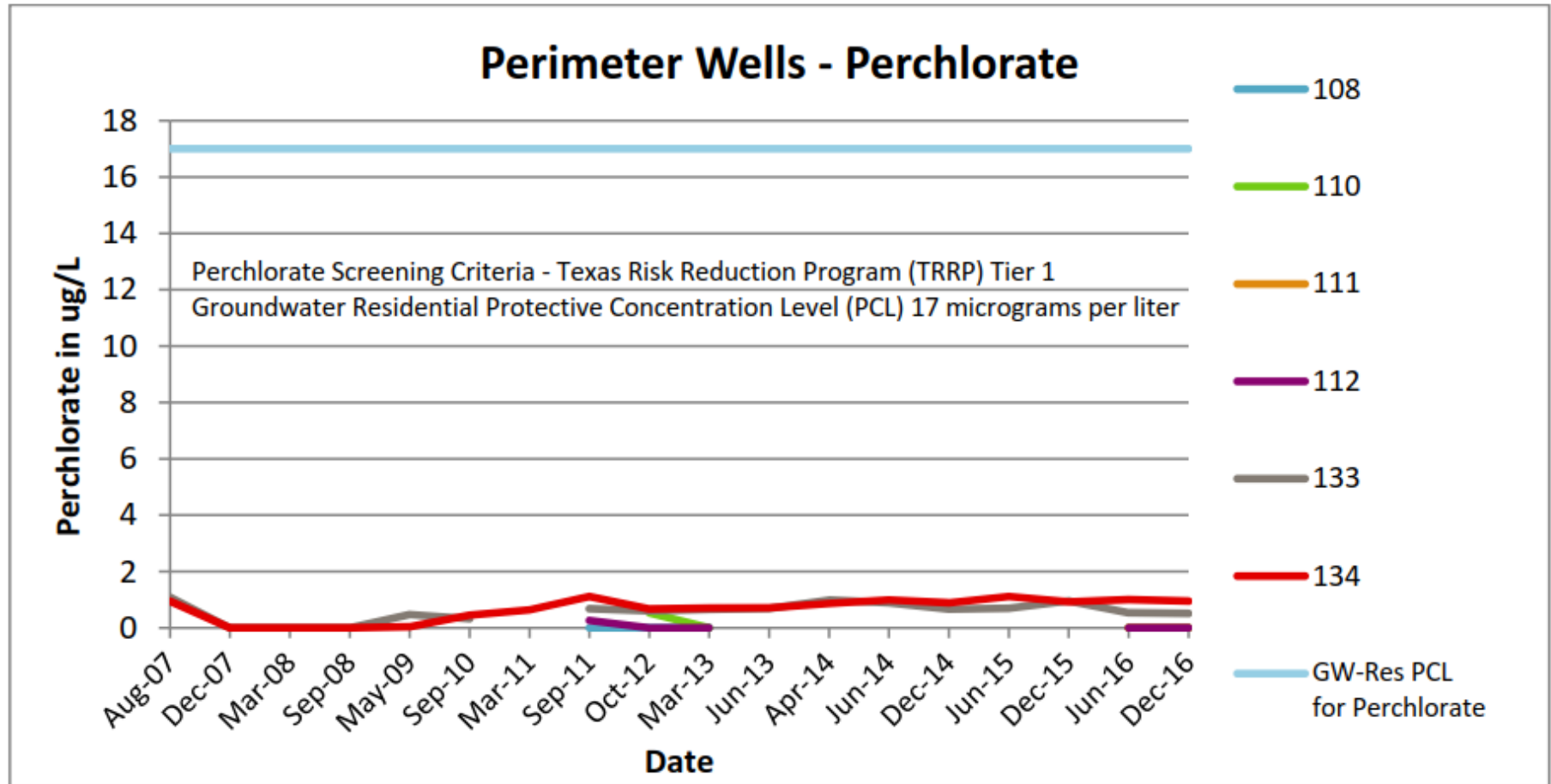
GPW – Goose Prairie Creek
HBW – Harrison Bayou

Perimeter Well Sampling

- A decision was made by the FFA representatives on January 31, 2017 regarding the perimeter well sampling that has been taking place as a requirement of the 1999 Unanimous Decision of the Dispute Resolution Committee.
- FFA representatives agreed that perimeter well sampling should be discontinued.

Perimeter Well Sampling

Perimeter sampling discontinued. Last samples collected Nov/Dec 2016.



Next RAB Meeting Schedule and Closing Remarks

- Schedule October 2017 RAB Meeting
- Other Issues/Remarks?

Questions?



Groundwater Treatment Plant - Processed Groundwater Volumes

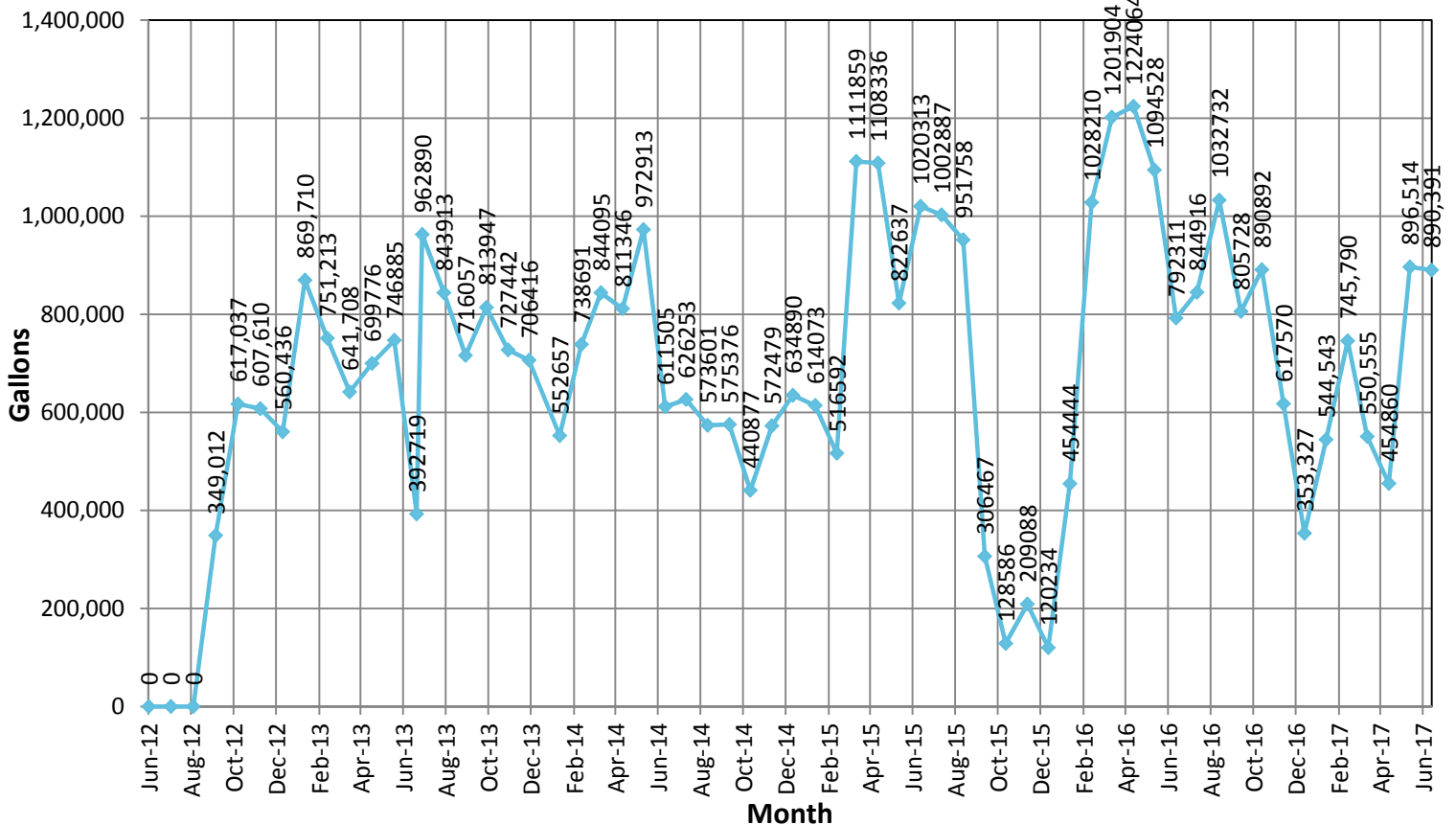
The amount of groundwater treated is determined by measuring the number of gallons of processed water.

Processed 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	843,913	716,057
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	706,416	552,657	738,691	844,095	811,346	972,913	611,505	626,253	573,601	575,376
Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15
440,877	572,479	634,890	614,073	516,592	1,111,859	1,108,336	822,637	1,020,313	1,002,887	951,758	306,467
Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16
128,586	209,088	120,234	454,444	1,028,210	1,201,904	1,224,064	1,094,528	792,311	844,916	1,032,732	805,728
Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17			
890,892	617,570	353,327	544,543	745,790	550,555	454,860	896,514	890,391			

*Indicates Estimate

Water Treated Monthly from June 2012 through June 2017



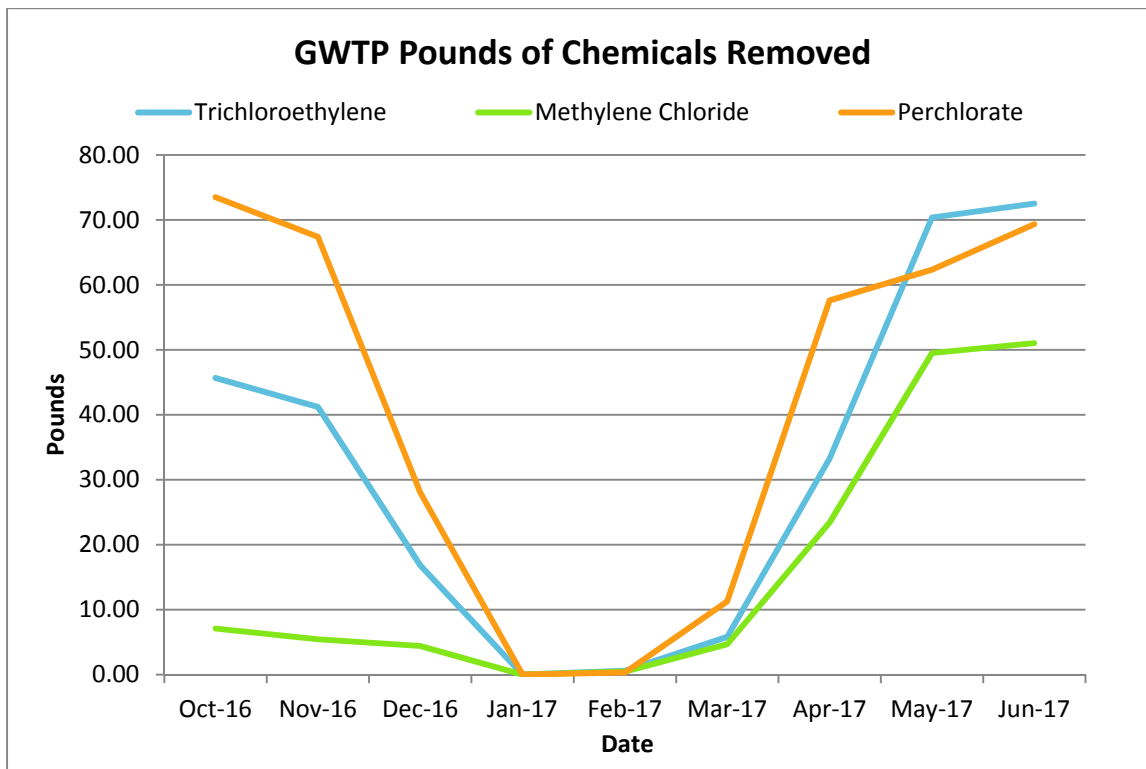
The pounds of chemicals removed for the 4th Quarter of 2016 and 1st and 2nd Quarters of 2017 can be found below and are calculated by the following formula:

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

Approximate Amount of Pounds of Chemicals Removed From LHAAP-18/24

	Trichloroethylene	Methylene Chloride	Perchlorate
Oct-16	45.65	7.08	73.49
Nov-16	41.21	5.44	67.39
Dec-16	16.85	4.40	28.05
Jan-17	0.00	0.00	0.00
Feb-17	0.59	0.47	0.32
Mar-17	5.82	4.67	11.28
Apr-17	33.28	23.41	57.60
May-17	70.38	49.51	62.35
Jun-17	72.52	51.02	69.34

ND – no data available



Water Discharge Location and Volume (Gallons)

Month	Harrison Bayou	LHAAP-18/24 Sprinklers	INF Pond	INF Pond to Harrison Bayou	Contract Hauled Off-Site
Oct-16	0	642,876	0	0	0
Nov-16	0	576,898	0	0	0
Dec-16	0	236,688	0	0	0
Jan-17	0	0	0	0	0
Feb-17	0	0	0	0	14,355
Mar-17	127,242	0	0	0	14,400
Apr-17	113,038	0	236,821	0	0
May-17	205,665	0	534,155	0	0
Jun-17	467,830	0	294,550	490,574	0

LHAAP-Quarterly Surface Water Sampling - December 2017

Location ID: Sample Date:	Units	MCL/MSC	HBW7_122617 12/26/17	HBW10_122617 12/26/17	HBW1_122617 12/26/17	GPW1_122617 12/26/17	GPW3_122617 12/26/17
Perchlorate (6850)			Harrison Bayou			Goose Prairie Creek	
Perchlorate	µg/L	72	< 4.0 U	< 4.0 U	1.1 J	< 4.0 U	< 4.0 U

MCL/MSC - Maximum Contaminant Limit/Medium-Specific Concentrations

µg/L - micrograms per liter

J - Estimated: The analyte was positively identified, the quantitation is between the method detection limit and reporting limit

U - Undetected: The analyte was analyzed for, but not detected.