DEPARTMENT OF THE ARMY
LONGHORN ARMY AMMUNITION PLANT
POST OFFICE BOX 220
RATCLIFF, AR 72951

February 16, 2021

DAIM-ODB-LO

Ms. Lauren Poulos
U.S. Environmental Protection Agency
Federal Facilities Section R6
1201 Elm Street, Suite 500
Dallas, TX 75202-2102

Re: Final Pre-Design Investigation Work Plan, LHAAP-29, Former TNT Production Area Group 2, Longhorn Army Ammunition Plant, Karnack, Texas

Dear Ms. Poulos,

An electronic copy of the above-referenced document is being transmitted to you for your records. The document includes revisions based upon the Texas Commission on Environmental Quality (TCEQ) and Environmental Protection Agency's (EPA) comments on the Draft received December 15, 2020 and December 16, 2020, respectively, and revisions based upon the TCEQ comments on the Draft Final received January 27, 2021. Response to comments on the Draft and Draft Final versions of the document are included within this Final.

The document was prepared by HDR Environmental, Operations and Construction, Inc. (HDR) on behalf of the Army as part of HDR's contract for the facility. I ask that Phil Werner, HDR's Project Manager, be copied on any communications related to the project.

The point of contact for this action is the undersigned. I may be contacted at 479-635-0110, or by email at rose.m.zeiler.civ@mail.mil.

Sincerely,

Rose M. Zeiler

Rose M. Zeiler, Ph.D.
Longhorn AAP Site Manager

Copies furnished:
A. Palmie, TCEQ, Austin, TX (1 electronic only)
A. Williams, USACE, Tulsa District, OK (1 electronic only)
R. Smith, USACE, Tulsa District, OK (1 electronic only)
A. Maly, USAEC, San Antonio, TX (1 electronic only)
T. Toudouze, USAEC, San Antonio, TX (1 electronic only)
L. Zographos, USAEC, San Antonio, TX (1 electronic only)

P. Bruckwicki, Caddo Lake NWR, TX (1 electronic only)
T. Burton, EPA ORD (1 electronic only)
K. Becher, USGS (1 electronic only)
K. Nemmers, Bhate CNTR (1 electronic only)

DEPARTMENT OF THE ARMY
LONGHORN ARMY AMMUNITION PLANT
POST OFFICE BOX 220
RATCLIFF, AR 72951

February 16, 2021

DAIM-ODB-LO

Ms. April Palmie
Texas Commission on Environmental Quality
Superfund Section, MC-136
12100 Park 35 Circle, Bldg D
Austin, TX 78753

Re: Final Pre-Design Investigation Work Plan, LHAAP-29, Former TNT Production Area Group 2, Longhorn Army Ammunition Plant, Karnack, Texas

Dear Ms. Palmie,

An electronic copy of the above-referenced document is being transmitted to you for your records. The document includes revisions based upon the Texas Commission on Environmental Quality (TCEQ) and Environmental Protection Agency's (EPA) comments on the Draft received December 15, 2020 and December 16, 2020, respectively, and revisions based upon the TCEQ comments on the Draft Final received January 27, 2021. Response to comments on the Draft and Draft Final versions of the document are included within this Final.

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Longhorn AAP Site Manager

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L. Poulos, USEPA Region 6, Dallas, TX (1 electronic only)
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P. Bruckwicki, Caddo Lake NWR, TX (1 electronic only)
K. Nemmers, Bhate CNTR, (1 electronic only)

Comments Response Matrix
Draft Report: Pre-Design Investigation Work Plan, LHAAP-29, Former TNT Production Area Group 2, Longhorn Army Ammunition Plant, Karnack, Texas
Submitted: November 2, 2020

-
Submitted by: William Rhotenberry EPA RPM Superfund Division Region 6
Responded by: Phil Werner, HDR
Date Responded: 12/16/2020

1. **Respondent concurs (C) or does not concur (D)**
2. **Commenter agrees (A) or does not agree (D) with response.**

Number	Section/Page	Paragraph/Line	Comment	C,D	Response	A,D
Reviewer #1:						
1	Figure 1		See typo on figure "Ammunition" spelled wrong on pop out name	C	Concur. Per a comment submitted by TCEQ, Figure 1 will be removed altogether and replaced with current Figure 2.	
2	Page 1-1	Section 1.1	First paragraph, suggest adding a figure here that just shows the different production pipelines.	C	Concur. The LHAAP location map (Figure 1) will be replaced by current Figure 2 and a new figure (Figure 2 revised) will be added to show the site features, solely.	
3	Page 1-1	Section 1.1, first paragraph, last sentence	Sentence states that site features are located on figure 2. However, figure 2 is just the location on LHAAP.	C	Concur. The LHAAP location map (Figure 1) will be replaced by current Figure 2 and a new figure (Figure 2 revised) will be added to show the site features, solely.	
4	Page 1-2	1st paragraph	Please add MNA to acronym list. Please add period to last sentence of paragraph. Suggest referring to figure that identifies plumes described at end of paragraph.	C D	Concur. MNA added to the acronym list. Since this is primarily a soil investigation to determine extent and estimated volume of explosives-impacted soils, a reference map showing groundwater plumes may be confusing or misleading. As such, the following text will be deleted from the work plan, "The depth of the shallow groundwater zone generally ranges from 17 to 45 ft bgs because of variable ground surface elevations across the site. The intermediate zone is less defined, but its depth has been measured to approximately 88 ft bgs. There are 3 shallow and one intermediate zone plumes at LHAAP-29."	

Number	Section/Page	Paragraph/Line	Comment	C,D	Response	A,D
5	Page 1-2	Section 1.2	Please add MSC GWP-Ind to acronym list.	C	Concur. The acronym GWP-Ind has been revised in the acronym list to state, "medium-specific concentration for industrial use based on groundwater protection" per TCEQ comment to follow the Final LHAAP-29 ROD description.	
6	Figure 3		Figure is extremely busy. Suggest having figure of with just the water lines and its features. Then a figure with historic data associated with those water lines. Then figure showing new proposed locations. Also, some things hard to read on figure such as last line in key for color coded standards, such as the gray one. Hard to tell when water line samples were collected and if there is data associated with them. Looks like manholes include data, but don't see any data for water lines. After further review there are other individual DPT location maps which helps.	C	The LHAAP location map (Figure 1) will be replaced by current Figure 2 and a new figure (Figure 2 revised) will be added to show the site features, solely. Figure 3 (current) will be retained with all information and site features but expanded onto 11 x 17 sized paper. The color scheme for the historic data will also be revised to enhance intensity, which will make the data easier to review. Separate maps already developed and included in the draft report will remain.	
7	Page 2-1	Building 812-F, First paragraph, third sentence	So are the four-feet intervals going to composited and if so, how is that being conducted?	C	Concur. The sentence has been revised to state, "Sample depths will be selected based on visual signs of contamination and/or presence of an odor, but will generally be collected *as a grab sample* within *the* 4 foot intervals (i.e., 0 - 4 ft bgs, 4 - 8 ft bgs, 8 - 12 ft bgs, and 12 - 16 ft bgs)."	
8	Page 2-1	Building 812-F, Second paragraph, first sentence	Suggest showing concentrations in same units as the MSC soil standard being uses, so convert these to mg/kg.	C	Concur. Units have been switched to milligrams per kilogram.	
9	Figure 3		Need to identify units for 29SG118 (mg/kg). Legend indicates a stream, but don't see one on the map. Suggest removing unless there is a stream within view of map.	C D	Concur. A note will be included in all three call out boxes that state units are in milligrams per kilogram (mg/kg). Do not concur. A stream is located on the base map at the eastern terminus of the TNT cooling water drain line (south) at sample location 29WL47 and in the pop up boxes for Cooling Water Outfall/Ditch B & C.	

Comments Response Matrix
Draft Report: Pre-Design Investigation Work Plan, LHAAP-29, Former TNT Production Area Group 2, Longhorn Army Ammunition Plant, Karnack, Texas
Submitted: November 2, 2020

Number	Section/Page	Paragraph/Line	Comment	C,D	Response	A,D
10	Page 2-2	Cooling Water Outfall/Ditch	For the area near building 812-F, samples are being collected down to 16 feet and at 4 feet intervals. Here the total depth is 8 feet and samples collected every 2 feet. What is the rationale for depths and interval sampled? Based on historical data?		Correct, sample collection depths are based on historic data. Detected di- and trinitrotoluene's were detected between 0.5 and 2 feet below ground surface.	
11	Figure 5		Need to add units to figure for concentrations detected. In addition, assume green coloration is current known extend of soil contamination. Need to add identification within the legend for green areas. Red triangles and labels need to be identified in legend as well.	C	Concur. A note will be included in all three call out boxes that state units are in milligrams per kilogram (mg/kg). Correct, the green areas denote the extent of soil contamination identified in the 2010 Shaw Final Feasibility Study. The green areas and red triangles/labels will be added to the legend with descriptions.	
12	Page 2-3	First paragraph	For 2-aminao-4, 6-DNT concentration of 19 is qualified with a JH. Not sure what the H qualifier might be. Could it be more like J+ where estimated value is biased high?	C	Correct, the value is estimated and biased high. The Shaw 2010 Final Feasibility Study lists the qualifier for this result (and others) as "concentration is estimated and biased high". This text has been added to the sentence, [JH = estimated biased high].	
13	Figure 6		Same comment as figure 5 regarding identifying green shaded area. Should there be labels on points shown in Building 812-A-A pop out?	C D	Concur. Figure 6 has been revised to remove the call out boxes, since these are presented in Figure 3 and then again in separate figures dedicated to each area (812-F and Cooling water outfall/ditch. The green areas and units have been added to the legend on Figure 5	
14	Page 2-3	Last paragraph	Suggest including concentrations of exceedances to text as it was done in previous paragraphs.	C	Concur. Concentrations will be added to the text for each exceedance.	
15	Table 1		Are the numbers of samples collected and QA/QC correct in this table? For instance, text indicates 8 soil borings at the Cooling Water/Outfall/Ditch at 0 to 2 ft, 2-4 ft, 4 to 6 ft and 6-8 ft. So that would be 32 samples correct? Also, would need to have 3 duplicates if that was the case. Also, table label indicates soils and groundwater samples to be collected, but no water samples are listed in table.	C	The table has been revised to indicate 32 grab samples will be collected and the appropriate number of QA/QC samples (10% for duplicate samples and 5% for MS/MSD samples). "Groundwater" has been removed from the table.	

Number	Section/Page	Paragraph/Line	Comment	C,D	Response	A,D
16	Table 3		Assume coordinates could be provided here from GIS for field team to locate when arriving on site and then a more accurate GPS location will be collected with the Trimble. Suggest adding anticipated sampling depths and intervals here as well.	D/E	Table 2 provides GPS coordinates that are known locations of the pipelines. These will be used by the field team to orient and locate the pipelines in the field. GPS coordinates will then be collected identifying the location where the sample was collected. Sample depths, as described in the work plan, will be collected based on the following, "Sample depths will be selected based on visual signs of contamination and/or presence of an odor, but generally a grab sample will be collected within every 4 foot interval (i.e., 0-4 ft bgs, 4-8 ft bgs, 8-12 ft bgs and 12-16 ft bgs)." As such, they will be determined in the field. However, the depth range will be added to each area header.	
17	Page 2-5	Section 2.4, first paragraph	Please add DQOs to acronym list.	C	Concur. Acronym added to list.	
18	Page 2-5	Section 2.4	Suggest including a discussion about equipment blanks since they are listed in Table 3.	C	Concur. A summary will be added on equipment blanks.	
19	Acronym list		Suggest removing NELAP since not used in text.	C	Concur. Acronym removed from list.	

Comments Response Matrix
Draft and Draft Final Report: Pre-Design Investigation Work Plan, LHAAP-29, Former TNT Production Area Group 2, Longhorn Army Ammunition Plant, Karnack, Texas
Draft Submitted: November 2, 2020
Draft Final Submitted: January 12, 2021

Document Submitted by: Rose Zeiler, BRAC Field Manager
Comments Submitted by: April Palmie, TCEQ Superfund Section
Responded by: Phil Werner, HDR EOC
Date Responded: Draft **December 18, 2020, Draft Final February 4, 2021**

1. **Respondent concurs (C) or does not concur (D)**
2. **Commenter agrees (A) or does not agree (D) with response.**

Number	Section/ Page	Paragraph/ Line	Comment	C,D	Response	A,D	Draft Final Comments	C,D	Draft Final Response
April Palmie									
1.	Planning		Please plan to take photographs and include a photo log to document the field work in the PSI Report. I mention this because there was no photo log in the last 47 PSI report. Since we likely will not be able to join the field effort, please include photo documentation of line conditions and soil in vicinity.	C	Concur. Photographs will be taken of all lines where exposed and the soil conditions surrounding them and excavated soil. HDR will photograph all DPT cores per our SOP. Any other notable conditions will also be photographed. Text will be added to Section 2.5 to capture this.		Thank you for the notes on the photographic log. If you aren't already planning to, please also take some general photographs to show site conditions and field equipment.	C	Photographs will be taken of the general site conditions and field equipment used.
2.	General		Throughout document replace any "GWP Ind" with "GWP-Ind". It is helpful to include MSC in the text (GWP-Ind MSC) Define it this way on acronym list (copied from ROD): GWP-Ind medium-specific concentration for industrial use based on groundwater protection	C	Concur. All references to GWP Ind will be revised to GWP-Ind MSC. The acronym list will be revised per the comment.	A	None.		
3.	1.1/1-1	1st paragraph	Last sentence says Figure 2 has site features, which is not the case. It would be helpful to have a figure with the site features (lines, MW-s, and former buildings) without any data results. I don't think we need Figure 1 in this plan if you wanted to rename Figure 2 to 1 and add a new Figure 2.	C	Concur. The LHAAP location map will be replaced by current Figure 2 and a new figure (Figure 2 revised) will be added to show the site features, solely.	A	None.		
4.	2.1	General	The confirmation and other samples taken along the cooling and wastewater lines are all very far apart (about every 500 feet along a line). If contamination from the lines is found in soil above action levels, at what phase of work would these areas be delineated for soil removal?	C	Concur. If contamination is found in soil during the PDI investigation, a subsequent PDI Addendum investigation would be conducted to delineate area(s).	A	None.		

Number	Section/ Page	Paragraph/ Line	Comment	C,D	Response	A,D	Draft Final Comments	C,D	Draft Final Response
April Palmie									
5.	2.1, 2-3		Isn't this paragraph also true for the wooden and transite wastewater lines? There is no comparable statement for highlighted portion in that discussion. *Samples collected along the lengths of the cooling water lines are intended to confirm that leaching from the lines has not occurred. Results from these confirmation samples may identify additional areas exceeding cleanup levels that would require soil excavation. The proposed cooling water line sample locations are shown in Figure 3 and Figure 6.*	C	The document does state the following concerning the wooden and transite wastewater lines, "Locations were selected based on historic sample results where nitrotoluene concentrations in soil, sediment or water (i.e., liquid and sediment/sludge collected from the pipelines) exceeded cleanup levels. These samples will confirm whether or not the pipelines have released COCs to the surrounding soil." However, the following text will be added for clarification, "These samples will confirm whether or not the pipelines have released COCs to the surrounding soil and identify additional areas exceeding cleanup levels that would require soil excavation."	A			
6.	2.4, 2-5		Spell out IAW (in accordance with). Revise this sentence: Upon completion of the data validation, a validated data package will be submitted prior to submittal of the Army Draft PSI Addendum Report.	C	Concur. IAW has been spelled out and the text revised to state Army Draft PDI Report.	A			
7.	2.5, 2-5		Correct these sentences: At the completion of the PDI Addendum field investigation, the HDR Project Chemist will review and validate the analytical results and prepare the data validation report. Figures will be prepared presenting nitrotoluene soil concentration maps and the extent of the exceedance of the TCEQ GWP-Ind MSC screening level in unsaturated soil.	C	Concur. Both sentences have been revised accordingly.	A			

Number	Section/ Page	Paragraph/ Line	Comment	C,D	Response	A,D	Draft Final Comments	C,D	Draft Final Response
April Palmie									
8.	Figures		Please revise and replace the figures with higher resolution images that take up more of the space on the pages. Please add figure number to the title section below or by the legend. Example, Figure 1: Longhorn Army Ammunition Plant Location Map. Another example below from Army's other contractor for LHAAP with very informative figure title. Figure 2-1 Baseline Sampling Results, Nove Remedial Action Completion Re Contigency Remedy, LHAAP- LONGHORN ARMY AMMUNITION PL KARNACK, TEXAS Add red triangle to map legends on relevant figures. Check figure legends for consistency. For example, 29SG118 is identified as "solid residue sample" on Figure 3 and "DPT soil sample" on Figure 4.	C	Concur. All figures will be checked and revised as necessary in conformance to the comments.	A			
9.	Figure 6		In addition to the general figure comments, please also: 1. Explain what "target/other" means in the legend. 2. Revise the soil boring color scheme. Pastel shades are difficult to distinguish against the yellow site background, especially the pale green for North TNT line. Why isn't there a SB near 32WL05?	C	Concur. All figures will be checked and revised as necessary in conformance to the comments. "Target/Other" has been removed from the legend, as have the Inserts A, B, and C since these have separate figures developed for them. Sample 29SB148 will be relocated to the 32WL05 area.		Thank you for moving a DPT point near 32WL05 but in the process of shuffling SBs, the DPT near MH02 was lost by moving 137 to replace where 148 was previously. Please consider adding an additional SB to cover MH02 location. If that will not work, please coordinate before dropping or moving an alternate sampling location.	C	An additional boring has been added to Figure 6 adjacent to MH02, and to Figure 3. Text has been added to Section 2.1, North and South Cooling Water Lines / Wooden and Transite TNT Wastewater Lines, that 33 samples will be collected. Tables 1 and 3 have been updated to indicate the new number of samples and location rationale, respectively.
10.	Table 1		Please revise the number of samples. For example, if there are 8 SB by building 812-F with 4 soil samples per boring, that means 32 soil samples. The QC totals will also change.	C	Concur. The table has been revised accordingly.	A			

Comments Response Matrix
Draft and Draft Final Report: Pre-Design Investigation Work Plan, LHAAP-29, Former TNT Production Area Group 2, Longhorn Army Ammunition Plant, Karnack, Texas
Draft Submitted: November 2, 2020
Draft Final Submitted: January 12, 2021

Number	Section/ Page	Paragraph/ Line	Comment	C,D	Response	A,D	Draft Final Comments	C,D	Draft Final Response
April Palmie									
11.	Table		Please add Cleanup Levels table for reference – this is Table 2-10 in the ROD.	C	Concur. The table will be added to the document for reference.	A			
		Draft Final Comments, 27 January 2021							
Number	**Section/ Page**	**Paragraph/ Line**	**Comment**	**C,D**	**Response**		**Draft Final Comments**	**C,D**	**Draft Final Response**
1.	Figure 3						In the Figures list page i, revise title to LHAAP-29 Planned DPT and Historic Sample Location Map to match title on the figure.	C	Figure title has been updated in the figures list in the Table of Contents.
2.	Figure 4						Please change the title on the Figure 4 to match title in the figures list on page i [Building 812-F -Planned DPT Soil Sample Location Map (Insert A – Figure 3)]. This is basically changing the title back to what was on the draft document with additional reference to inset. Also, having the units explanation as part of the color dot label is not consistent with the other figures. Please move mg/kg note below the list of features or below the pop out box with results.	C	The title on Figure 4 has been revised to state, "Building 812-F -Planned DPT Soil Sample Location Map (Insert A – Figure 3)". The "Units in milligrams per kilogram (mg/kg)" has been added to the pop out box.
3.	General						Thank you for the revisions to Figures and Table 3.	C	You're welcome.

Final
Pre-Design Investigation Work Plan

LHAAP-29, FORMER TNT PRODUCTION AREA
GROUP 2
Longhorn Army Ammunition Plant
Karnack, Texas

February 2021

Prepared For:

U.S. Army Corps of Engineers – Tulsa District

Prepared By:

HDR
2650 Park Tower Drive, Suite 400
Vienna, VA 22180

Contract No. W912BV 19 D 0016
Task Order No. W912BV20F0096

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Final
Pre-Design Investigation
Work Plan
FOR
LHAAP-29, FORMER TNT PRODUCTION AREA GROUP 2
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Prepared For:

U.S. Army Corp of Engineers, Tulsa District

Prepared By:

HDR, Inc.
2650 Park Tower Drive, Suite 400
Vienna, VA 22180

Contract No. W912BV19D0016
Task Order No. W912BV20F0096

February 2021

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Table of Contents

Figures

Tables

Acronyms and Abbreviations

2,4-DNT	2,4-Dinitrotoluene
2,6-DNT	2,6-Dintrotoluene
2,4,6-TNT	2,4,6-Trinitrotoluene
AECOM	AECOM Technical Services, Inc.
bgs	below ground surface
CLP	Contract Laboratory Program
COC	Contaminant of Concern
DOT	Department of Transportation
DNAPL	dense non-aqueous phase liquid
DPT	direct push technology
DQOs	Data quality objectives
ft	feet
FS	Feasibility Study
GWP-Ind	medium-specific concentration for industrial use based on groundwater protection
GWTP	groundwater treatment plant
HDR	HDR Environmental, Operations and Construction, Inc.
IWWP	Installation Wide Work Plan
IDW	investigative derived waste
ISTD	in-situ thermal desorption
LHAAP	Longhorn Army Ammunition Plant
LUCs	Land Use Controls
mg/kg	milligrams per kilogram
MNA	monitored natural attenuation
MSCs	medium-specific concentrations
MS/MSD	matrix spike/matrix spike duplicate
PDI	Pre-Design Investigation
PPE	personal protective equipment
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RI	Remedial Investigation
ROD	Record of Decision
SVOC	semi-volatile organic compounds
TCEQ	Texas Commission on Environmental Quality
TCLP	toxicity characteristic leaching procedure
TNT	trinitrotoluene
USACE	U.S. Army Corps of Engineers

Acronyms and Abbreviations

USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

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1 Introduction

HDR Environmental, Operations and Construction, Inc. (HDR) has prepared this Pre-Design Investigation (PDI) Work Plan to meet the objectives specified in the Final Record of Decision (ROD [HDR, 2019]) to further define soils impacted by explosives at the former Longhorn Army Ammunition Plant (LHAAP) site LHAAP-29, Former TNT Production Area, Group 2 located in Karnack, Texas. The purpose of this PDI Work Plan is to identify the activities to be completed to support development of the Remedial Design (RD) by defining the extent and estimated volume of explosives-impacted soils near former Building 812-F and the cooling water outfall/ditch. Further, this PDI Work Plan identifies soil sampling activities that will be completed to confirm that leaching from the North and South Cooling Water lines and wooden/transite trinitrotoluene (TNT) wastewater lines has not occurred and impacted adjacent soil. This document has been prepared under the U. S. Army Corps of Engineers (USACE) Tulsa District Contract Number W912BV19D0016 Task Order No. W912BV20F0096.

This document describes the PDI activities to be completed at LHAAP-29. The PDI field effort will be conducted in accordance with procedures outlined in relevant sections of the Installation Wide Work Plan (IWWP) (AECOM, 2014); specifically those procedures for conducting direct push technology drilling (DPT), soil sample collection, sample handling and laboratory analyses, decontamination, handling and disposal of investigation derived waste (IDW), and surveying. The IWWP was reviewed by and concurrence was obtained from the Texas Commission on Environmental Quality (TCEQ) and the U.S. Environmental Protection Agency (USEPA). The results of this investigation will be presented in a PDI Report, which will support development of the RD specification package and cost estimates.

1.1 Background

The Former TNT Production Area was in operation from April 1943 to August 1945 as a six-line plant with a supporting acid plant. The plant produced 180 million kilograms of TNT throughout the period of operation. A bulk toluene storage area servicing the TNT Production Area was located adjacent to the production area. TNT wastewater (red water) from the production of the TNT was sent through wooden pipelines to a storage tank and pump house, and then to the TNT Wastewater Treatment Plant (LHAAP-32). The wooden pipelines were taken out of service, clear flushed and abandoned in 1946. The transite TNT wastewater pipeline was added north of the wooden line to carry the TNT wastewater. Cooling water (blue water) from the production area ran through vitreous clay main lines and into an open ditch. The transite wastewater pipeline was made of concrete and asbestos material, while the vitreous clay piping also contained an asbestos wicking. The structures, except for the foundations, were demolished and removed in 1959. The transite wastewater pipeline and cooling water lines remain in place. The lines are buried at depths of 3 to 5 feet below ground surface (ft bgs) or deeper. Soak-out of out-of-specification rocket motors took place from 1959 to the mid-1970s and involved the use of methylene chloride-based industrial solvent at tank 801-F (USACE, 2020). The location of LHAAP-29 is provided in **Figure 1**, while the site features are provided in **Figure 2**.

Explosive compounds have been detected in soil, surface water, sediment, and groundwater samples. Volatile organic compounds (VOCs) have also been detected in groundwater. Perchlorate was first detected in soil and groundwater at this site in 2000. A Remedial Investigation (RI) for groundwater and soil was completed in 2002 and a Feasibility Study (FS) evaluating remedial alternatives for groundwater and soil was finalized in 2010 (Shaw, 2010). Fieldwork to support an addendum to the RI/FS for LHAAP-29 was completed in 2013 and the RI addendum, which further defined the extent of soil and groundwater contamination and conducted additional treatability studies, received approval in August 2016. An FS Addendum evaluated additional remedial alternatives for groundwater and was completed in 2017. The Proposed Plan was completed in November 2018 and the Final ROD was signed in September 2019 that selected the final remedy, including excavation and off-site disposal of contaminated soils, flushing, inspection, and plugging of the TNT cooling water and wastewater lines, in situ thermal desorption (ISTD) treatment of the intermediate groundwater zone dense non-aqueous phase liquid (DNAPL) plume, monitored natural attenuation (MNA) for the shallow zone groundwater plumes and for the intermediate groundwater plume following ISTD, and land use controls (LUCs) for soil and groundwater (USACE, 2020).

The remedy for soils, per the Final ROD, dictates excavation and off-site disposal at a Resource Conservation and Recovery Act (RCRA) Subtitle D-permitted landfill. This action would remove explosives and perchlorate contaminated soils and achieve the following:

- Removal of soil that poses a direct risk to the hypothetical future maintenance worker, thereby protecting human health by preventing inhalation, ingestion, and dermal contact with the Contaminants of Concern (COCs);
- Removal of contaminated soil that is a potential source of contaminant migration to surface water and groundwater; and
- Removal of soil posing a risk to ecological receptors.

The FS Addendum (AECOM, 2017) and Final ROD state that additional soil sampling would be required during the RD phase to further define the final excavation extent and volume near former Building 812-F and at the cooling water outfall/ditch. Soil samples would also be collected adjacent to the North and South Cooling Water lines, as well as the wooden and transite TNT wastewater lines, to confirm that leaching from the lines has not occurred. The results from the confirmation soil sampling may identify additional areas exceeding the cleanup levels that would require soil excavation.

1.2 Objective

The primary objectives of this PDI field effort are as follows:

- Further evaluate the extent and volume of explosives-contaminated soil present at levels exceeding the TCEQ medium-specific concentration for industrial use based on groundwater protection (GWP-Ind MSC) at Building 812-F;
- Further evaluate the extent and volume of explosives-contaminated soil present at levels exceeding the TCEQ GWP-Ind MSC at the cooling water outfall/ditch;
- Further evaluate the extent and volume of explosives-contaminated soil, if present at levels exceeding the TCEQ GWP-Ind MSC, located adjacent to the north and south cooling water lines and wooden and transite TNT wastewater lines; and
- Provide extent and volume data for contaminated soil that supports development of the RD.

1.3 Scope

The scope of the field work will include the following activities:

- Advancement of 8 DPT boreholes adjacent to Building 812-F to 16 ft bgs;
- Collection of 4 soil samples per boring and analysis for explosives via method SW 8330A;
- Advancement of 8 DPT borings around the cooling water outfall/ditch to 8 ft bgs;

- Collection of 4 soil samples per boring and analysis for explosives via method SW 8330A;
- Advancement of 32 DPT borings adjacent to the north and south cooling water lines and wooden and transite TNT wastewater lines to 16 ft bgs;
- Collection of 4 soil samples per boring and analysis for explosives via method SW 8330A;
- Conducting a topographic survey of the LHAAP-29 site depicted at no more than a 1-foot contour interval to include the Refuge boundary; and
- Handling and disposal of IDW soil cuttings.

2 Field Investigation Activities and Methods

This section provides the activities and methods to be used to perform soil sampling and analyses, conduct a topographic survey of the site, handle and dispose of IDW, and quality control/quality assurance procedures and data validation.

Field efforts will focus on further delineating the spatial/vertical extent and volume of explosives contamination in unsaturated soil around Building 812-F, the cooling water outfall/ditch, and adjacent to the north and south cooling water lines, and wooden and transite TNT wastewater lines. For the purpose of characterization, soils will be compared to the TCEQ GWP-Ind MSC for 2,4-Dinitrotoluene (2,4-DNT) (0.042 milligrams per kilogram [mg/kg]); 2,6-Dinitrotoluene (2,6-DNT) (0.042 mg/kg); and 2,4,6-Trinitrotoluene (2,4,6-TNT) (5.1 mg/kg).

In total, soil borings will be advanced at 48 locations using a GeoProbe 7730 DT rig outfitted with dual sampling tubes. The methods and procedures are described below.

2.1 DPT Advancement: Soil Sampling and Analyses

The dual tube method uses two sets of probe rods to collect continuous soil cores, where the larger diameter set of rods is driven into the ground as an outer casing. These outer rods receive the driving force from the hammer and provide a sealed hole from which soil samples may be recovered without the threat of cross contamination. The second, smaller set of rods are placed inside the outer casing. The smaller rods hold the macro sample liner in place as the outer casing is driven one sampling interval (~4 ft bgs) at a time. The small rods are then retracted to retrieve the macro core sample liner. After retrieval, the acetate sleeve containing the soil core will be removed from the sample barrel and logged using the Unified Soil Classification System Standard Practice for Classification of Soils.

Building 812-F

Eight DPT borings will be advanced near Building 812-F to a maximum depth of 16 ft bgs. Four soil samples will be collected from each DPT boring and analyzed for explosives using method SW 8330A for a total of 32 samples. Sample depths will be selected based on visual signs of contamination and/or presence of an odor, but will generally be collected as a grab sample within the 4 foot intervals (i.e., 0 - 4 ft bgs, 4 - 8 ft bgs, 8 - 12 ft bgs, and 12 - 16 ft bgs).

The 8 DPT borings will be centered around historic sample location 29SG118 (AECOM 2014) where 2,4-DNT (0.138 milligrams per kilogram [mg/kg] at 6 ft bgs & 17.1 mg/kg at 10 ft bgs) and 2,6-DNT (3.42 mg/kg at 10 ft bgs) were detected above the soil cleanup levels. Four samples will be offset on a grid 10 ft and 20 ft, respectively, from 29SG118. Sample location 29SG118 is approximately 50 feet west of Building 812-F and adjacent to the TNT Cooling Water Drain Line (North). The PDI field effort will satisfy requirements for additional sampling specified in the Final ROD to further define explosives impacts addressed in the Selected Remedy for Soil Excavation (HDR, 2019). The proposed sample locations are shown in **Figure 3** (**Inset A**), with greater detail provided in **Figure 4**.

Cooling Water Outfall/Ditch

Eight DPT borings will be advanced along the Cooling Water Outfall/Ditch to a maximum depth of 8 ft bgs. Four soil samples will be collected from each DPT boring and analyzed for explosives using method SW 8330A for a total of 32 samples. Sample depths will be selected based on visual signs of contamination and/or presence of an odor, but generally will be collected within every 2 foot interval (i.e., 0 - 2 ft bgs, 2 - 4 ft bgs, 4 - 6 ft bgs and 6 - 8 ft bgs).

Two separate areas will be investigated along the Cooling Water Outfall/Ditch: the first will be centered on historic sample locations 29SD46 and 29SB112, while the second will be centered on historic sample location 29SD13. Historic sample location 29SD46 had detections of TNT (26,000 mg/kg), 2,4-DNT (8,000 mg/kg), and 2,6-DNT (15 mg/kg) at 0 – 0.5 ft bgs, while sample location 29SB112 had detections of 2,4-DNT (0.0544 J mg/kg [estimated] at 0.5 ft bgs) and 2,6-DNT (0.0862 mg/kg at 0.5 ft bgs and 0.0704 mg/kg at 2 – 4 ft bgs) that exceed cleanup levels. Historic sample location 29SD13 had a single detection of TNT (51 J mg/kg) at 0.5 ft bgs that exceeded the cleanup level. One sample will be offset 10 feet up gradient from 29SD46, while a second sample will be offset 10 feet down gradient from 29SB112. The remaining two samples will be offset 10 feet from a centerline connecting the two samples; one to the northwest and one to the southeast. The PDI field effort will satisfy requirements for additional sampling specified in the Final ROD to further define explosives impacts addressed in the Selected Remedy for Soil Excavation (HDR, 2019). The proposed sample locations are shown in **Figure 3** (**Inserts B** and **C**), with greater detail provided in **Figure 5**.

North and South Cooling Water Lines / Wooden and Transite TNT Wastewater Lines

Thirty-three (33) DPT borings will be advanced along the North and South Cooling Water Lines / Wooden and Transite TNT Wastewater Lines to a maximum depth of 16 ft bgs. Four soil samples will be collected from each DPT boring and analyzed for explosives using method SW 8330A for a total of 132 samples. Sample depths will be selected based on visual signs of contamination and/or presence of an odor, but generally a grab sample will be collected within every 4 foot interval (i.e., 0-4 ft bgs, 4-8 ft bgs, 8-12 ft bgs and 12-16 ft bgs). At excavated areas used to identify the location of the TNT wooden wastewater line, soil samples will be collected from 0 – 4 ft below the bottom of the pipeline and 4 – 12 feet below the bottom of the pipeline. The remaining two samples will be used to collect liquid and sediment/sludge samples, if present, by breaching the wooden line. If the line is collapsed, a sample of the collapsed material will be collected. Since the lines are buried at least 3 ft bgs, all samples will be collected from depths below the lines to a maximum depth of 16 ft bgs. This will ensure unsaturated soils will be collected for analysis, since the shallow zone water elevation is reported to vary between 17 and 45 ft bgs.

The north and south cooling water lines (blue cooling water lines) are constructed of vitrified clay with an asbestos wicking. There are approximately 5,000 feet of pipe in the main lines, approximately 1,680 linear feet of pipe from each production area to the main line, and 12 manholes. These lines were gravity fed and were fitted with manholes. Past investigations determined the lines contained solid residues that are contaminated with explosives at concentrations that are above the GWP-Ind MSC (solid residue). The liquid and solid residue were collected from the manholes. When unearthed, the lines were reported in good condition. The cooling water lines discharge to the cooling water outfall/ditch near the LHAAP-29 pump house.

The red liquor TNT wastewater line was originally installed as a wooden pipeline at a depth of 3 to 5 ft bgs and was taken out of service, clear-flushed and abandoned in 1946 (HDR, 2019). The pipeline was approximately 4,800 feet in length, 12 inches in diameter, and coated with an asphalt material. Several trenches were excavated across the wooden line in 1993, and the wood was found to be soft and severely degraded at most locations (HDR, 2019). Liquid and sediment/sludge samples were collected from the TNT wooden wastewater line during this effort and after review, some of the data was deemed unusable for environmental decision making. However, two samples (liquid sample 29WL01 and sediment/sludge sample 29WL03) that identified high concentrations of 2,4,6-TNT (liquid – 3,500 µg/L and sediment – 3,700 mg/kg) were found to be acceptable The deteriorated condition of the line and the potential for residual explosives may present a continuing source of groundwater contamination. The transite TNT wastewater pipeline was added parallel to and north of the wooden line to carry the TNT wastewater. The transite TNT wastewater line had two solid residue samples with detections of explosives that were above the GWP-Ind MSC. Solid residue sample 29WL14, collected from the southwestern end of the pipeline, contained 2,4,6-TNT (58.4 mg/kg), 2,4-DNT (7.21 mg/kg), 2-amino-4,6-DNT (19 JH mg/kg [JH = estimated biased high]), and 4-amino-2,6-DNT (13.3 mg/kg), while solid residue sample 29WL13, collected from the mid-point of the pipeline, contained 2,4,6-TNT (526 mg/kg), 2,4-DNT (89 mg/kg), and 1,3-DNB (1.08 mg/kg). Samples collected from three soil borings located adjacent to the TNT wooden wastewater line were found to contain explosives that were above the GWP-Ind MSC. Soil boring 29SB09 and 29SB09R, collected from the southwestern end of the pipeline, contained 2,4,6-TNT (7.5 mg/kg and 14.7 mg/kg, respectively), while soil boring 29SB85, collected from the northwestern end of the pipeline, contained 2-amino-4,6-DNT (0.9 mg/kg) and 4-amino-2,6-DNT (0.3 J mg/kg).

Confirmation samples will be collected along the lengths of the two cooling water lines (north and south. Samples will be collected from locations where historic nitrotoluene concentrations in soil, sediment or water (collected from manholes on the pipelines) exceeded cleanup levels. The sediment and water samples were collected from manholes in the cooling water lines; these junctures tend to be low points in the lines that would be the most likely to accumulate sediment/water that could leach to adjacent soil. Samples will also be collected from locations along the pipelines where samples had not previously been collected. The intent of these samples is to provide coverage along the entire length of the pipelines. The cooling water lines will be identified in the field by locating and staking the exposed manholes along the entire length. Sample locations will then be marked and the horizontal coordinates (northing and easting) recorded using a Trimble Global Positioning Unit. The Trimble will have the capability of collecting horizontal coordinates with sub-meter accuracy. The data will be based on the North American Datum of 1983 and used to develop geospatially referenced site maps and figures.

Samples collected along the lengths of the cooling water lines are intended to confirm that leaching from the lines has not occurred. Results from these confirmation samples may identify additional areas exceeding cleanup levels that would require soil excavation. The proposed cooling water line sample locations are shown in **Figure 3**, with greater detail provided in **Figure 6**.

Samples will be collected along the lengths of the wooden and transite TNT wastewater lines. Locations were selected based on historic sample results where nitrotoluene concentrations in soil, sediment or water (i.e., liquid and sediment/sludge collected from the pipelines) exceeded cleanup levels. These samples will confirm whether or not the pipelines have released COCs to the surrounding soil and identify additional areas exceeding cleanup levels that would require soil excavation. The two detections of explosives in the transite wastewater line that exceeded the soil TCEQ GWP-Ind MSC cleanup levels include the explosives 2,4,6-TNT (58.4 mg/kg, 526 mg/kg) and

2,4-DNT (7.21 mg/kg, 89 mg/kg), as well as 2-amino-4,6-DNT (19.0 JH), 4-amino-2,6-DNT (13.3 mg/kg), and 1,3-dinitrobenzene (1,3-DNB [1.08 mg/kg]). The three soil samples collected adjacent to the TNT wooden wastewater line with detections of COCs that exceeded the soil TCEQ GWP-Ind MSC cleanup levels include the explosive 2,4,6-TNT (14.7 mg/kg), as well as 2-amino-4,6-DNT (0.9 mg/kg), and 4-amino-2,6-DNT (0.3 J) at concentrations below the cleanup levels. Additional samples will be collected from locations to provide coverage along the pipelines where samples had not previously been collected. Historic sample coordinates recorded by Shaw during an investigation conducted in 2006 will be used to locate the transite and wooden TNT wastewater lines in the field (Shaw, 2007). The locations will be confirmed by excavating trenches with a backhoe, then marked with stakes, and the horizontal coordinates (northing and easting) recorded using a Trimble Global Positioning Unit. A maximum of 8 trenches will be excavated along the length of the TNT wastewater pipelines until the entire length and direction has been determined. Where the TNT wooden wastewater line has been exposed by trenching, the wooden line, if intact, will be opened to collect liquid and sediment/sludge samples for explosives analysis. If the line is collapsed, a sample of the collapsed material will be collected. DPT soil samples collected from under the exposed wooden pipeline will be taken from 0 – 4 feet below the pipe and 4 - 8 feet below the pipe to confirm that leaching from the TNT wooden wastewater line has not occurred. Sample locations are shown in **Figure 3**, with greater detail provided in **Figure 6**. The list of analytes, minimum number of samples, and method are provided in **Table 1**. **Table 2** provides the samples where coordinates were recorded by Shaw. **Table 3** provides the list of samples by number, location, and the rationale for the selecting the location. **Table 4** provides the LHAAP-29 clean up levels presented in the ROD.

The DPT sampling equipment will be decontaminated after each interval to prevent cross contamination. Decontamination water will be containerized and disposed at the groundwater treatment plant (GWTP). Excess soil cuttings not collected for a sample will be containerized in Department of Transportation (DOT) approved 55-gallon open-top drums and left adjacent to the borehole until categorized as either hazardous or non-hazardous. A sample from the excess soils will be sent to a stationary lab and analyzed using the toxicity characteristic leaching procedure (TCLP) for the full suite of toxicity characteristics (i.e, VOCs, semi-volatile organic compounds [SVOCs], herbicides, pesticides, and metals/mercury), ignitability, corrosivity, and reactivity to determine hazardous waste characteristics. If the excess soil is determined to be non-hazardous it will be removed from the drums and spread on the ground adjacent to the borehole. The field work will follow methodologies and procedures described in the AECOM 2014 IWWP.

2.2 Surveying

A professional land surveyor licensed in the State of Texas will perform a topographic survey of LHAAP-29 and all associated structures (excluding wells) on the property. Topography shall be depicted at no more than a 1-foot contour interval. The topographic survey will include the Refuge boundary. The horizontal coordinates (northing and easing) will be based on the North American Datum of 1983. The vertical elevations will be based on the North American Vertical Datum of 1988.

HDR will collect the horizontal coordinates (northing and easting) at each borehole location using a Trimble Global Positioning Unit. The Trimble will have the capability of collecting horizontal coordinates with sub-meter accuracy. The data will be based on the North American Datum of 1983 and used to develop geospatially referenced site maps and figures. The topographic survey will be incorporated and support development of the RD.

2.3 Investigative Derived Waste Handling and Disposal

IDW generated during the investigation will include soil cuttings, disposable sampling equipment, development and purge water, equipment decontamination fluids, and personal protection equipment (PPE). IDW (except PPE, disposable sampling equipment, and decontamination fluids/development/purge water) will be containerized pending analytical results and waste profiling. The IDW management storage and disposal will be performed in accordance with the IWWP (AECOM, 2014).

2.4 Quality Assurance/Quality Control and Data Validation

To ensure defensible data, HDR will meet the project-specific Data Quality Objectives (DQOs) for sampling, analysis, and Quality Assurance/Quality Control (QA/QC) by collecting the proper quantities and types of samples, using the correct analytical methodologies, implementing field and laboratory QA/QC procedures, and using various data validation and evaluation processes.

Field QC will be performed during sample collection, shipping, and handling. Sample QC for the analytical samples will be assessed through the use of duplicate samples. Duplicate samples, which are used to evaluate field and laboratory precision, will be collected at a rate of 10%.

A matrix spike/matrix spike duplicate (MS/MSD) sample pair, which is used by the laboratory to measure matrix interference, will be collected at a rate of 5% for each analysis. Since the observed lithology is relatively heterogeneous across the site, the MS/MSD and QC sample locations will be selected in the field to achieve a representative distribution.

An equipment rinsate blank (i.e., “equipment blank”) will be collected by pouring analyte free source water poured over a decontaminated piece of field sampling equipment that is considered ready to collect or process an additional sample. Equipment rinsate blanks are to be collected from non-dedicated sampling equipment to assess the adequacy of the decontamination process. Typically, retail distilled water will be utilized for rinsate blank source water.

A temperature blank provided by the laboratory will be included in each sample cooler. A temperature blank is a sample of laboratory-grade distilled water that travels with the project cooler from the laboratory to the sampling site and back to the laboratory without being opened. The temperature of the blank is obtained by the laboratory when samples are received to verify that the temperature of the samples during transportation did not exceed 4°C.

The HDR project chemist will complete a data quality review of all analytical results in accordance with the USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Superfund Organic Methods Data Review (USEPA, 2017).

Review of the analytical data will be completed as a Stage 2AVM Validation as described in the USEPA Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use (USEPA, 2009), while 10% will be completed as a Stage 3VM Validation. Upon completion of the data validation, a validated data package will be provided prior to submittal of the Army Draft PDI Report.

2.5 Reporting

At the completion of the PDI field investigation, the HDR Project Chemist will review and validate the analytical results and prepare the data validation report. HDR will then prepare the PDI Report. The report will contain an introduction, sampling approach, sample results and evaluation, and a conclusions section. Figures will be prepared presenting nitrotoluene soil concentration maps and the extent of the exceedance of the TCEQ GWP-Ind MSC screening level in unsaturated soil. The figures will be prepared to be consistent in content and format with the figures presented in the Revised Feasibility Study (AECOM, 2017). A photo-log of all investigative activities will be compiled and presented as an attachment to the PDI Report. Photographs will be taken of all DPT sample cores, wastewater and cooling lines where exposed, soil conditions surrounding the exposed lines, and excavated soil. Any other notable conditions will also be photographed. Results and conclusions from the report will be used to support development of the RD. Specifically, results from the confirmation samples collected at Building 812-F, Cooling Water Outfall/Ditch, and Cooling Water and Wastewater Lines may identify additional areas exceeding cleanup levels that would require soil excavation.

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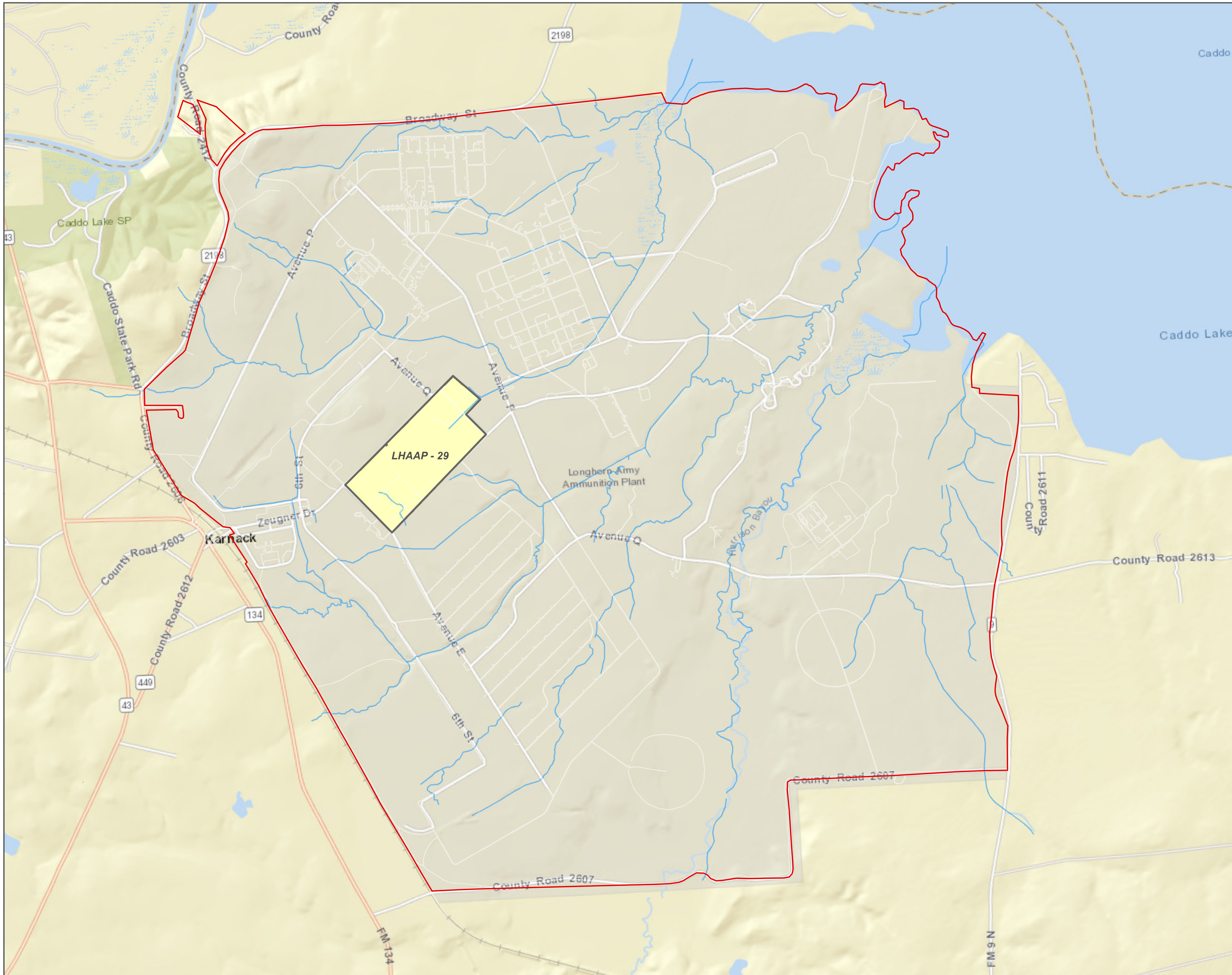


LEGEND

Roads
Streams
Site LHAAP-29
LHAAP Installation Boundary

DATA SOURCES: AECOM, 2016, Draft Final Remedial Investigation Addendum LHAAP-29, Former TNT Production Area, Group 2 Longhorn Army Ammunition Plant, Karnack, Texas. July. ESRI

DISCLAIMER: Map information was compiled from the best available sources. No warranty is made for its accuracy or completeness.

LHAAP-29 SITE LOCATION MAP

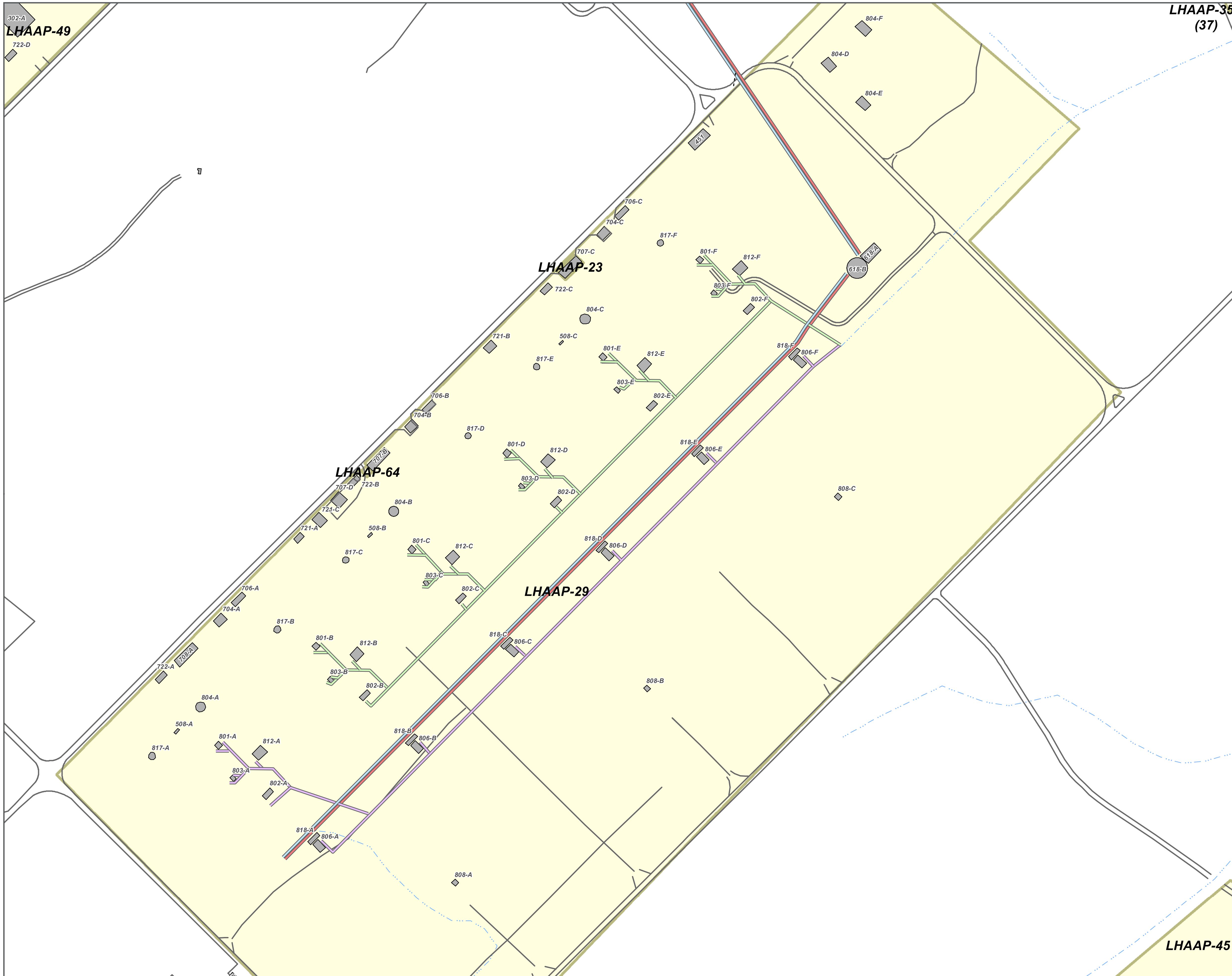
LHAAP-29 PDI WORK PLAN
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

N

0 0.5 1
MILES

FIGURE 1

PATH: J:\2018\18-025_LHAAP_SITES29_47_18AND24_ROD_(WERNER)\7.2_WORK_IN_PROGRESS\MAP_DOCS\DRAFT\LHAAP29\LHAAP_29_PDI_WORKPLAN_SITE_VICINTY_FIG1.MXD - USER: KLOFGREN - DATE: 1/10/2021



LEGEND

- TNT Cooling Water Drain Line (North)
- TNT Cooling Water Drain Line (South)
- TNT Wooden Wastewater Line
- TNT Transite Wastewater Line
- Stream
- Road
- Building
- Site LHAAP-29

DATA SOURCES: Shaw, 2010, Final Feasibility Study, LHAAP-29, Former TNT Production Area, Group 2, Longhorn Army Ammunition Plant, Karnack, Texas, December.

DISCLAIMER: Map information was compiled from the best available sources. No warranty is made for its accuracy or completeness.

LHAAP-29 SITE FEATURES MAP

LHAAP-29 PDI WORK PLAN
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

N

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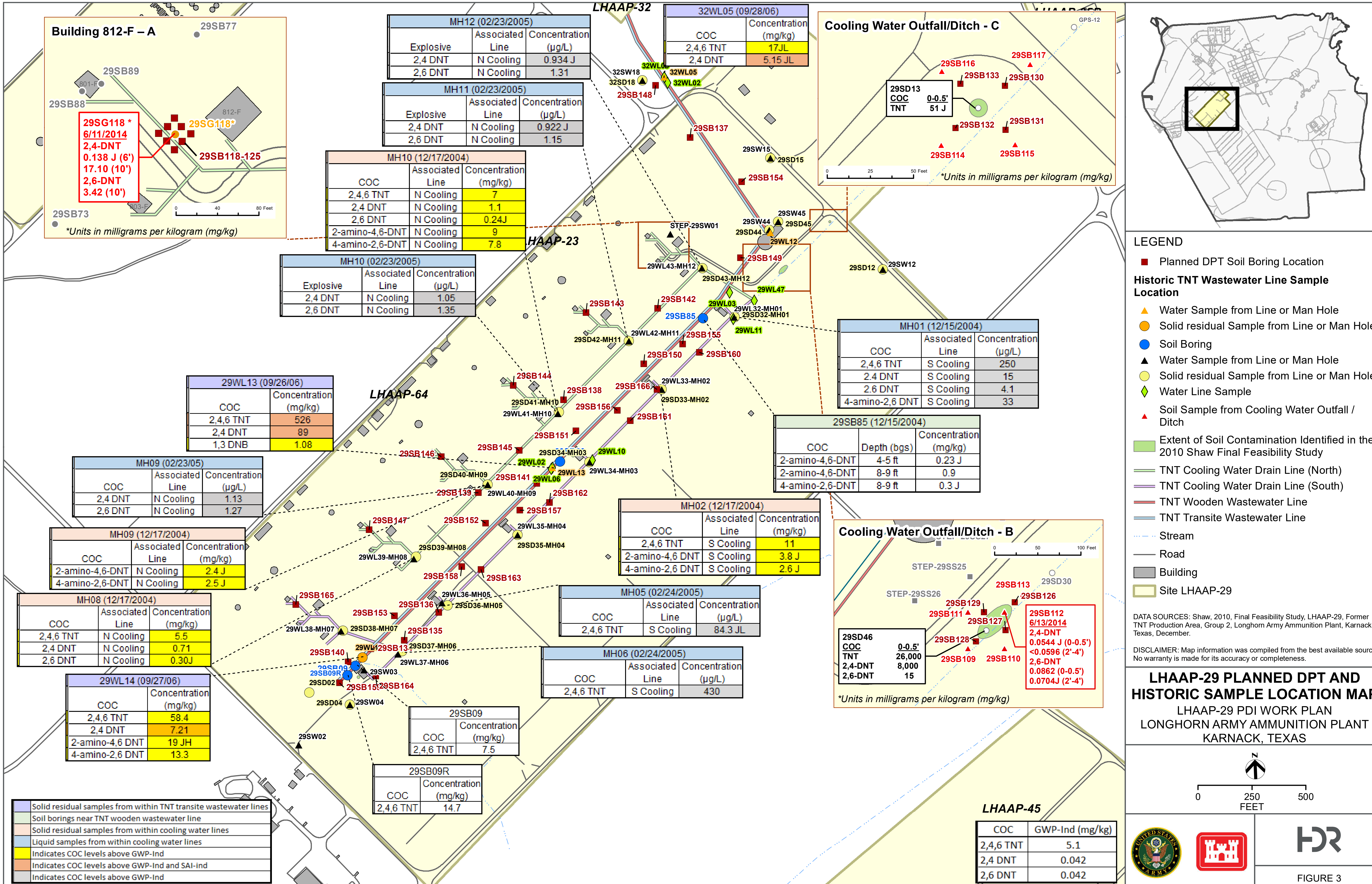
FEET

FIGURE 2

PATH: J:\2018\18-025_LHAAP_SITES29_47_18AND24_ROD_(WERNER)\7.2_WORK_IN_PROGRESS\MAP_DOCS\DRAFT\LHAAP29\LHAAP_29_PDI_WORKPLAN_WASTEWATER_COOLINGWATERLINE_FIG2.MXD - USER: KLOFGREN - DATE: 1/10/2021



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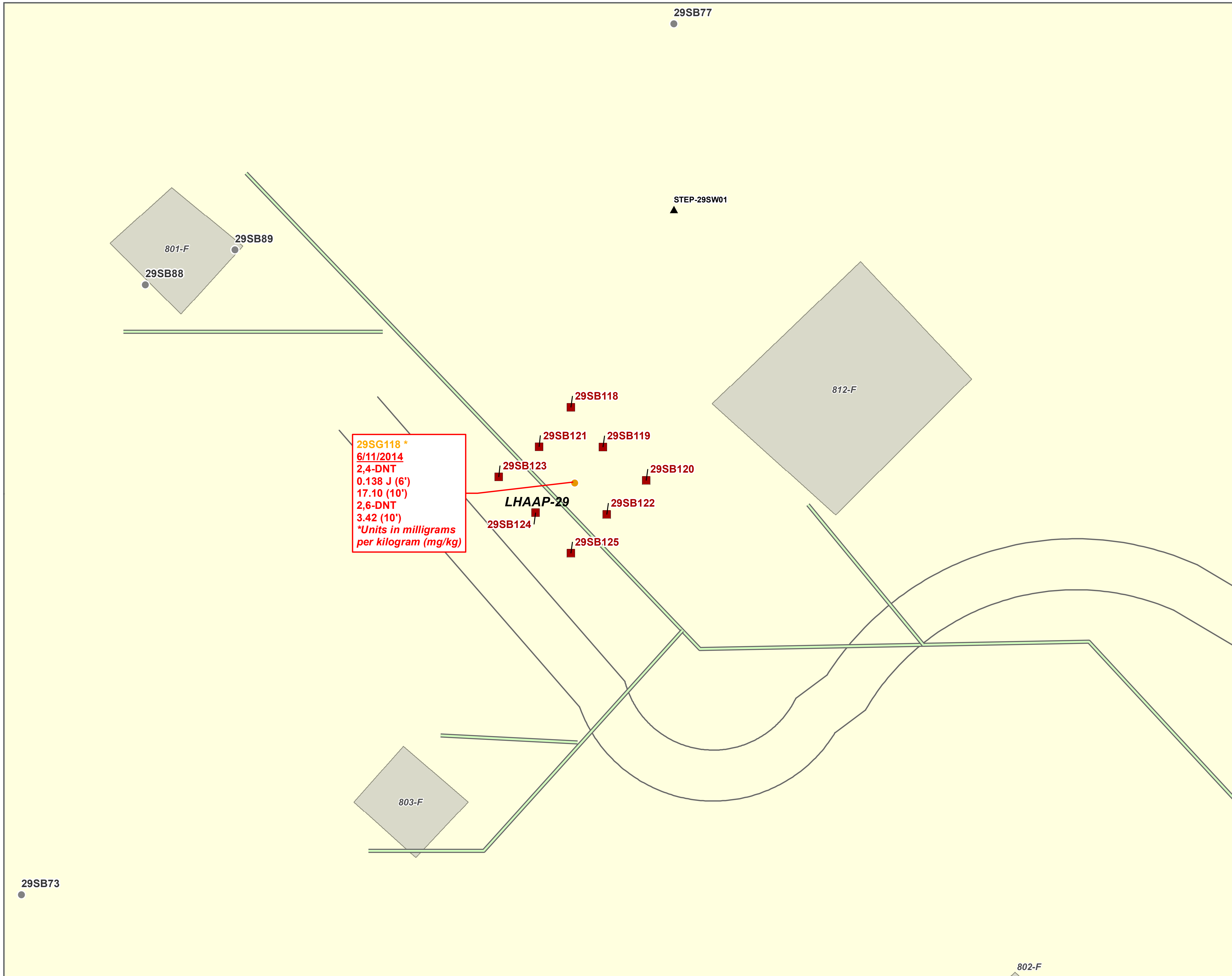
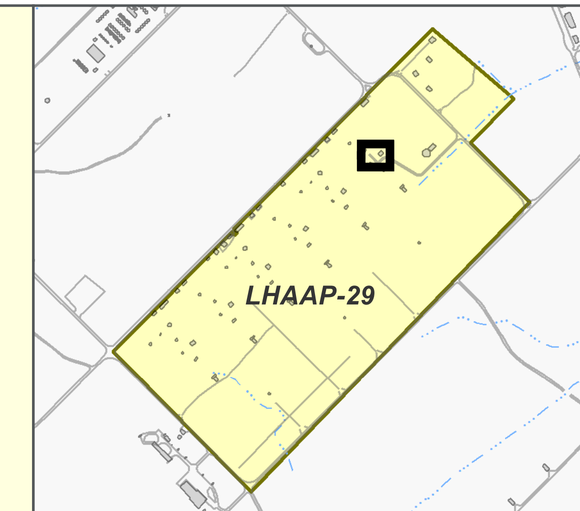




LEGEND

- Planned DPT Soil Boring Location

Historic TNT Wastewater Line Sample Location

- Solid Residual Sample from Line or Manhole
- Water Sample from Line or Man Hole
- Surface Soil Samples
- TNT Cooling Water Drain Line (North)
- Stream
- Road
- Building
- Site LHAAP-29

DATA SOURCES: Shaw, 2010, Final Feasibility Study, LHAAP-29, Former TNT Production Area, Group 2, Longhorn Army Ammunition Plant, Karnack, Texas, December.

DISCLAIMER: Map information was compiled from the best available sources. No warranty is made for its accuracy or completeness.

BUILDING 812-F -PLANNED DPT SOIL SAMPLE LOCATION MAP (INSERT A – FIGURE 3)

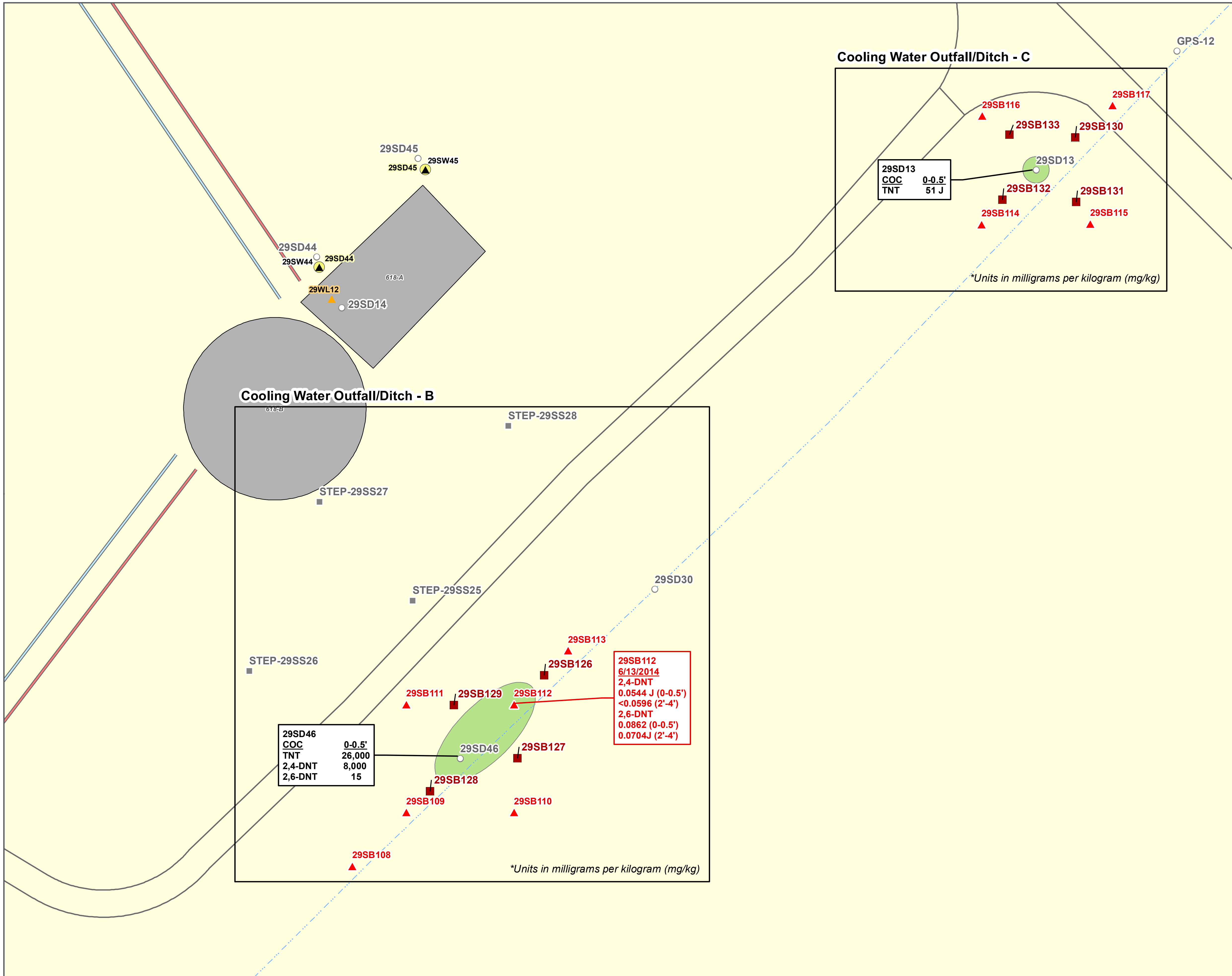
LHAAP-29 PDI WORK PLAN
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

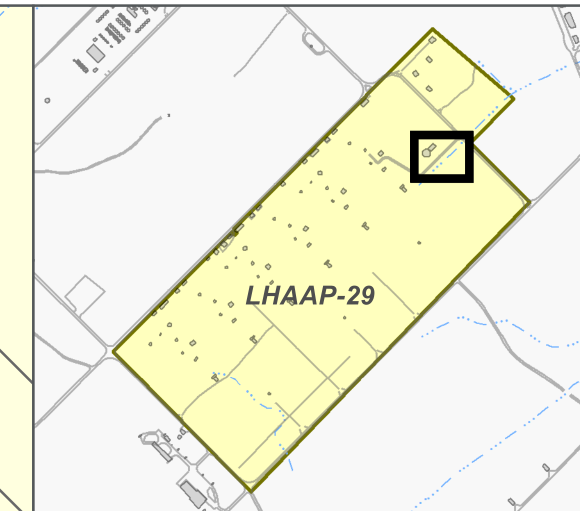
N

0 25 50
FEET

FIGURE 4

PATH: J:\2018\18-025_LHAAP_SITES29_47_18AND24_ROD_(WERNER)\7.2_WORK_IN_PROGRESS\MAP_DOCS\DRAFT\LHAAP29\LHAAP_29_PDI_WORKPLAN_BUILDING812F_PROPOSEDSAMPLES_FIG4.MXD - USER: KLOFGREN - DATE: 1/28/2021





LEGEND

- Planned DPT Soil Boring Location

Historic TNT Wastewater Line Sample Location

- Water Sample from Line or Man Hole
- Water Sample from Line or Man Hole
- Solid residual Sample from Line or Man Hole
- Sediment Samples
- Surface Soil Samples
- Soil Sample from Cooling Water Outfall / Ditch
- Extent of Soil Contamination Identified in the 2010 Shaw Final Feasibility Study
- TNT Wooden Wastewater Line
- TNT Transite Wastewater Line
- Stream
- Road
- Building
- Site LHAAP-29

DATA SOURCES: Shaw, 2010, Final Feasibility Study, LHAAP-29, Former TNT Production Area, Group 2, Longhorn Army Ammunition Plant, Karnack, Texas, December.

DISCLAIMER: Map information was compiled from the best available sources. No warranty is made for its accuracy or completeness.

COOLING WATER OUTFALL / DITCH PLANNED DPT SOIL SAMPLE LOCATION MAP (INSERT B & C - FIGURE 3)
LHAAP-29 PDI WORK PLAN
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

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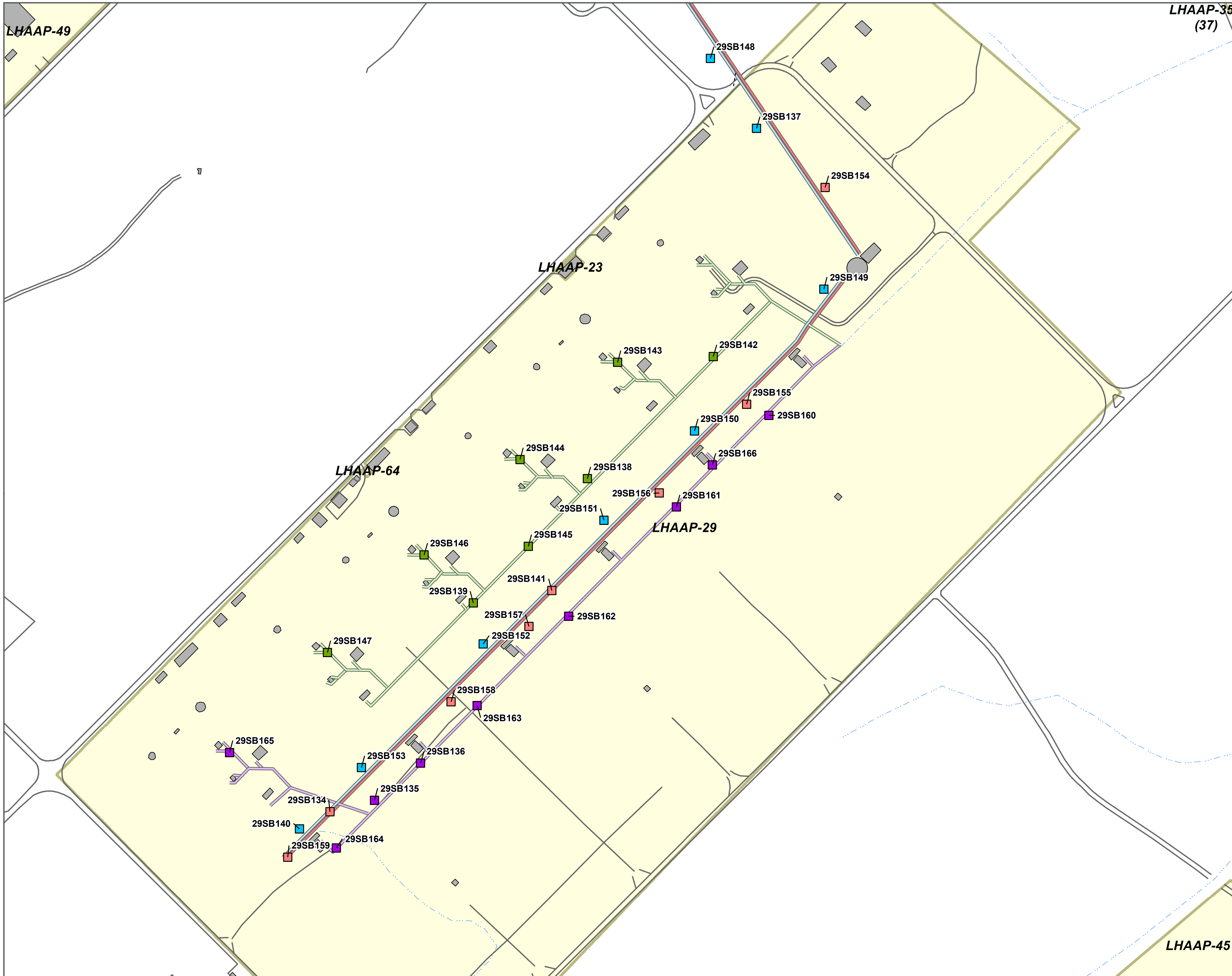
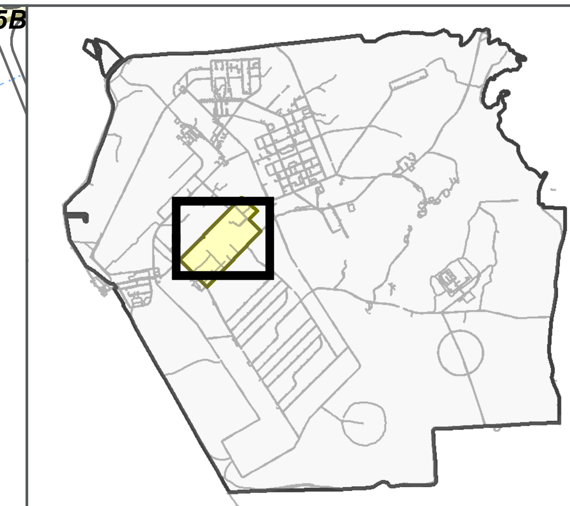
0 50 100
FEET

FIGURE 5

PATH: J:\2018\18-025_LHAAP_SITES29_47_18AND24_ROD_(WERNER)\7.2_WORK_IN_PROGRESS\MAP_DOCS\DRAFT\LHAAP29\LHAAP_29_PDI_WORKPLAN_COOLINGWATEROUTFALL_DITCHBC_PROPOSEDSAMPLES_FIG5.MXD - USER: KLOFGREN - DATE: 1/10/2021





LEGEND

LEGEND - Planned DPT Soil Boring Location

- TNT Cooling Water Drain Line (North)
- TNT Cooling Water Drain Line (South)
- TNT Transite Wastewater Line
- TNT Wastewater Line
- TNT Cooling Water Drain Line (North)
- TNT Cooling Water Drain Line (South)
- TNT Wooden Wastewater Line
- TNT Transite Wastewater Line
- Stream
- Road
- Building
- Site LHAAP-29

DATA SOURCES: Shaw, 2010, Final Feasibility Study, LHAAP-29, Former TNT Production Area, Group 2, Longhorn Army Ammunition Plant, Karnack, Texas, December.

DISCLAIMER: Map information was compiled from the best available sources. No warranty is made for its accuracy or completeness.

TNT COOLING WATER / WASTEWATER LINES PLANNED DPT SOIL SAMPLE LOCATION MAP

LHAAP-29 PDI WORK PLAN
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

N
0 250 500
FEET

FIGURE 6

PATH: J:\2018\18-025_LHAAP_SITES29_47_18AND24_ROD_(WERNER)\7.2_WORK_IN_PROGRESS\MAP_DOCS\DRAFT\LHAAP29\LHAAP_29_PDI_WORKPLAN_WASTEWATER_COOLINGWATERLINE_PROPOSEDSAMPLES_FIG6.MXD - USER: KLOFGREN - DATE: 1/28/2021

Table 1. Soil Analytical Sample Summary

Parameter/Method	Matrix	Field Samples	No. of Dups	No. of MS	No. of MSD	Equipment Blanks	Total No. of Samples
Building 812-F							
Explosives SW 8330A	Soil	32	3	2	2	1	40
Cooling Water Outfall/Ditch							
Explosives SW 8330A	Soil	32	3	2	2	1	40
North and South Cooling Water Lines / Wooden and Transite TNT Wastewater Lines							
Explosives SW 8330A	Soil	132	13	6	6	6	163
IDW Waste Profile							
TCLP VOCs 1311/8260B	Soil	1	0	0	0	0	1
TCLP SVOCs 1311/8270C	Soil	1	0	0	0	0	1
TCLP Metals/Mercury 1311/6010C/7470A	Soil	1	0	0	0	0	1
TCLP Herbicides 1311/8151	Soil	1	0	0	0	0	1
TCLP Pesticides 1311/8081A/B	Soil	1	0	0	0	0	1
Ignitability (flash point)	Soil	1	0	0	0	0	1
Corrosivity	Soil	1	0	0	0	0	1
Reactivity	Soil	1	0	0	0	0	1

Table 2. Sample Locations and Coordinates for the TNT Wastewater Lines

Sample	Approximate Depth to Top of Pipe (feet bgs)	Sample Date	Sample Time	Past Sample from the Location	Northing	Easting	Comments on Sample
32WL05	3.33	9/28/2006	10:06	32WL03	6957115.7	3306449.5	Gel-like consistency
29WL13	3.67	9/28/2006	8:50	29WL06	6955304.7	3305931.6	Gel-like consistency
29WL12	NA	9/28/2006	8:15	Not applicable. 2006 sample was collected where open end of transite pipe was accessible at northwest side of pond.			Sample was collected at 3.5 to 4.0 feet inside the pipe. Solids were dry and gritty.
29WL14	4.00	9/27/2006	16:45	29WL05	6954425.6	3305050.8	Consistency of thin mud

Table 3. Sample Collection List and Rationale

Sample Number	Sample Location	Sample Collection Rationale
Building 812-F Sample Locations (0 - 4 ft bgs, 4 - 8 ft bgs, 8 - 12 ft bgs, and 12 - 16 ft bgs)		
29SB118	Offset from historic sample 29SG118 50 feet west of Building 812-F, production area feeder line, northern end of N. cooling water line	Further define explosives impacts
29SB119	Offset from historic sample 29SG118 50 feet west of Building 812-F, production area feeder line, northern end of N. cooling water line	Further define explosives impacts
29SB120	Offset from historic sample 29SG118 50 feet west of Building 812-F, production area feeder line, northern end of N. cooling water line	Further define explosives impacts
29SB121	Offset from historic sample 29SG118 50 feet west of Building 812-F, production area feeder line, northern end of N. cooling water line	Further define explosives impacts
29SB122	Offset from historic sample 29SG118 50 feet west of Building 812-F, production area feeder line, northern end of N. cooling water line	Further define explosives impacts
29SB123	Offset from historic sample 29SG118 50 feet west of Building 812-F, production area feeder line, northern end of N. cooling water line	Further define explosives impacts
29SB124	Offset from historic sample 29SG118 50 feet west of Building 812-F, production area feeder line, northern end of N. cooling water line	Further define explosives impacts
29SB125	Offset from historic sample 29SG118 50 feet west of Building 812-F, production area feeder line, northern end of N. cooling water line	Further define explosives impacts
Cooling Water Outfall/Ditch (0 - 2 ft bgs, 2 - 4 ft bgs, 4 - 6 ft bgs and 6 - 8 ft bgs)		
29SB126	Southern area of the cooling water outfall/ditch, Area B, offset from historic sample 29SB112	Further define explosives impacts
29SB127	Southern area of the cooling water outfall/ditch, Area B, offset from historic sample 29SB112	Further define explosives impacts
29SB128	Southern area of the cooling water outfall/ditch, Area B, offset from historic sample 29SB112	Further define explosives impacts
29SB129	Southern area of the cooling water outfall/ditch, Area B, offset from historic sample 29SB112	Further define explosives impacts
29SB130	Northern area of the cooling water outfall/ditch, Area C, offset from historic sample 29SD13	Further define explosives impacts
29SB131	Northern area of the cooling water outfall/ditch, Area C, offset from historic sample 29SD13	Further define explosives impacts
29SB132	Northern area of the cooling water outfall/ditch, Area C, offset from historic sample 29SD13	Further define explosives impacts
29SB133	Northern area of the cooling water outfall/ditch, Area C, offset from historic sample 29SD13	Further define explosives impacts

Table 3. Sample Collection List and Rationale

Sample Number	Sample Location	Sample Collection Rationale
North Cooling Water Line (0-4 ft bgs, 4-8 ft bgs, 8-12 ft bgs and 12-16 ft bgs)		
29SB138	Adjacent to mid-point of N. cooling water line adjacent to historic solid residue sample collected from pipeline at MH10	Targeted sample to confirm leaching has not occurred from the N. cooling water line
29SB139	Adjacent to mid-point of N. cooling water line adjacent to historic liquid and solid residue sample collected from pipeline at MH09	Targeted sample to confirm leaching has not occurred from the N. cooling water line
29SB142	Adjacent to northern end of N. cooling water line	Provide coverage for area not previously sampled
29SB143	Adjacent to production area feeder line, northern end of N. cooling water line	Provide coverage for area not previously sampled
29SB144	Adjacent to production area feeder line, northern end of N. cooling water line	Provide coverage for area not previously sampled
29SB145	Adjacent to mid-point of N. cooling water line	Provide coverage for area not previously sampled
29SB146	Adjacent to production area feeder line, southern end of N. cooling water line	Provide coverage for area not previously sampled
29SB147	Adjacent to production area feeder line, southern end of N. cooling water line	Provide coverage for area not previously sampled
South Cooling Water Line (0-4 ft bgs, 4-8 ft bgs, 8-12 ft bgs and 12-16 ft bgs)		
29SB135	Adjacent to southern end of S. cooling water line adjacent to historic liquid sample collected from pipeline at MH06	Targeted sample to confirm leaching has not occurred from the S. cooling water line
29SB136	Adjacent to southern end of S. cooling water line adjacent to historic liquid sample collected from pipeline at MH05	Targeted sample to confirm leaching has not occurred from the S. cooling water line
29SB160	Adjacent to northern end of S. cooling water line, south side	Provide coverage for area not previously sampled
29SB161	Adjacent to northern end of S. cooling water line, south side	Provide coverage for area not previously sampled
29SB162	Adjacent to mid-point of S. cooling water line, south side	Provide coverage for area not previously sampled
29SB163	Adjacent to southern end of S. cooling water line, south side	Provide coverage for area not previously sampled
29SB164	Adjacent to southern terminus of S. cooling water line, south side	Provide coverage for area not previously sampled
29SB165	Adjacent to production area feeder line, southern end of S. cooling water line	Provide coverage for area not previously sampled
29SB166	Adjacent to mid-point of S. cooling water line adjacent to historic solid residue sample collected from pipeline at MH02	Targeted sample to confirm leaching has not occurred from the S. cooling water line
TNT Transite Wastewater Line (0-4 ft bgs, 4-8 ft bgs, 8-12 ft bgs and 12-16 ft bgs)		
29SB137	Adjacent to northern branch of transite wastewater line, north side	Provide coverage for area not previously sampled
29SB140	Adjacent to southern end of transite wastewater line, , adjacent to historic residue sample collected from pipeline at 29WL14, north side	Targeted sample to confirm leaching has not occurred from the transite wastewater line
29SB148	Adjacent to northern branch of transite wastewater line, west side	Provide coverage for area not previously sampled
29SB149	Adjacent to northern end of transite wastewater line, north side	Provide coverage for area not previously sampled
29SB150	Adjacent to northern end of transite wastewater line, north side	Provide coverage for area not previously sampled

Table 3. Sample Collection List and Rationale

Sample Number	Sample Location	Sample Collection Rationale
29SB151	Adjacent to mid-point of transite wastewater line, north side	Provide coverage for area not previously sampled
29SB152	Adjacent to mid-point of transite wastewater line, north side	Provide coverage for area not previously sampled
29SB153	Adjacent to southern end of transite wastewater line, north side	Provide coverage for area not previously sampled
TNT Wooden Wastewater Lines (0-4 ft bgs, 4-8 ft bgs, 8-12 ft bgs and 12-16 ft bgs)		
29SB134	Adjacent to southern end of wooden wastewater line, adjacent to historic residue sample collected from pipeline at 29WL14, north side	Targeted sample to confirm leaching has not occurred from the wooden TNT line
29SB141	Adjacent to mid-point of wooden wastewater line, adjacent to historic residue sample collected from pipeline at 29WL13, north side	Targeted sample to confirm leaching has not occurred from the wooden TNT line
29SB154	Adjacent to northern branch of wooden wastewater line, east side	Provide coverage for area not previously sampled
29SB155	Adjacent to northern end of wooden wastewater line, south side	Provide coverage for area not previously sampled
29SB156	Adjacent to northern end of wooden wastewater line, south side	Provide coverage for area not previously sampled
29SB157	Adjacent to mid-point of wooden wastewater line, south side	Provide coverage for area not previously sampled
29SB158	Adjacent to mid-point of wooden wastewater line, south side	Provide coverage for area not previously sampled
29SB159	Adjacent to southern end of wooden wastewater line, south side	Provide coverage for area not previously sampled

Table 4. Cleanup Levels at LHAAP-29

Medium	Chemical of Concern	Cleanup Level
Soil		**GWP-Ind (mg/kg)**
	2,4,6-Trinitrotoluene	4.7[a] 5.1[b]
	2,4-Dinitrotoluene	0.042
	2,6-Dinitrotoluene	0.042
	Perchlorate**	7.2
Transite TNT Wastewater Line		**GWP-Ind (mg/kg)**
Solid Residue	1,3-Dinitrobenzene	1
	2,4,6-Trinitrotoluene	5.1
	2,4-Dinitrotoluene	0.042
	2-amino-4,6-Dinitrotoluene	1.7
	4-amino-2,6-Dinitrotoluene	1.7
Cooling Water Drain Line		**GWP-Ind (mg/kg)**
Solid Residue	2,4,6-Trinitrotoluene	5.1
	2,4-Dinitrotoluene	0.042
	2,6-Dinitrotoluene	0.042
	2-amino-4,6-Dinitrotoluene	1.7
	4-amino-2,6-Dinitrotoluene	1.7

Notes:

** Potential COC in soil due to high perchlorate concentration in groundwater

[a] applies to 0-3 feet below ground surface

[b] applies from 3 feet below ground surface to groundwater interface

GWP-Ind Texas Commission on Environmental Quality soil medium specific concentration for industrial use based on groundwater protection

mg/kg milligrams per kilogram

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