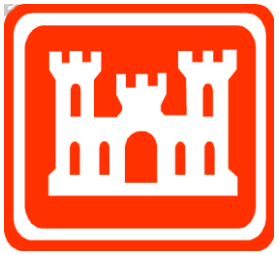
# FINAL
# PROPOSED PLAN
# FOR LHAAP-04
# FORMER PILOT WASTEWATER TREATMENT PLANT
# LONGHORN ARMY AMMUNITION PLANT
# KARNACK, TEXAS

**Prepared For:**

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

**Prepared By:**

AECOM

**AECOM Technical Services**

**December 2012**

# THE U.S ARMY ANNOUNCES THE PROPOSED PLAN FOR LONGHORN ARMY AMMUNITION PLANT LHAAP-04 (FORMER PILOT WASTEWATER TREATMENT PLANT)

## 1.0 INTRODUCTION

The U.S Army is issuing this Proposed Plan for public comment and participation in accordance with Section 117(a) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, as amended, and Sections 300.430(f)(2) and (f)(3) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR Part 300).

The primary purpose of the Proposed Plan is to facilitate public involvement in the remedy selection process for environmentally impacted sites. It provides the public with basic background about Longhorn Army Ammunition Plant (LHAAP) and site LHAAP-04, the rationale for selecting the Preferred Alternative, and summaries of other alternatives considered for protecting human health and the environment from the chemical of concern, perchlorate, detected in groundwater. The Preferred Alternative for the LHAAP-04 site is Alternative 3: In-situ bioremediation and land use controls (LUCs).

The U.S. Army, the lead agency for environmental response actions at LHAAP, is acting in partnership with United States Environmental Protection Agency (USEPA) Region 6 and Texas Commission on Environmental Quality (TCEQ). As the lead agency, the U.S. Army is charged with planning and implementing remedial actions at the LHAAP. Regulatory agencies assist the U.S. Army by providing technical support, project review, project comment, and oversight in accordance with the CERCLA and Superfund Amendments and Reauthorization Act (SARA) and the LHAAP Federal Facilities Agreement (FFA).

### DATES TO REMEMBER

***PUBLIC COMMENT PERIOD*:**

**December 10, 2012 to January 9, 2013**

The U.S. Army invites you to participate during the public comment period by submitting comments on the LHAAP-04 Proposed Plan. The U.S. Army will accept written comments on the Proposed Plan during the public comment period.

PUBLIC MEETING: The U.S. Army will hold a public meeting to explain the Proposed Plan for LHAAP-04. Oral and written comments will be accepted at the meeting. The meeting will be held on December 18, 2012 from 6:00 p.m. to 7:00 p.m. at Karnack Community Center.

For more information, see the Administrative Record at the following location:

Marshall Public Library

300 S. Alamo

Marshall, Texas 75670

Business Hours: Monday – Thursday (10.00 a.m. – 8.00 p.m.)

Friday – Saturday (10.00 a.m. – 5.00 p.m.)

**For further information on LHAAP-04, please contact:**

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Contaminated soil at the LHAAP-04 site was removed in 2009 under CERCLA removal authority, eliminating the principal threat at the site. This Plan addresses groundwater contamination and is the planned final remedy for contamination at the LHAAP-04 site.

The U.S. Army, in consultation with USEPA Region 6 and TCEQ, will select a final remedy for the site after reviewing and considering all information submitted during the 30-day public comment period. The U.S. Army may modify the Preferred Alternative or select another response action presented in the Proposed Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all alternatives presented in the Proposed Plan.

This Proposed Plan summarizes LHAAP-04 site information contained in the Administrative Record file for LHAAP-04. Relevant information in this Proposed Plan is presented in the following sections:

1.0 Introduction

2.0 Site Background

3.0 Site Characteristics

4.0 Scope and Role

5.0 Risk Summary

6.0 Remedial Action Objectives

6.0 Summary of Remedial Alternatives

8.0 Evaluation of Alternatives

9.0 Summary of the Preferred Alternative

10.0 Community Participation

11.0 References

## 2.0 SITE BACKGROUND

The LHAAP is located in central-east Texas in the northeastern corner of Harrison County **(Figure 1**). The installation occupies approximately 1,400 of its former 8,416 acres between State Highway 43 at Karnack, Texas, and the western shore of Caddo Lake. The nearest cities are Marshall, Texas, approximately 14 miles to the southwest, and Shreveport, Louisiana, approximately 40 miles to the southeast.

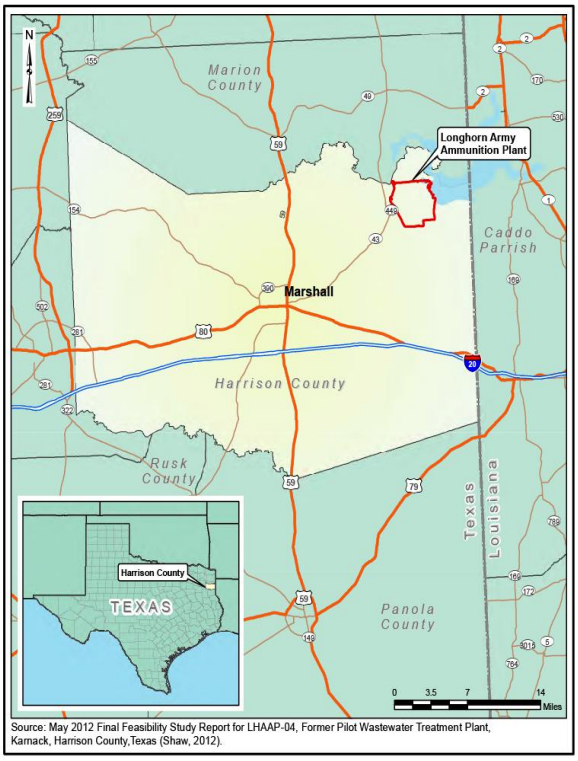


**Figure 1 – LHAAP Location**

Caddo Lake, a large freshwater lake situated on the Texas-Louisiana border, bounds LHAAP to the north and east.

The U.S. Army has transferred nearly 7,000 acres to the U.S. Fish and Wildlife Service (USFWS) for management as Caddo Lake National Wildlife Refuge. The property transfer process is continuing as response is completed at individual sites. The Longhorn Restoration Advisory Board has been kept informed of investigations and progress at Longhorn and site LHAAP-04 through regular quarterly meetings. Additionally, the Administrative Record is updated at least twice per year and is available at the Marshall Public Library.

Due to releases of chemicals from operations at the facility, LHAAP was placed on the Superfund National Priorities List (NPL) on August 9, 1990. Activities to remediate contamination associated with the listing of LHAAP as a NPL site began in 1990. The U.S. Army, the USEPA, and the Texas Water Commission (currently known as TCEQ) have

entered into a CERCLA Section 120 FFA since that time for remedial activities at LHAAP. The FFA became effective December 30, 1991.

LHAAP operated until 1997 when it was placed on inactive status and classified by the U.S. Army Armament, Munitions, and Chemical Command as excess property.

A site description of LHAAP-04, site characteristics, and a summary of site risks are provided below followed by a discussion of remedial alternatives and the Preferred Alternative recommendation.

**LHAAP-04**

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 (**Figure 2**). Industrial wastewater treatment operations began at LHAAP-04 in 1984. Industrial wastewater from sumps throughout LHAAP was trucked to the plant for treatment. After the wastewater settled, it was transferred to one of two storage tanks, and then was pumped through a heat exchanger to an evaporation tower. Solids were shipped offsite for disposal. Sludge from the settling tanks was dewatered and drummed weekly, then burned at Burning Ground No. 3 (LHAAP-18/24) (Plexus, 2005).

The demolition of the former pilot wastewater treatment facility structures, tanks, and piping, and the disposal of associated wastes were completed in the summer of 1997 as part of Resource Conservation and Recovery Act (RCRA) closure of the plant.

Various sampling events were conducted at LHAAP-04 from 1993 through 2008 to assess contamination from past operations and its impact to the soil and/or groundwater (Shaw, 2012). A Remedial Investigation (RI) for the LHAAP-04 was completed in 2002 (Jacobs, 2002). Following RCRA closure of LHAAP-04, soil sampling was conducted and LHAAP-04 was approved for closure according to 30 Texas Administrative Code 335 Subchapter S, Risk Reduction Rule Standard 2 in 1998 with the stipulation that the remaining soil contamination

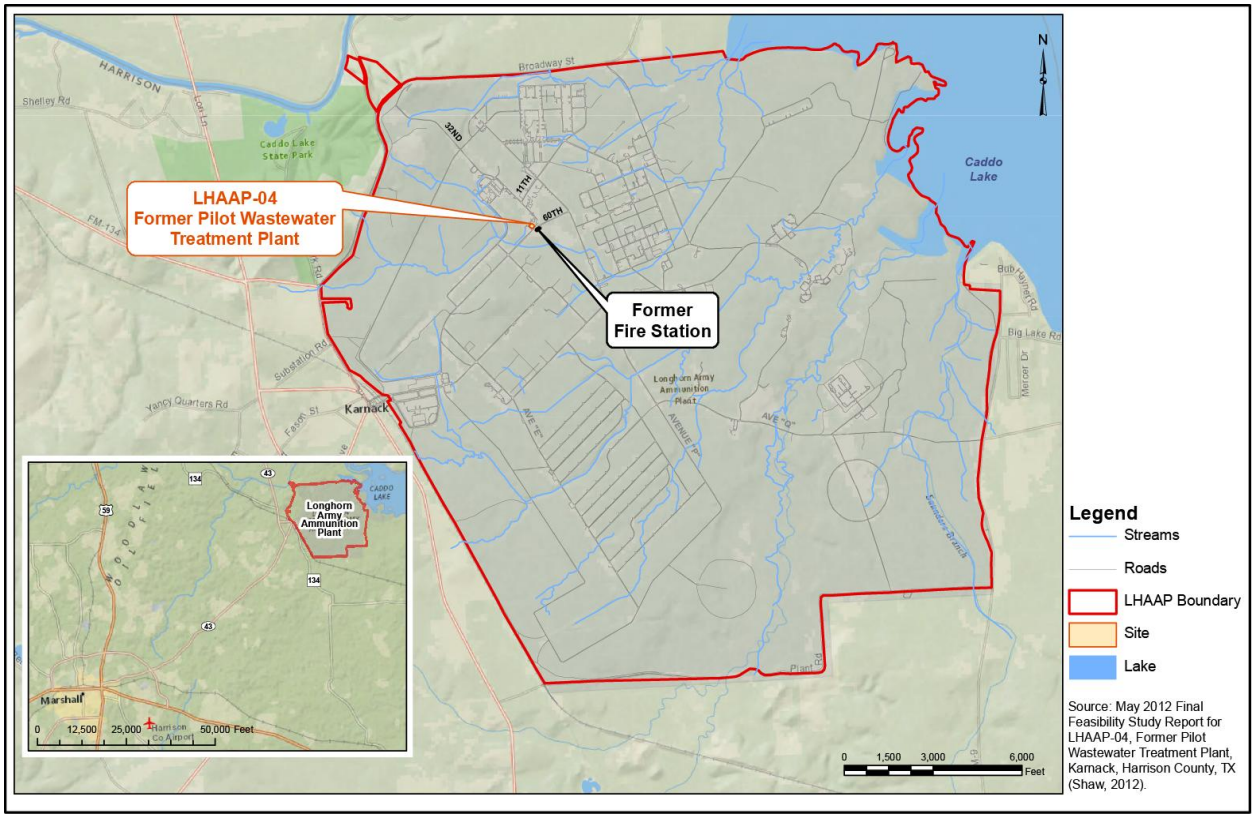


**Figure 2 - LHAAP-04 Site Location**

be addressed under CERCLA (Shaw, 2009a). Within the perchlorate contaminated soil area at LHAAP-04 there was an isolated area of mercury contamination that was above the soil medium specific concentration (MSC) for industrial use based on inhalation, ingestion, and dermal contact (TCEQ, 2006).

An Engineering Evaluation/Cost Analysis and an Action Memorandum were prepared for the LHAAP-04 site (Shaw, 2009b). The removal of soil contaminated with perchlorate and mercury was conducted in 2009 under CERCLA removal authority eliminating the principal threat at the site. The contaminated soil was excavated in 2009 along the southern edge of the slab, which formerly housed storage tanks for the former pilot wastewater treatment facility. A total of approximately 3,406 cubic yards of contaminated soil was removed and disposed off-site (Shaw, 2011). The perchlorate contaminated soil clean-up was based on the TCEQ MSC for the protection of industrial groundwater standard. Removal of the perchlorate and mercury contaminated soil eliminated the risk of soil migration to groundwater pathway.

Because of the inflow of groundwater into the excavation, soil confirmation samples from the floor of two confirmation grids (FL09 and FL11) could not be collected to document clean closure of the site. Perchlorate levels were unconfirmed within these grids.

In summary, the industrial wastewater treatment plant was demolished in 1997 and soil contaminated with perchlorate and mercury was removed in 2009. A Feasibility Study (FS) to address groundwater contaminated with perchlorate was completed in 2012 (Shaw, 2012).

## 3.0 SITE CHARACTERISTICS

The LHAAP-04 site is situated on the outcrop of Wilcox Group which generally consists of a few feet of residually derived soils overlying interbedded silts and clays (Shaw, 2012). Shallow groundwater at LHAAP-04 has been assessed via seven monitoring wells installed near LHAAP-04 to depths of approximately 20 feet below ground surface. Based on the potentiometric surface map for LHAAP -04, the groundwater flow direction in the shallow saturated zone is to the northeast (**Figure 3**).

The former pilot wastewater treatment plant was

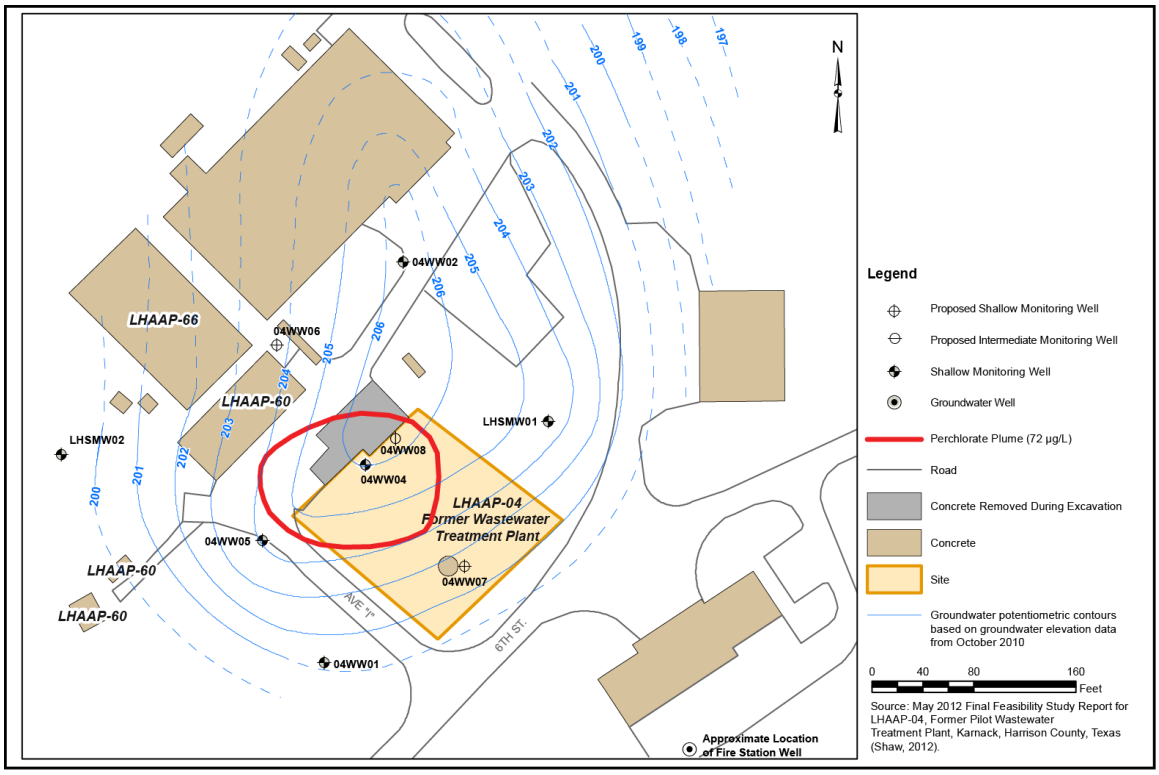


**Figure 3 – LHAAP-04 Perchlorate Plume in Groundwater**

the most likely source of contaminants that were released into the environment. Perchlorate was likely released into the environment via overflows, spills, and discharges to soil.

The perchlorate impacts in shallow groundwater are limited to an area in the vicinity of well 04WW04, located closest to the former pilot wastewater treatment plant (**Figure 3**). Although contaminated soil was confirmed removed to levels at or below the TCEQ soil MSC for protection of groundwater based on industrial use of 7.2 milligrams per kilogram (mg/kg) in all except two grids (FL09 and FL11), residual perchlorate levels in these two areas are unconfirmed. The well with the highest perchlorate detection is situated at the location of these two grids (Shaw, 2011).

Goose Prairie Creek is located approximately 700 feet to the south of the LHAAP-04 site. It is not expected that the LHAAP-04 site will contribute to surface water perchlorate contamination since the perchlorate contaminated soil has been removed (Shaw, 2012).

## 4.0 SCOPE AND ROLE OF THE PROPOSED REMEDY

This is the second and final planned Remedial Action for the LHAAP-04 site. The groundwater COC is perchlorate. The Preferred Alternative of completing In-situ Bioremediation with LUCs will reduce the level of perchlorate in groundwater toward the Remedial Action Objectives (RAOs), prevent migration of the plume, and reduce or eliminate exposure to contaminated groundwater. LUCs may be terminated when groundwater COC concentrations are reduced to levels to that allow for unlimited use and unrestricted exposure.

## 5.0 SUMMARY OF LHAAP-04 SITE RISKS

A Baseline Human Health and Screening Ecological Risk Assessment were performed for LHAAP-04 in 2003 (Jacobs, 2003), and presented the human health risks and hazards to a hypothetical future maintenance worker under an industrial scenario for soil and groundwater and a screening level ecological risk assessment. Subsequently, a baseline ecological risk assessment was also conducted and concluded that there is no impact to ecological receptors (Shaw, 2007). For the human health risk assessment, soil and groundwater data were used to calculate the aggregate risk values, which were then compared to the USEPA target risk range of $1 \times 10^{-4}$ to $1 \times 10^{-6}$ for the excess lifetime cancer risk and a hazard index (HI) of 1. The risks were:

**Soil**

For the hypothetical future maintenance worker exposure to soil at LHAAP-04, the carcinogenic risk and non-carcinogenic hazard were 1.2 x 10-6 with HI below 1 (0.28).

**Groundwater**

For the hypothetical future maintenance worker exposure to the groundwater at LHAAP-04 the carcinogenic risk and non-carcinogenic hazard were 4.5x10-5 with HI below 1 (0.19).

Since the completion of risk assessments, additional soil and groundwater data has been collected and analyzed. Soil samples collected after the risk assessment contained perchlorate and mercury concentrations that posed unacceptable risk or hazards to human health. These soils with high perchlorate and mercury concentrations were removed and sent to an off-site landfill in 2009 (Shaw, 2011). The remaining soil after completion of the removal activity does not pose unacceptable risk or hazard to human health based on exposure pathway for an industrial worker (Shaw, 2012).

Additional groundwater data collected after the risk assessment indicated that well 04WW04 had perchlorate concentrations exceeding the groundwater MSC for industrial use (GW-Ind) level of 72 micrograms per liter (µg/L). The perchlorate concentrations in the groundwater exceed the GW-Ind value, so are presumed to pose an unacceptable risk to human health.

The baseline ecological risk assessment concluded that no unacceptable risk was present in the Industrial Sub-Area which LHAAP-04 is a part of, and therefore, no further action is needed at LHAAP-04 for protection of ecological receptors (Shaw, 2007).

LHAAP-04 is not expected to contribute to surface water contamination since the contaminated soil has been removed (Shaw, 2011). Groundwater modeling also concluded that there was no impact to surface water from groundwater (Shaw, 2007). The modeling report considered a perchlorate concentration in groundwater (78,200 µg/L) more than ten times the highest measured groundwater concentration at LHAAP-04 (5,410 µg/L). The only pathway considered complete for remediation is the future industrial groundwater use and the GW-Ind value for perchlorate (72 µg/L) is the proposed cleanup level for perchlorate in groundwater.

Based on the groundwater risk, the U.S. Army's current judgment is that the Preferred Alternative identified in this Proposed Plan or one of the other active measures considered, is necessary to protect public health, welfare, or the environment from actual or threatened impacts from perchlorate in groundwater.

## 6.0 REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) are established to protect human health and the environment while also meeting Applicable or Relevant and Appropriate Requirements (ARARs). The identification of RAOs must consider the environmental issues at the site and the receptors that are affected. As identified in the conceptual site model (CSM), the primary environmental issue at LHAAP-04 is groundwater that exceeds the GW-Ind value for perchlorate and has the potential to adversely impact human health. Ecological risk is not a concern at LHAAP-04. Based on these considerations, the RAOs for LHAAP-04 are as follows:

- 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;
- Prevent groundwater contaminated with perchlorate from migrating into nearby surface water.

## 7.0 SUMMARY OF REMEDIAL ALTERNATIVES

LUCs, long-term monitoring (LTM), and Five-Year Reviews are common elements for all the action alternatives. These common elements are described below.

**Land Use Controls**

LUCs are any restriction or control, arising from the need to protect human health and the environment, that limits the use of and/or exposure to any portion of that property, including water resources.

Proposed LUCs as part of the action alternatives are:

- LUC to restrict land use to non-residential use until it is demonstrated that the COCs in soil and groundwater are at levels that allow for unlimited use and unrestricted exposure.
- LUC prohibiting potable use of groundwater above cleanup levels until it is demonstrated that the COCs are at levels that allow for unlimited use and unrestricted exposure.

**Long Term Monitoring**

LTM is the monitoring conducted after a remedy is selected and implemented, and is used to evaluate the degree to which the remedial measure achieves its objectives. Alternatives 2 through 5 at the LHAAP-04 site include long-term groundwater monitoring activities. LTM would include monitoring of a select number of groundwater wells to evaluate contaminant migration, ensure that the groundwater COC plume continues to degrade and verify that COC levels do not exceed the cleanup levels.

The LTM would be continued as required to demonstrate effectiveness of the remedy, and

compliance with ARARs, until RAOs are achieved.

**Five-Year Reviews**

Five-Year Reviews are intended to evaluate whether the response action remains protective of human health and the environment, is functioning as designed, and necessary operation and maintenance is being performed. For the LHAAP-04 site, the Five-Year Review would focus on effectiveness of the remedial action and achievement of specific performance levels established in the Record of Decision (ROD). Five-Year Reviews would include document reviews, review of cleanup standards, inspections, technology reviews, and preparation of a report summarizing the findings and recommendations. Five-Year Reviews would be performed until site conditions allow for unlimited use and unrestricted exposure.

The unique elements of each remedial alternative are identified below.

**Alternative 1 – No Action**

The No Action Alternative is required by CERCLA and serves as a baseline for comparison to other alternatives. Under this alternative, contaminated groundwater would remain in place without implementation of any contaminant removal, treatment, containment, or monitoring. The No Action Alternative would not eliminate risks or achieve RAOs. The No Action alternative is required to be listed for baseline comparison purposes, but will not be considered as a realistic alternative.

There are no costs associated with the No Action alternative.

*Estimated Total Present Worth* (PW) *Cost: $0*

**Alternative 2 – Monitored Natural Attenuation (MNA), LUCs**

This Alternative relies on monitoring the natural attenuation of contaminant concentrations in groundwater under an MNA program, combined with maintenance of LUCs as described in the common elements above. Groundwater monitoring would be performed to monitor whether the perchlorate concentrations in groundwater remain stable and continue to degrade via naturally occurring processes. The estimated cleanup time is 12 years and is based on a half life of 1.9 years using limited data from other LHAAP monitoring wells with similar perchlorate concentrations. Actual cleanup time could be higher or lower than this estimate.

The estimated PW costs for this Alternative were based on LTM of five wells for 15 years and use a 30-year evaluation period.

*Estimated Total Direct Capital Cost: $121,000*

*Estimated Total Operation and Maintenance (O&M) Cost: $444,000*

*Estimated Total PW Cost: $565,000*

**Alternative 3 – In-situ Bioremediation, LUCs**

This is the Preferred Alternative and is designed to reduce contamination in the area of highest perchlorate concentrations in the groundwater plume. It relies on In-situ Bioremediation using bioaugmentation, to reduce concentrations to acceptable values in a shorter time than MNA. LUCs would be maintained as described in the common elements above.

ISB is a technology that encourages growth and reproduction of indigenous microorganisms to enhance biodegradation of organic constituents such as perchlorate in the saturated groundwater zone. A substrate will be injected into the target treatment area via injection points/wells. Bioaugmentation will be performed if necessary to introduce the appropriate kind of microbial culture into the subsurface environment. A groundwater monitoring program includes the installation of additional groundwater monitoring wells in addition to sampling of the well located at the Fire Station. Groundwater sampling of these wells will be implemented as necessary to monitor the effectiveness and progress of in-situ bioremediation in reducing perchlorate concentrations in groundwater.

The estimated PW costs for this Alternative were based on LTM for 8 years and use a 30-year evaluation period.

*Estimated Total Direct Capital Cost: $233,000*

*Estimated Total O&M Cost: $405,000*

*Estimated Total PW Cost:* *$638,000*

**Alternative 4 – Extraction and Treatment, LUCs**

This alternative is designed to reduce perchlorate contamination in the area of highest concentrations in the groundwater plume via extraction (using extraction wells) and treatment of groundwater to achieve the cleanup level. Plume areas outside the extraction system are also expected to attain the cleanup level in a shorter duration after the highest perchlorate concentrations are removed. It is estimated that the perchlorate cleanup level in the groundwater would be achieved in approximately 15 months of treatment, provided extraction and treatment results are favorable. A trailer mounted treatment system will be used to remove perchlorate from the extracted groundwater using ion exchange resin technology. The treated effluent would be re-injected via four temporary wells back into the shallow zone at the site.

LUCs would be maintained as described in the common elements above.

It is estimated that the extraction and treatment of perchlorate contaminated groundwater will be performed for a period of 15 months and LTM would continue for 5 years and include costs associated with maintenance of LUCs for that period.

*Estimated Total Direct Capital Cost:* *$312,000*

*Estimated Total O&M Cost:* *$418,000*

*Estimated Total PW Cost:* *$730,000*

**Alternative 5 – Interceptor Collection Trenches, Extraction and Treatment, MNA, LUCs**

This alternative is designed to reduce perchlorate contamination in the area of highest concentrations in the groundwater plume via extraction using interceptor collection trenches followed by treatment of the extracted groundwater to achieve the perchlorate cleanup level. The extracted water will be treated using an ion exchange resin technology and the treated groundwater will be re-injected into the shallow zone at the site. Because the groundwater in the area with highest perchlorate concentration is removed and treated, perchlorate in portion of the plume located outside the influence of the extraction system is also expected to naturally attain the clean up level in a shorter duration (Shaw, 2012).

LUCs will be maintained as described in the common elements above.

The extraction and treatment portion of this alternative is estimated to take approximately six months. The LTM would continue for 5 years and include costs associated with maintenance of LUCs for that period.

*Estimated Total Direct Capital Cost:* *$389,000*

*Estimated Total O&M Cost:* *$394,000*

*Estimated Total PW Cost:* *$783,000*

## 8.0 EVALUATION OF ALTERNATIVES

Nine criteria identified in the NCP, 300.430(f)(1)(i), are used to evaluate the different remediation alternatives individually and against each other in order to select a remedy. The evaluation includes threshold criteria (requirements that must be met) and balancing criteria (used to weigh trade-offs). The modifying criteria (anticipated agency and public acceptance) will be evaluated based on comments received on this Proposed Plan.

### 1. Overall Protection of Human Health and the Environment

Overall protection of human health and the environment is the primary objective of a Remedial Action. The No Action Alternative does not achieve the RAOs and provides no reduction in risks to the human health or the environment. The other four alternatives achieve the RAOs. Alternative 2 relies most heavily on LUCs combined with MNA and does not provide contaminant removal or treatment in groundwater other than from natural processes. Alternatives 3, 4, and 5 also provide overall protection of human health and the environment and the ARARs for these alternatives are expected to be achieved in a shorter time frame due to active treatment components.

**2. Compliance with ARARs**

ARARs are environmental laws that are identified on a site-specific basis. Alternative 1 does not comply with chemical-specific ARARs as no remedial action would be implemented. The action-specific ARAR does not apply to Alternative 1 since no remedial activities would be conducted. Alternatives 2, 3, 4, and 5 are expected to comply with chemical-specific ARARs and action-specific ARARs. There are no location-specific ARARs.

**3. Long-Term Effectiveness and Permanence**

Alternative 1 would be least effective and permanent because no contaminant removal or treatment would take place and no active measures would be implemented to control exposure risks posed by contaminated site. Alternative 2 offers long-term effectiveness through implementation of MNA with LUCs, which would minimize the hazard posed by contaminated groundwater, albeit in a longer time than Alternatives 3, 4 and 5. Alternatives 3, 4, and 5 will provide long-term effectiveness and permanence and in addition, they are designed to reduce groundwater contaminant concentrations and achieve clean up levels in a shorter duration. LUCs associated with Alternatives 2, 3, 4, and 5 will be in place until levels that allow for unlimited use and unrestricted exposure are achieved.

**4. Reduction in Toxicity, Mobility, or Volume Through Treatment**

Alternative 1 does not include a remedy, so there is no documentation of reduction in toxicity, mobility or volume. Alternative 2 does not employ active treatment and will rely on naturally occurring processes to achieve reduction in toxicity, mobility, and volume as contaminants are reduced to concentrations below risk criteria. Alternative 3 provides a reduction in toxicity, mobility, and volume via bioremediation of perchlorate. Alternatives 4 and 5 will reduce the volume of contamination via extraction of impacted groundwater and will provide reduction in toxicity and mobility via treatment of impacted groundwater. The degree of reduction in toxicity and mobility will depend upon the treatment processes.

**5. Short-Term Effectiveness**

Short-term effectiveness is used to evaluate the length of time needed to implement an alternative for a risk to on-site workers and the nearby community during remedial action implementation.

Alternative 1 does not involve any remedial actions, so no short-term risk to workers, the community or the environment would exist.

The implementation of Alternative 3, 4, or 5 would require more time than alternative 2 due to requirement for pre-design activities. LUCs associated with Alternatives 2, 3, 4, and 5 will be in place until levels that allow for unlimited use and unrestricted exposure are achieved.

Alternatives 4 and 5 are also operation and maintenance (O&M) intensive, with greater potential for short-term physical safety risks to on-site workers, and refuge visitors.

**6. Implementability**

Under alternative 1, no remedial action would be taken. Therefore, no difficulties or uncertainties would be associated with its implementation. Alternatives 2, 3, 4, and 5 can be easily implemented from a technical standpoint as all equipment, materials, and services required are readily available. Alternative 3 would be slightly more difficult to implement than Alternative 2 from a technical standpoint due to the specialized expertise required to design and construct the In-situ Bioremediation treatment elements. Administratively, all of the alternatives are implementable.

**7. Cost**

Cost Estimates are used in the CERCLA FS process to eliminate those remedial alternatives that are significantly more expensive than competing alternatives without offering commensurate increases in performance or overall protection of human health or the environment. For each alternative addressed in the comparative analysis, a total PW cost was developed including both capital and long-term

O&M costs. These costs are estimates with an intended accuracy range of +50% to -30% of the estimates. Of the action alternatives, Alternative 2 is the least expensive, followed by Alternative 3, Alternative 4, and Alternative 5, which is the most expensive Alternative.

| | |
|---|---|
| Alternative 1 Total PW Cost: | $0 |
| Alternative 2 Total PW Cost: | $565,000 |
| Alternative 3 (Preferred Alternative) | |
| Total PW Cost: | $638,000 |
| Alternative 4 Total PW Cost: | $730,000 |
| Alternative 5 Total PW Cost: | $783,000 |

**8. State/Support Agency Acceptance**

The TCEQ and the EPA concur with the Preferred Alternative.

**9. Community Acceptance**

Community acceptance of the Preferred Alternative will be evaluated based on comments received during the public comment period for this Proposed Plan. A Responsiveness Summary will be included in the LHAAP-04 Decision Document (DD).

## 9.0 SUMMARY OF THE PREFERRED ALTERNATIVE

Based on the evaluation of alternatives, Alternative 3 (In-situ Bioremediation, LUCs) is the Preferred Alternative for the LHAAP-04 because it:

- Is protective of human health and the environment;
- Complies with ARARs;
- Is expected to achieve RAOs;
- Has been shown to be both efficient and effective at other sites with similar contamination;
- Is easy to implement with no adverse short-term impacts;
- Is more cost-effective than Alternatives 4 and 5.

The Preferred Alternative involves In-situ Bioremediation to reduce perchlorate concentrations in groundwater to achieve the cleanup level, and maintenance of LUCs until it is demonstrated that the COCs are at levels that allow for unlimited use and unrestricted exposure. Groundwater in the hot spot area in the vicinity of monitor well 04WW04 will be targeted by In-situ Bioremediation. Additional site investigation is proposed to better define the area of treatment, and delineate perchlorate extent and obtain geochemistry information. In-situ Bioremediation would be performed in the target treatment area using a substrate which would be injected via direct push technology injection points.

Introduction of the appropriate microbial culture via bioaugmentation will be performed to assist in In-situ Bioremediation. It is anticipated that the substrate would be injected in the first year, and that the injection would occur in the shallow zone, at no deeper than 25 feet bgs. Performance monitoring will be performed to monitor the effectiveness of this Preferred Alternative. Additional applications may be needed based on in situ effectiveness of the In-situ Bioremediation technology. Performance monitoring would be performed on a quarterly basis for a period of two years and will include analysis of perchlorate and other geochemical parameters. LTM would begin in year 3 after treatment and would be conducted semiannually for 3 years (through Year 5), then annually for years 6 through 8.

The U.S. Army will implement LUCs under this alternative through the Remedial Design.

The Preferred Alternative can change in response to public comments or new information.

Based on information currently available, the U.S. Army believes the Preferred Alternative meets the threshold criteria and provides the best balance of tradeoffs among the alternatives with respect to the balancing and modifying criteria. The U.S. Army expects the Preferred Alternative to satisfy the following requirements of CERCLA Section 121(b):

- be protective of human health and the environment;
- comply with ARARs; and
- be cost effective.

## 10.0 COMMUNITY PARTICIPATION

The U.S. Army, USEPA, and TCEQ provide information regarding LHAAP-04 through public meetings and the Administrative Record file for the facility. The public is encouraged to gain a more comprehensive understanding of the sites.

The public comment period for this Proposed Plan offers the public an opportunity to provide input to the LHAAP-04 remedial action planning process. The Proposed Plan is available in the Administrative Record (see "Dates to Remember" on page 1 of this Proposed Plan for location). The public comment period will begin on December 10, 2012 and end on January 9, 2013.

After the public has had an opportunity to review this Proposed Plan during the public comment period and the U.S. Army reviews the public comments received on it, the U.S. Army will publish the selected remedy for the LHAAP-04, the basis for its selection, the associated RAOs, and any contingency planning in a DD. The U.S. Army will also incorporate a Responsiveness Summary addressing public comments in the DD.

## 11.0 REFERENCES

Jacobs, 2002, *Remedial Investigation Report Addendum for the Group 4 Sites, Remedial Investigation Report, Sites 04, 08, 67, and Hydrocarbon Study, Longhorn Army Ammunition Plant, Karnack, Texas, Oak Ridge, Tennessee*, February.

Jacobs, 2003, *Final Baseline Human Health and Screening Ecological Risk Assessment for the Group 4 Sites (Sites 04, 08, 35A, 35B, 35C, 46, 47, 48, 50, 60, 67, Goose Prairie Creek, Saunders Branch, Central Creek, and Caddo Lake), Longhorn Army Ammunition Plant, Karnack, Texas, Final, Oak Ridge, Tennessee*, June.

Plexus, 2005, *Environmental Site Assessment, Phase I and II Report, Final, Production Areas, Longhorn Army Ammunition Plant, Karnack, Texas*, February.

Shaw, 2007, *Final Modeling Report, Derivation of Soil and Groundwater Concentrations Protective of Surface Water and Sediment, Revision 1, Longhorn Army Ammunition Plant, Karnack, Texas*, February.

Shaw, 2009a, *Final Action Memorandum for Former Pistol Range and LHAAP-04, Former Pilot Wastewater Treatment Plant, Karnack, Harrison County, Texas*, July.

Shaw, 2009b, *Final Engineering Evaluation/Cost Analysis, LHAAP-04, Former Pilot Wastewater Treatment Plant, Longhorn Army Ammunition Plant, Texas*, March.

Shaw, 2011, *Final Completion Report Non-Time-Critical Removal Action, Longhorn Army Ammunition Plant, Karnack, Texas, Houston, Texas*, August.

Shaw, 2012, *Final Feasibility Study Report for LHAAP-04, Former Pilot Wastewater Treatment Plant, Karnack, Harrison County, Texas*, May.

Texas Commission on Environmental Quality (TCEQ), 2006, *Updated Examples of Standard No. 2, Appendix II, Medium-Specific Concentrations*, March 31.

## GLOSSARY OF TERMS

Specialized terms used in this Proposed Plan are defined below:

**Administrative Record File**: A file which is maintained and contains all information used to make a decision on the selection of a response action under CERCLA.

**Applicable or Relevant and Appropriate Requirements (ARARs):** The federal and state environmental laws and regulations that must be complied with when undertaking a selected remedy. These requirements may vary among sites and alternatives.

**Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)**: A law that establishes a program to identify hazardous waste sites and procedures for cleaning up sites to be protective of human health and the environment, and evaluate damages to natural resources.

**Conceptual Site Models (CSMs)**: a description of a site and its environment that is based on existing knowledge and is updated regularly

**Decision Document (DD)**: A public document that identifies the selected remedy, the final remedial action objectives (RAOs), measures to achieve RAOs, the basis for the decision, remedial action performance expectations, and metrics to assess remedial progress. The DD is based on the information and technical analysis generated during the remedial investigation/feasibility study, consideration of ARARs, and consideration of public comments. All information used to make a final remedy decision must be documented in the site Administrative Record.

**Feasibility Study (FS):** An investigation stage in the CERCLA clean-up process to identify the alternatives available to address contamination at a site, including an analysis of cost and how each alternative will protect human health and the environment

**Five-year Review**: A process that evaluates the protectiveness of the remedy and determines whether conditions remain protective of human health and the environment. CERCLA Section 121(c) and the National Contingency Plan at 40 CFR Section 300.430(f)(4)(ii) require that remedial actions that result in hazardous substances, pollutants, or contaminants remaining at a site above levels that allow for unlimited use and unrestricted exposure be reviewed every 5 years to ensure protection of human health and the environment.

**National Oil and Hazardous Substances Pollution Contingency Plan (NCP)**: Also referred to as the National Contingency Plan, it is a plan required by CERCLA and codified at 40 CFR Section 300 that provides a framework for responding to releases or threats of release of hazardous substances and oil discharges.

**Present Worth (PW) Analysis**: A method to evaluate expenditures that occur over different time periods. By discounting all costs to a common base year, the costs for different remedial action alternatives can be compared. When calculating present worth costs for Superfund sites, capital as well as operation & maintenance costs are included.

**Proposed Plan**: A public participation requirement of CERCLA Section 117 in which the lead federal agency summarizes the preferred cleanup strategy, the rationale for the preference, the alternatives evaluated in the remedial investigation/feasibility study, and any ARAR waivers proposed for site cleanup. The Proposed Plan is issued to the public to solicit public review and comment on all alternatives under consideration.

**Public Comment Period**: A prescribed period during which the public may comment on the Proposed Plan.

**Remedial Action**: The means selected to achieve RAOs; also, the construction or implementation phase that follows the remedial design of the selected cleanup alternative at an NPL site.

**Remedial Action Objective (RAO):** The goals established for a remedy that ensure protection of human health and the environment.

**Remedial Investigation (RI):** An investigation stage in the CERCLA clean-up process in which the nature and extent of contamination (types of chemicals and how far they have travelled vertically and horizontally) is determined

**Resource Conservation and Recovery Act (RCRA):** The Resource Conservation and Recovery Act (RCRA), enacted in 1976, is the principal Federal law in the United States governing the disposal of solid waste and hazardous waste

**Risk Assessment:** An Analysis of the potential adverse health effects (current and future) caused by hazardous substances. The assessment contributes to decisions regarding appropriate response alternatives.

**ACRONYMS**

| | |
|---|---|
| ARARs | applicable or relevant and appropriate requirements |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| COC | contaminant of concern |
| DD | Decision Document |
| FFA | Federal Facilities Agreement |
| FS | Feasibility Study |
| GW-Ind | Groundwater Medium Specific Concentration for Industrial Use |
| HI | Hazard Index |
| LHAAP | Longhorn Army Ammunition Plant |
| LUC | Land Use Control |
| LTM | Long-term Monitoring |
| µg/L | micrograms per liter |
| mg/kg | milligrams per kilogram |
| MNA | Monitored Natural Attenuation |
| MSC | medium specific concentration |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan |
| NPL | National Priorities List |
| O&M | operation and maintenance |
| PW | present worth |
| RAO | remedial action objective |
| RCRA | Resource Conservation and Recovery Act |
| RI | remedial investigation |
| ROD | Record of Decision |
| SARA | Superfund Amendments and Reauthorization Act |
| TCEQ | Texas Commission on Environmental Quality |
| USEPA | United States Environmental Protection Agency |
| USFWS | United States Fish and Wildlife Service |