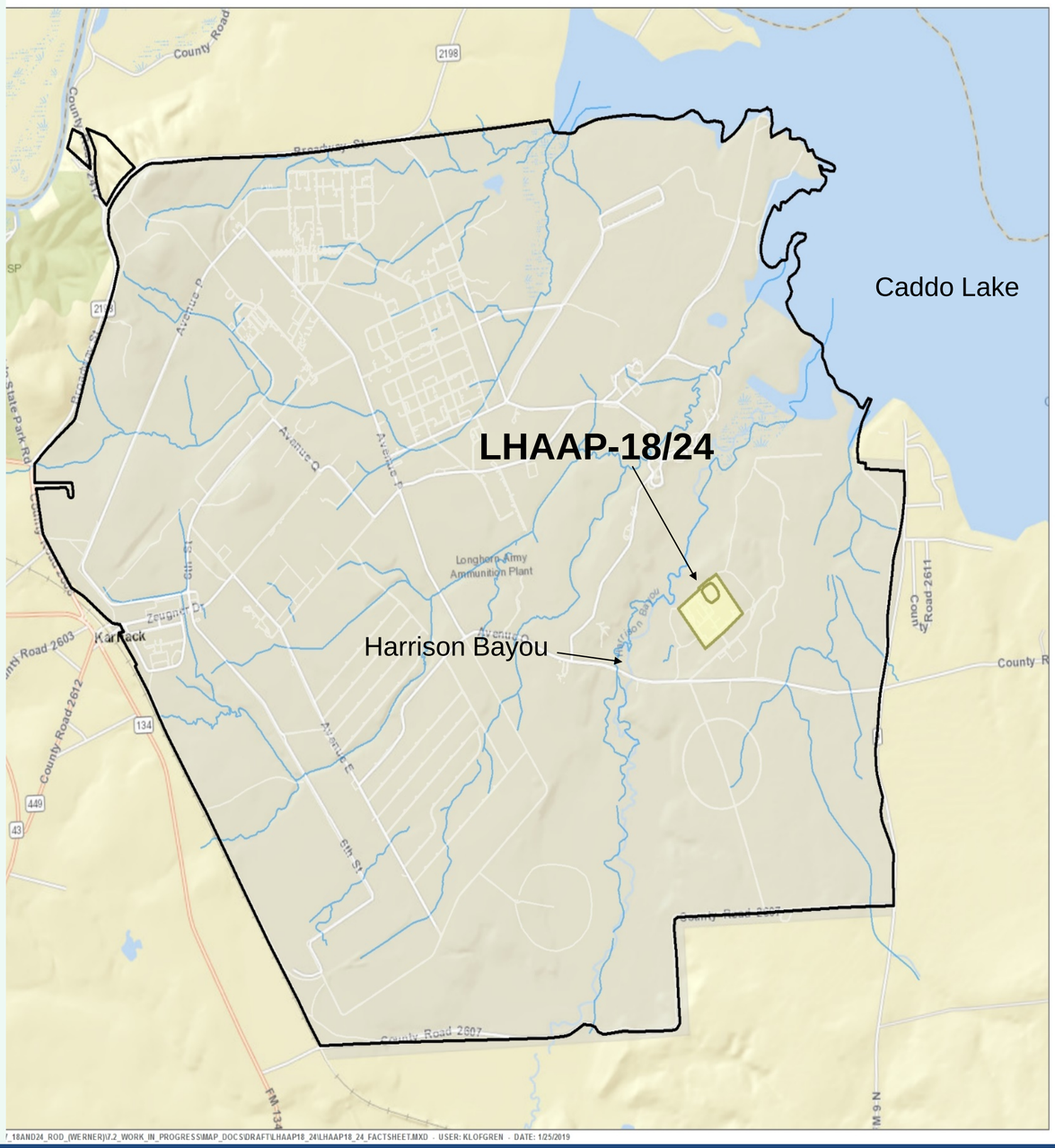
LHAAP-18/24, Burning Ground No. 3 and Unlined Evaporation Pond

PREFERRED REMEDY: Enhanced Groundwater Extraction and Treatment, Land Use Controls (LUCs) in the Shallow Zone and Wilcox Formation, Enhanced In Situ Bioremediation (EISB) Inside and Outside the Containment Area in the Shallow Zone and in the Wilcox Formation, Unsaturated Soil Excavation and Off-Site Disposal, and Thermal Dense Non-Aqueous Phase Liquid (DNAPL) Removal

Site History

LHAAP-18/24, the former Burning Ground No. 3 and Unlined Evaporation Pond (UEP), is located in the southeastern portion of LHAAP and covers approximately 34.5 acres. The site is a former industrial area and was used for the treatment, storage, and disposal of solid and liquid explosive, pyrotechnic, and solvent waste by open burning/open detonation, incineration, evaporation, and burial. LHAAP-18 Burning Ground No. 3 operated between 1955 and 1998, while LHAAP-24 UEP operated from 1963 to 1984. After a Remedial Investigation was completed in 2001 and subsequent Post-Screening Investigations in 2013-2014 and 2016, a Revised Feasibility Study was performed in 2017 to evaluate remedial alternatives for the site. The Proposed Plan was completed in February 2019. The preferred remedy identified in the Proposed Plan is Enhanced Groundwater Extraction and Treatment, Land Use Controls (LUCs) in the Shallow Zone and Wilcox Formation, Enhanced In-Situ Bioremediation (EISB) Inside and Outside the Containment Area in the Shallow Zone and in the Wilcox Formation, Unsaturated Soil Excavation and Off-Site Disposal, and Thermal Dense Non-Aqueous Phase Liquid (DNAPL) Removal.



Interim Remedial Actions

Sludge from the UEP was removed in 1986 and the impoundment was capped. The majority of impacts to the soil were remediated during the 1997 LHAAP-18/24 Interim Remedial Action (IRA) when approximately 32,000 cubic yards of soil was removed. A groundwater extraction system incorporating approximately 5,000 feet of interceptor-collection trenches (ICTs) and a groundwater treatment plant (GWTP) were installed in 1997 to control the migration of contaminated groundwater and to protect surface water. The area within the ICTs is considered the containment area. Harrison Bayou is located adjacent to the site and drains to Caddo Lake, a drinking water supply.

Human Health Risk Assessment

The Baseline Human Health Risk Assessment (BHHRA) was conducted for LHAAP-18/24 to determine current and future effects of contaminants on human health. Based on the BHHRA, it was concluded that chemicals pose an unacceptable cancer risk and an unacceptable non-cancer hazard to a hypothetical future maintenance worker under an industrial scenario. The risk and Hazard Index values are based on the industrial exposure scenario that includes drinking the water or using the water for hand washing or showering.

Ecological Risk Assessment

A baseline ecological risk assessment (BERA) was performed for the industrial area including LHAAP-18/24. There were no unacceptable risks identified for ecological receptors within LHAAP-18/24 and no action is required.

Chemicals of Concern

- Soil chemicals of concern (COCs) are Volatile Organic Compounds (VOCs) (methylene chloride [MC], trichloroethene [TCE], tetrachloroethene [PCE]), and perchlorate.
- Shallow Zone groundwater COCs are VOCs (MC, TCE, cis-1,2-dichloroethylene (DCE), PCE, benzene, 1,1,2-trichloroethane (TCA), vinyl chloride, bromodichloromethane, 1,3,5-trinitrobenzene, 1,4-dioxane), metals (arsenic, barium, chromium, cobalt, nickel), and perchlorate.
- Wilcox Formation groundwater COCs are VOCs (MC, TCE, cis 1,2-DCE, PCE, benzene, 1,1,2-TCA, 1,1,1,2-tetrachloroethane, vinyl chloride, bromodichloromethane, 1,3,5-trinitrobenzene, 1,4-dioxane), metals (arsenic, barium, cobalt), and perchlorate.

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Remedial Action Objectives (RAOs)

- Protect human health by preventing human exposure to the groundwater contaminated with COCs.
- Protect human health and the environment by preventing groundwater contaminated with COCs from migrating into nearby surface water.
- Protect human health and the environment by preventing the migration of contaminants to groundwater from potential sources in the soil.
- Return groundwater to its beneficial uses wherever practicable, within a timeframe that is reasonable given the particular circumstances of the site.

Remedial Alternatives

- Alternative 1 – No Action Alternative – Estimated Cost $0.
- Alternative 2 – Enhanced Groundwater Extraction and Ex-Situ Treatment, LUCs, EISB Inside and Outside the Containment Area and in the Wilcox Formation, Unsaturated Soil Excavation, and Off-Site Disposal – Estimated Cost $34,160,000.
- Alternative 3 – Groundwater Extraction and Treatment, Monitored Natural Attenuation (MNA) Outside the Containment and in the Wilcox Formation, LUCs, and Containment Area Slurry Wall – Estimated Cost $18,650,000.
- Alternative 4 – Enhanced Groundwater Extraction and Treatment, LUCs, EISB Inside and Outside the Containment Area and in
  the Wilcox Formation, Unsaturated Soil Excavation and Off-Site Disposal, and Surfactant Enhanced DNAPL Removal – Estimated Cost $32,500,000.
- Alternative 5 – Enhanced Groundwater Extraction and Treatment, LUCs, EISB Inside and Outside the Containment Area and in the Wilcox Formation, Unsaturated Soil Excavation and Off-Site Disposal, and Thermal DNAPL Removal – Estimated Cost $32,670,000.
- Alternative 6 – Enhanced Groundwater Extraction and Treatment, LUCs, EISB Inside and Outside the Containment Area and in the Wilcox Formation, Unsaturated Soil Excavation and Off-Site Disposal, and Enhanced DNAPL Remediation using Zero-Valent Iron (ZVI) – Estimated Cost $121,620,000.

The alternatives were evaluated based on effectiveness, implementability, and cost. The No Action alternative provides a comparative baseline, but does not meet RAOs. All five action alternatives protect human health and the environment; however, Alternative 3, which relies the most heavily on containment and LUCs, does not provide the same degree of contaminant removal or treatment in groundwater as the other alternatives. Alternatives 2, 4, 5, and 6 provide a similar level of overall protection and can eventually achieve the cleanup levels for the groundwater COCs due to active remediation and continued operation of the groundwater treatment system for contaminant removal; however, the duration to achieve the cleanup levels vary. Alternative 5 would be a permanent solution and would most effectively and rapidly reduce contaminant concentrations and meet the RAOs. Enhanced groundwater extraction and treatment will stabilize and contain the groundwater plumes. Thermal desorption treatment followed by EISB and MNA of the DNAPL areas is expected remove 99.9% of the VOCs in the shortest timeframe. MNA following the thermal desorption treatment and EISB for groundwater is estimated to reduce COCs to cleanup levels in 20 years, compared to the other alternatives, which would take 30 to hundreds of years.

Description of the Preferred Remedy – Alternative 5:

Soil:

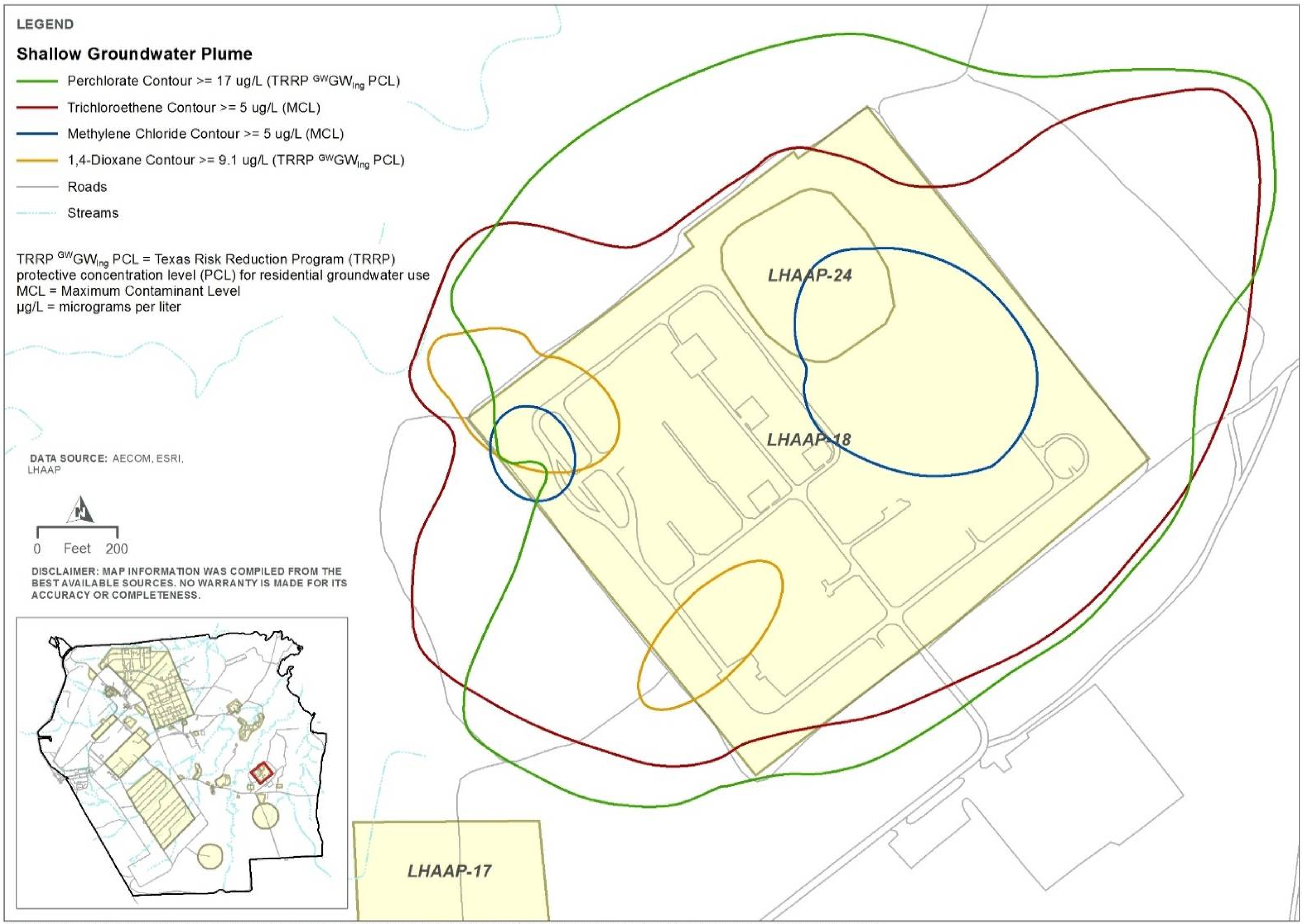
- Excavation and off-site disposal of unsaturated soil exceeding groundwater protection standards. One area beneath the UEP, two areas south, and two areas to the west will be excavated up to 12 feet below ground surface.

Groundwater:

- Continued use of the existing groundwater extraction system with enhancements may be required until COC concentrations are low enough that MNA can address remaining contamination within the containment area.
- Continued operation of the current or potentially a new GWTP, including contingency use of advanced oxidation process for treatment of 1,4-dioxane.
- Implementation of EISB of shallow zone groundwater outside the containment area at several locations; in the Wilcox formation at three or more locations, and inside the containment at five or more locations or as needed.
- Implementation of thermal desorption to remove DNAPL in two distinct areas inside the containment area at the site.
- MNA for both shallow and intermediate zone groundwater for areas outside the influence of the treatment areas and for areas inside the influence of the treatment areas (after evaluation of EISB) to reduce contaminant levels to cleanup levels and confirm the contaminated groundwater remains localized with minimal migration.
- Maintenance of existing cap over the former UEP.
- Long-term LUCs for the Shallow Zone and Wilcox Formation aquifers that will ensure protection of human health by preventing exposure until levels that allow for unlimited use and unlimited exposure have been attained.

CERCLA Five Year Reviews until the levels of COCs in soil and groundwater allow for unlimited use and unrestricted exposure.

LHAAP-18/24 Groundwater Contamination
Shallow Zone



LHAAP-18/24 Groundwater Contamination

Wilcox Formation