EA Engineering, Science, and Technology, Inc.

225 Schilling Circle
Hunt Valley, MD 21031
Telephone: 410-584-7000
Fax: 410-472-9875
www.eaest.com

FINAL
OPERATIONAL RANGE ASSESSMENT PROGRAM REPORT
RED RIVER ARMY DEPOT, TEXAS

To meet Department of Defense (DoD) requirements and support the U.S. Army's Sustainable Range Program, the Army is conducting the Operational Range Assessment Program (ORAP) to determine whether a release or substantial threat of release of munitions constituents of concern (MCOC) from an operational range to an off-range area creates a potentially unacceptable risk to human health or the environment. The initial ORAP assessment—Phase I—is a qualitative evaluation of whether: (a) a MCOC source existed on the operational range footprint, (b) there is a potential migration mechanism, and (c) human or sensitive ecological receptors are present. Conclusions from the Phase I place each operational range into one of two categories: Unlikely or Inconclusive. Operational range areas categorized as "Unlikely" are those where there is sufficient evidence to show that there are no known releases or source-receptor interactions that could present an unacceptable risk to human health or the environment, based on a review of the information available; no further action needs to be taken for these ranges at this time and the installation is placed into a periodic year review cycle. Operational range areas categorized as "Inconclusive" are those where existing information either is insufficient to make a source-receptor interaction determination, or indicates the potential for such interaction to be occurring. Sites with ranges categorized as Inconclusive are recommended for further evaluation by conducting an ORAP Phase II assessment (Phase II).

The Phase II re-evaluates whether the source-receptor pathway identified during the Phase I is complete, identifies any new information that may impact the Phase I's conclusions, and as necessary involves a quantitative assessment consisting of the collection and laboratory analysis of environmental media to determine whether MCOC are potentially leaving an operational range footprint by an identified pathway (e.g., groundwater or surface water) and pose a potential risk to off-site receptors.

Red River Army Depot (RRAD) occupies 15,839 acres in Bowie County 10 mi west of Texarkana and 0.5 mi east of New Boston. RRAD currently utilizes seven operational ranges totaling approximately 33 acres, with the remaining 15,806 acres consisting of non-operational area (including the cantonment area). Four of the seven operational ranges are programmatically excluded from the ORAP. These excluded ranges include one trap and skeet range encompassing 1.8 acres and three Resource Conservation and Recovery Act permitted open burn / open detonation areas encompassing 14 acres. The three remaining operational ranges include two firing ranges (one small arms range; and one research, development, testing, and evaluation range), and one maneuver and training area (fire training tower).

The Phase I completed for RRAD in 2008 categorized the single 15.7-acre small arms range as Inconclusive due to potential surface water and/or groundwater pathways (EA, 2008) and recommended the range for a quantitative Phase II assessment.

Small caliber munitions are the primary munitions used (limited inert medium caliber practice munitions are also used) on the small arms range. MCOC associated with small caliber munitions include metals (i.e., antimony, copper, lead, and zinc).

The Phase I identified shallow groundwater as the primary migration pathway for MCOC from the Inconclusive range. Shallow alluvial deposits located along drainage areas are reported to be in hydraulic connection to streams, with depth to groundwater close to the surface. Shallow groundwater from the

Inconclusive range likely flows east with discharge to Nettles Creek, located approximately 700 ft east of the Inconclusive range. Although five bedrock water supply wells are located within four miles southeast and, therefore, potentially downgradient of the Inconclusive range, due to the distance to the downgradient water supply wells (3.1–3.5 mi), the depth of the wells, and the likelihood that shallow groundwater discharges to Nettles Creek which serves as a hydraulic barrier to shallow groundwater flow, it is unlikely that metals MCOC originating from the Inconclusive range will migrate via the groundwater pathway at concentrations that pose an unacceptable risk to off-range users of drinking water wells.

During the Phase II site reconnaissance, a drainage swale was identified exiting the northeastern corner of the Inconclusive range. The swale receives stormwater runoff and drainage from the range. Due to the presence of a defined surface water pathway, surface water draining the Inconclusive range is considered the primary pathway for MCOC migration. Due to the interconnection of surface water and shallow groundwater, shallow groundwater is considered a secondary pathway where potential MCOC can leach/infiltrate into shallow groundwater and discharge to Nettles Creek. Sampling of surface water in Nettles Creek would address MCOC migration via both surface water and groundwater from the Inconclusive range to downstream receptors.

Off-range human and ecological receptors are associated with Nettles Creek downstream from the Inconclusive range, with human receptors including recreational users of Elliott Creek Reservoir (an impoundment of Nettles Creek) and ecological receptors including downstream sensitive environments (i.e., wetlands along Nettles Creek) and federal and state threatened species.

Adjoining areas of concern were identified upstream and upgradient from the Inconclusive range during the Phase I and Phase II site reconnaissance. These areas included Texamericas East (formerly Lone Star Army Ammunition Plant) located approximately 0.6 mi north of the range, and one closed test range located less than 0.2 mi north of the range. Explosives and heavy metals have been detected in soil, sediment, surface water, and groundwater at Texamericas East. Small caliber munitions were used at the closed test range, and metals MCOC have been detected in soils within the target / bullet trap, associated with the closed range.

Phase II multi-season field sampling was conducted at RRAD during May 2012 and September 2012. Surface water, sediment, and benthic macroinvertebrate samples were collected from two locations on Nettles Creek at RRAD: one location downstream of the potential MCOC source area and one reference location upstream. Due to the potential for MCOC migration in surface water from adjoining areas of concern, the reference sampling location was located upstream from the Inconclusive range and downstream from areas of concern to determine if MCOC originated from the Inconclusive range or migrated from an upstream source. Wet and dry season sampling was conducted to identify potential seasonal variations in water quality transport characteristics. Diurnal variations in surface water quality were accounted for using 24-hour composite samples. The effects of precipitation and runoff on water quality were considered by collecting 2-hour composite samples at each stream location after a storm event during the dry season. Sediment and benthic macroinvertebrate samples were collected as composited grab samples from all surface water sampling locations.

Surface water samples were analyzed for metals and standard water quality parameters (including temperature, pH, dissolved oxygen, oxidation reduction potential, and turbidity). Sediment samples were analyzed for metals, total organic carbon, and simultaneously extracted metals / acid-volatile sulfides (SEM/AVS). SEM/AVS sampling is used to evaluate the bioavailability and toxicity of metals in sediment.

Statistical analysis was performed on the analytical data collected from downstream sample location at RRAD. The statistical analysis process included comparison to reference concentrations using a *t*-test

($\alpha = 0.05$), and calculation of the 95 percent upper confidence limit of the mean (UCLM) for comparison to site-specific screening Operational Range Assessment Screening Values. Surface water ecological screening criteria for copper, lead, and zinc were dependent upon location-specific hardness results (i.e., calcium carbonate). As a conservative measure, ecological screening values used for completing statistical analysis of surface water at RRAD were adjusted based on the lowest hardness value observed at each sampling location.

While UCLMs at both the reference and downstream sampling locations did not exceed drinking water screening levels, the 95 percent UCLM lead and copper concentrations in surface water exceeded site-specific ecological screening levels at both the downstream sampling location and upstream reference location. Additionally, the 95 percent UCLM concentrations for copper and lead (4.7 and 3.3 µg/L, respectively) at the upstream reference location were higher than the downstream location, and the average lead and copper concentrations were also higher in the upstream reference location samples than downstream samples. Based on these observations, the elevated concentrations of copper and lead observed in surface water from Nettles Creek are not thought to be attributable to activities within the Inconclusive range. No metals were detected above ecological screening levels in any of the sediment samples at the reference or downstream sample locations, and no statistical difference was observed in concentrations for lead, copper, zinc, and antimony in sediment from these locations. Additionally, normalized SEM/AVS results suggest that bioavailability of metals in sediment is limited, and toxicity from metals in sediment is unlikely.

Benthic macroinvertebrate results indicate that the upstream and downstream sampling locations support a robust and healthy benthic community. Although diversity index values for the downstream location were statistically lower than associated reference location during the wet season, the diversity index values indicated that both the upstream and downstream locations were classified in the clean stream category. Dry season sampling results at both the upstream and downstream sampling locations exhibited a decline in the benthic community relative to the wet season results. Limited stream flow and dry conditions during the dry season sampling event may have contributed to this difference. Overall, the benthic macroinvertbrate surveys suggest that the downstream and upstream benthic communities are comparable and it is unlikely that the downstream benthic community is being influenced by activities at the Inconclusive range.

In summary, based on the result of the Phase II assessment, metals MCOC are unlikely to be migrating from the small arms range at concentrations that pose an unacceptable risk to off-range human and ecological receptors (i.e., recreational users of Elliott Creek Reservoir, and wetlands and threatened species downstream of the Inconclusive range). Although elevated concentrations of copper and lead were reported in surface water downgradient of the operational range, the concentrations are no higher than concentrations detected in samples from the upstream reference location. Therefore, based on the Phase II assessment, operational range areas at RRAD are categorized as Unlikely and placed into the ORAP 5-year periodic review cycle (**Figure 1**).

Operational Range Assessment Program
Phase II Quantitative Assessment
Red River Army Depot, Texas

EA Engineering, Science, and Technology, Inc.

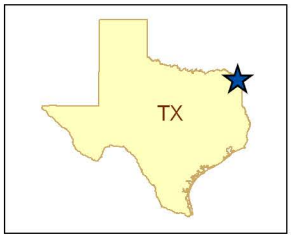
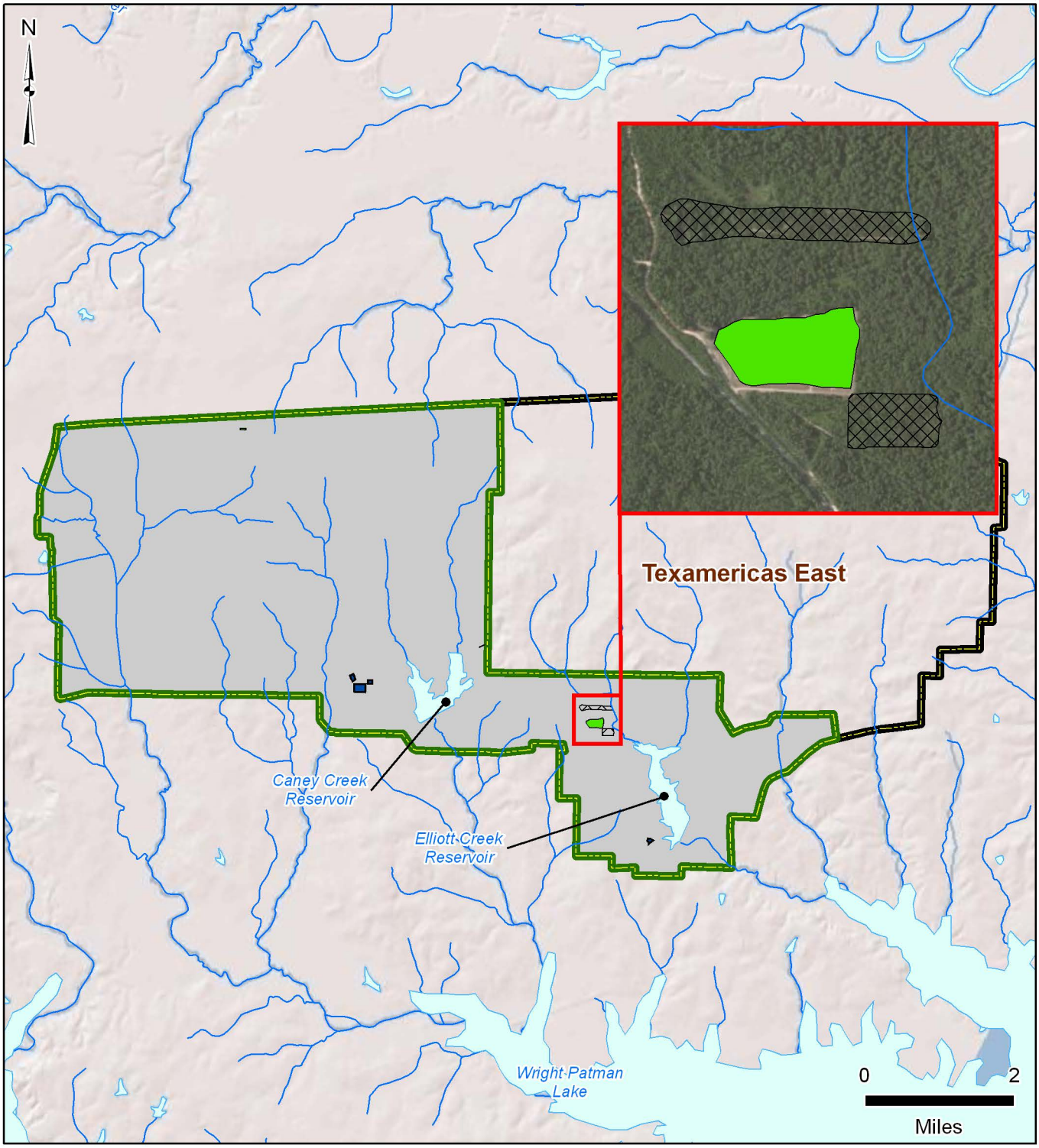


Figure 1
Summary of Phase II Conclusions



Installation Data
- Installation Boundary
- Non-Operational Area
- Closed
- Texamericas East Boundary

Phase II Conclusions
- Unlikely
- Programmatically Excluded

Hydrology
- River/Stream
- Water Body

Data Sources:
ARID-GEO 2007,
ArcGIS Map Service 2010
ERI 2006

Date:.....April 2013
Prepared By:..EA Engineering,Science, and Technology
Prepared For:.....U.S. Army