

## Executive Summary

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Congress directed the U.S. Army Corps of Engineers (USACE) to evaluate the potential impact of perchlorate releases associated with the former Naval Weapons Industrial Reserve Plant in McGregor, Texas (NWIRP McGregor) due to concern that these releases may have impacted water quality and/or the environment in the adjacent Bosque and Leon River watersheds. These watersheds flow into Lake Belton and Lake Waco, which serve as the water supply sources for approximately 500,000 people in the surrounding communities. The primary goal of the USACE and the multi-disciplinary project team they assembled was to evaluate potential human and environmental exposures to perchlorate in the Lake Waco and Lake Belton study area (Figure 2-2). Perchlorate is a contaminant of concern because it interferes with iodide uptake in the thyroid gland. This study was restricted to perchlorate contamination outside of the NWIRP property boundary; it was not intended to characterize perchlorate contamination within the NWIRP boundary, nor was it intended to address contaminants other than perchlorate. This report presents the results of the team's study.

The project team performed a number of investigations to meet the study goal, including extensive sampling and analysis for perchlorate in stream and lake water, stream and lake sediment pore water, and plants and animals from the study area. Additional laboratory and modeling studies provided valuable information on the nature of perchlorate uptake in plants and animals and on the ability of perchlorate to be transformed into less harmful species by natural processes. The project team also collected data to better characterize the surface hydrology and hydrogeological characteristics of the Bosque and Leon River watersheds, as these factors influence how perchlorate moves through the environment. The results from these studies are discussed in detail in Chapter 5.

Based on all of the investigations completed during this study, as well as evidence that the current and historical remediation activities conducted by the U.S. Navy are having a significant and positive effect, the project team concluded that the 500,000 public water supply users in the communities surrounding Lake Belton and Lake Waco are not at risk of exposure to perchlorate from this source. However, certain NWIRP vicinity residents and recreational users of the area could potentially be exposed to perchlorate, as discussed below. An overview map of perchlorate detections in the study area is included on Plate 6. Major findings from this study are summarized below:

### Potential for Human Exposure:

- Based on data collected during this study, public water supply use and consumption of beef from cattle raised in the area appear to present no risk of exposure to perchlorate.
- The potential for exposure to perchlorate exists for certain NWIRP vicinity residents who consume vegetation from gardens irrigated with perchlorate-contaminated spring or stream water in the area. An exposure potential also exists for people who consume water from impacted wells or streams or consume wild vegetation collected near impacted streams. Exposure via incidental ingestion during swimming or wading could potentially occur in the watersheds where perchlorate is present at detectable concentrations.

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- People who consume fish caught in these watersheds, including Lake Belton and Lake Waco, could potentially be exposed to perchlorate in fish fillets, although the risk of this exposure is thought to be low.

### Potential for Ecological Exposure:

- Aquatic and terrestrial plants in the study area do take up perchlorate from streams or groundwater with detectable perchlorate concentrations. Perchlorate is released back into the environment from trees when they lose their leaves.
- Animals in affected areas can be exposed to perchlorate either directly from drinking contaminated stream water or indirectly by consuming plants that have been exposed to perchlorate. Laboratory studies indicate the highest potential exposure levels near NWIRP may be sufficient to cause thyroid histopathological impacts in small mammals. The effects of this exposure on populations of small mammals is unclear. Perchlorate levels in streams are not high enough to affect frog metamorphosis.
- Perchlorate detections in fish were sporadic, occurring in only some fish caught at each location. Unlike other animals, however, some fish with detectable perchlorate concentrations were found even in areas with no detectable concentrations in the water, including Lake Belton and Lake Waco.

### Perchlorate Occurrence and Fate and Transport within the Watersheds:

- Concentrations of perchlorate emanating from the NWIRP site in groundwater and surface streams are significantly diluted before reaching either Lake Waco or Lake Belton. No perchlorate was detected during extensive sampling in either the Middle Bosque River or the Leon River, the main rivers flowing into these lakes that receive surface runoff from NWIRP. Likewise, all water and sediment pore water sampling conducted in the lake delta areas, sampling at water intakes, and water sampling along transects throughout Lake Belton showed no detectable concentrations of perchlorate during this study (method detection limits of 1 µg/L).
- Detections of perchlorate in the streams adjacent to NWIRP were sporadic and varied greatly. Even the highest concentrations detected in these relatively low-discharge streams during this study were well below the estimated levels necessary to ultimately cause a concentration at the reporting limit (4 µg/L) in the lakes.
- Based on bench-scale studies, bacteria in the anoxic region of Lake Belton have a demonstrated ability to break down perchlorate to a harmless chemical species.
- Sampling at Cowhouse Creek, which flows into Lake Belton from the Fort Hood area, showed no detectable perchlorate concentrations (method detection limit of 1 µg/L). Based on this limited sampling, surface runoff from Fort Hood is not thought to contribute perchlorate to Lake Belton.

Findings presented on potential exposures to perchlorate are dependent on continued remediation efforts by the U.S. Navy. Chapter 8 includes a more comprehensive list of study findings. All of these findings are supported by study data and discussions included in this report in Chapters 5, 6, and 7.