

# **Targeted Brush Control in the E.V. Spence Reservoir Watershed**

## **Final Report**



Funding provided through a CWA §319(h) Nonpoint Source Grant from the  
Texas State Soil and Water Conservation Board and the  
U.S. Environmental Protection Agency  
TSSWCB Projects 03-06 and 00-11

## Executive Summary

The E.V. Spence Reservoir (Segment 1411) was placed on the *State of Texas 1998 Clean Water Act Section 303(d) List* because sulfate and total dissolved solids (TDS) concentrations exceeded the water quality standards criteria of 450 mg/L, and 1500 mg/L, respectively. These loadings are a result of both natural and man-made, nonpoint source pollution which is prevalent in numerous locations within the basin. Improper brine disposal, leaking oil well casings, and the over-pressurization of down-hole formations are the prime sources of the man-made pollution. Surface water traveling across mineral beds such as salt flats, the dissolution of natural underground mineral deposits, and the concentration effects of certain types of plants are the primary causes of the natural pollution.

The proliferations of invasive species of brush into the western portions of Texas are a recognized problem in water management. Three species that occur in the E.V. Spence Reservoir watershed include juniper, saltcedar and mesquite. These plants have a high water consumption rate and easily out-compete most native species. A single mature plant can absorb as much 200 gallons of water a day. Because salt cedar is a deciduous plant, salt stored in the leaves is concentrated at the soil surface when leaves are dropped in the fall. Saltcedar is especially detrimental to water quality because of its ability to transport salts from ground water to its leaves. Saltcedar can tolerate chloride concentrations as high as 35,000 mg/L, much higher than most plant species. This makes it almost impossible for native species to take root.

In 1999, the Texas Commission on Environmental Quality (TCEQ) and the Colorado River Municipal Water District (CRMWD) developed two Total Maximum Daily Loads (TMDLs), one for sulfate and the second for TDS, with the primary focus area being on segment 1412 of the Colorado River between Lake J.B. Thomas and the E.V. Spence Reservoir. In August 2001, the TCEQ adopted the *Implementation Plan for Sulfate and Total Dissolved Solids TMDLs in the E.V. Spence Reservoir*. The goal of the implementation plan (I-Plan) is to achieve reductions in annual-average concentration and total-annual loading of sulfate and TDS in the E.V. Spence Reservoir watershed. The Texas State Soil and Water Conservation Board (TSSWCB) utilized Clean Water Act (CWA) Section 319(h) funds to initiate a project entitled *Targeted Brush Control in the E.V. Spence Reservoir Watershed* to implement the targeted brush control measures described in the I-Plan.

The goal of the *Targeted Brush Control in the E.V. Spence Reservoir Watershed* project was to chemically treat saltcedar in riparian areas along the Colorado River and its tributaries below Lake J.B. Thomas to the E.V. Spence Reservoir in an effort to reduce nonpoint source pollution loadings resulting from invasive brush species on agricultural land. The TSSWCB also provided technical and financial assistance to agricultural producers within the Champion Creek Reservoir watershed for targeted brush control activities. It was estimated that targeted brush control would increase water yield 3,843 acre-feet per year to the E.V. Spence Reservoir. An increase in water yield will in return reduce pollutant concentrations. If all management practices prescribed in the I-Plan were implemented, an estimated 39% pollutant reduction will be achieved.

The saltcedar spraying was scheduled to be carried out over a period of three years beginning in 2004. However, in 2004 saltcedars were attacked by a scale insect which caused early senescence. Experts recommended postponing spraying until the following year because the compromised leaves would not provide ideal conditions for absorption and translocation of the herbicide to the roots. During the remaining project years of 2005 through 2007, a total of 11,391 acres were treated.

## Introduction

The E.V. Spence Reservoir is a 15,893-acre reservoir located in the upper Colorado River Basin, located approximately 2 miles west of Robert Lee, Texas (Figure 1). The Reservoir was completed in 1969 and is owned and operated by the CRMWD. E.V. Spence Reservoir is an important water supply for the surrounding region. It provides a portion of the water for 305,000 residents of the cities of Big Spring, Coahoma, Midland, Odessa, Robert Lee, San Angelo, and Stanton. Additionally, the reservoir serves mining and industrial uses, and it is a popular destination for recreational fishermen.

Water quality testing found that excessive levels of sulfate and TDS were affecting the lake and its use for drinking water. As a result, the E.V. Spence Reservoir (Segment 1411) was placed on the *State of Texas 1998 CWA 303(d) List* because sulfate and TDS concentrations exceeded the segment water quality standards criteria of 450 mg/L, and 1500 mg/L, respectively. These loadings are a result of both natural and man-made nonpoint source pollution, which is prevalent in numerous locations within the basin. Improper brine disposal, leaking oil well casings, and the over-pressurization of down-hole formations are the prime sources of the man-made pollution. Surface water traveling across mineral beds such as salt flats, the dissolution of natural underground mineral deposits, and the concentration effects of certain types of plants are the primary causes of the natural pollution.

In 1999, TCEQ and CRMWD began developing two Total Maximum Daily Loads (TMDLs), one for sulfate and the second for TDS, for segment 1412 of the Colorado River between Lake J.B. Thomas and the E.V. Spence Reservoir. The TCEQ approved the TMDLs on February 9, 2001 and submitted them to the U.S. Environmental Protection Agency (EPA) for final review and approval. The TMDLs required load reductions between 38% and 39% for chloride, sulfate, and TDS in the E.V. Spence Reservoir.

On August 10, 2001, the TCEQ adopted the *Implementation Plan for Sulfate and Total Dissolved Solids TMDLs in the E.V. Spence Reservoir* to implement the two TMDLs. This implementation plan (I-Plan) was designed to achieve the reductions in the annual-average concentration and total-annual loading of sulfate and TDS in the E.V. Spence Reservoir watershed as defined in the approved TMDLs. Together, the TMDL and the I-Plan serve as the mechanism to reduce the pollutant, restore the full use of the waterbody and remove it from the 303(d) List.

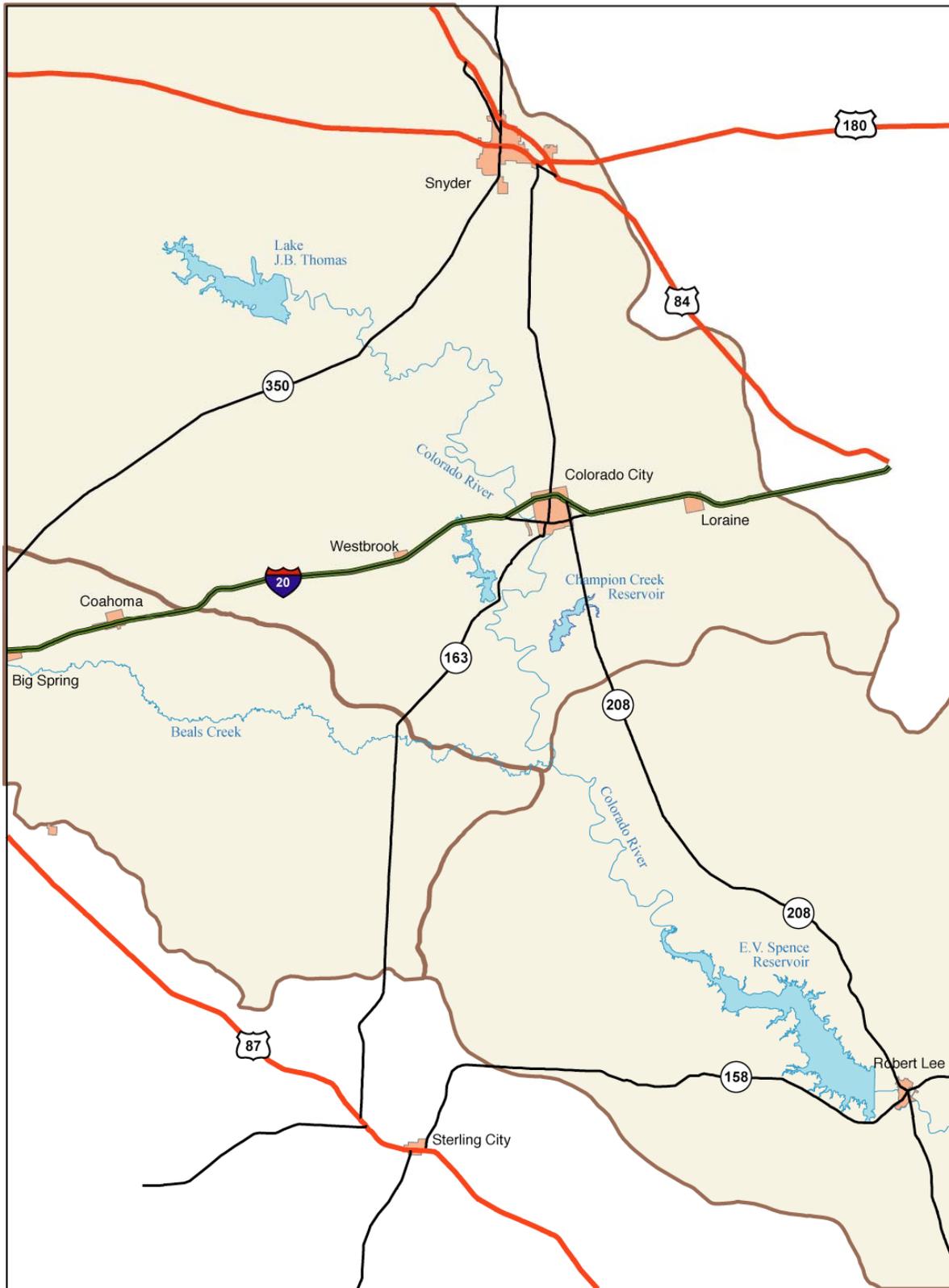


Figure 1. Upper Colorado River Basin

To achieve the needed reductions, the following suite of measures were outlined in the I-Plan: 1) point source controls, 2) modification of reservoir operations, 3) water quality diversions, 4) oil well plugging, 5) weather modification, 6) remediation of magnesium plant site, and 7) targeted brush control. If all management practices prescribed in the I-Plan are implemented, an estimated 39% pollutant reduction will be achieved.

The proliferations of invasive species such as juniper, saltcedar and mesquite into the E.V. Spence Reservoir watershed are a recognized problem in water management. These plants have a high water consumption rate and easily out-compete most native species. Saltcedar is especially detrimental to water quality because of its ability to transport salts from groundwater to its leaves. A single mature plant can absorb as much as 200 gallons of water a day. Because saltcedar is a deciduous plant, salt stored in the leaves is concentrated at the soil surface when leaves are dropped in the fall. Saltcedar can tolerate chloride concentrations as high as 35,000 mg/L, which is much higher than most plant species. This makes it almost impossible for native species to take root.

In the I-Plan no additional mass loadings were assumed to accompany the runoff originated from brush control. It was estimated that targeted brush control would increase water yield 3,843 acre-feet per year to the E.V. Spence Reservoir. This increase in water yield will reduce pollutant concentrations. The TSSWCB utilized Clean Water Act §319(h) funds to initiate a project entitled *Targeted Brush Control in the E.V. Spence Reservoir Watershed* to implement the targeted brush control measures described in the I-Plan.

## Materials and Methods

The foundation of this project was the TSSWCB working cooperatively with the Upper Colorado Soil and Water Conservation District (SWCD), Mitchell SWCD, Coke County SWCD, CRMWD, Texas Department of Agriculture (TDA), Texas Parks and Wildlife Department (TPWD), U.S. Fish and Wildlife Service (USFWS), Natural Resource Conservation Service (NRCS), Texas AgriLife Extension Service, and others in an effort to reduce nonpoint source pollution loadings resulting from invasive brush species on agricultural land. These targeted brush control activities will be conducted as prescribed in the I-Plan for E.V. Spence Reservoir. The goal of the project was to chemically treat saltcedar in a 150 foot corridor along the Colorado River and its tributaries below Lake J.B. Thomas to the E.V. Spence Reservoir. It has been estimated that 95% of all saltcedar in the watershed exists within the riparian areas.



It was decided that aerial application of *Arsenal* herbicide from a helicopter was the most efficient and cost-effective way to treat saltcedar. The State of Texas issued an Invitation for Bids and a qualified expert was selected to conduct the aerial application.

*Arsenal* is a product better known for its use for brush control on utility right-of-ways. The State of Texas had to obtain an EPA Section 24(c) “Special Local Needs” Label so that *Arsenal* could be applied in riparian areas adjacent to the habitat for the

Texas poppy-mallow, a federally endangered plant species. Prior to February 2003, Arsenal could not be applied in Coke, Runnels and Mitchell Counties due to the presence of Texas poppy-mallow. Texas Department of Agriculture, Texas AgriLife Extension Service, and the CRMWD worked with EPA and USFWS to revise the 24(c) Label to include the counties above. Subsequent to receiving the 24(c) Label, BASF added an aquatic label (Habitat) for the active ingredient (Imazapyr) in Arsenal. Habitat was used in the latter stages of the project primarily in the E.V. Spence lake basin where a significant infestation of saltcedar was present in waters of the reservoir.

To prevent impacts to the federally endangered Texas poppy-mallow, all aerial applications within ¼ mile of Tivoli or Brownfield sands in Coke, Runnels and Mitchell counties were made by helicopter using controlled droplet nozzles, boom configurations, and air speeds below 60 mph to achieve an average spray droplet size of 1000 microns or greater. In addition, a 60 foot aerial spray buffer in topography or lateral distance from the Tivoli and Brownfield sands was maintained at all times. Aerial spraying was conducted between August 15 and October 15, the dormant season for the Texas poppy-mallow.

The estimated life of a one-time chemical treatment is approximately 15 years. To extend the life of these chemical treatments, the USDA-Agricultural Research Service (USDA-ARS), through a Clean Water Act §319(h) nonpoint source grant from TSSWCB (project 03-11), has been conducting studies using Chinese leaf beetles (*Diorhabda elongate*) as a biological control for saltcedar. Located on Beals Creek (Figures 2 and 4), the project site is approximately 10 km and will demonstrate the effectiveness of the leaf beetle in controlling existing stands of saltcedar, saltcedar regrowth following herbicidal treatments and the effects of this control on recovery of native plant and animal communities and on water conservation. The effectiveness of the beetles in controlling saltcedar will be determined by monitoring beetle populations, dispersal and damage to saltcedar trees and any damage to non-target plants, by ground level surveys along transects outward from the release sites at the peak of last-instar larval populations during each generation, and by remote sensing (low-level aerial photography). The effects of biological control on recovery of native plant and wildlife (bird) communities will be monitored annually, during mid to late spring. Results and success of the Chinese leaf beetle demonstration will be available in summer 2008.

The TSSWCB is also responsible for managing brush in areas where brush is contributing to a substantial water conservation problem and designates areas of critical need in the state in which to implement the State Brush Control Program. The TSSWCB designated the Champion Creek Reservoir watershed as an area of critical need and provided \$716,354 of State Brush Control Program funding to manage brush on 15,000 acres. This should not only improve conditions in Champion Creek Reservoir, but should also contribute to improvements to E.V. Spence Reservoir and help in the implementation of measures outlined in the TMDL.

In order to measure the success of the implementation efforts, the CRMWD has been conducting water quality monitoring, enhancement and water diversion on the Colorado River for a number of years. It has collected a great deal of data for the Clean Rivers Program (CRP) and is using this dataset to evaluate and monitor water quality of the Colorado River. CRMWD continues to monitor the water quality of Lake Spence to further determine the success of implementation efforts.

## **Results and Discussion**

The aerial application of Arsenal to treat saltcedar in a 150 foot corridor along the Colorado River and its tributaries below Lake J.B. Thomas to the E.V. Spence Reservoir (Figure 2.) was scheduled to be carried out over a period of three years beginning in 2004. However, in 2004 saltcedars were attacked by a scale insect which caused early senescence. Although it did not damage the plants significantly, experts recommended postponing spraying until the following year because the compromised leaves would not provide ideal conditions for absorption and translocation of the herbicide to the roots.

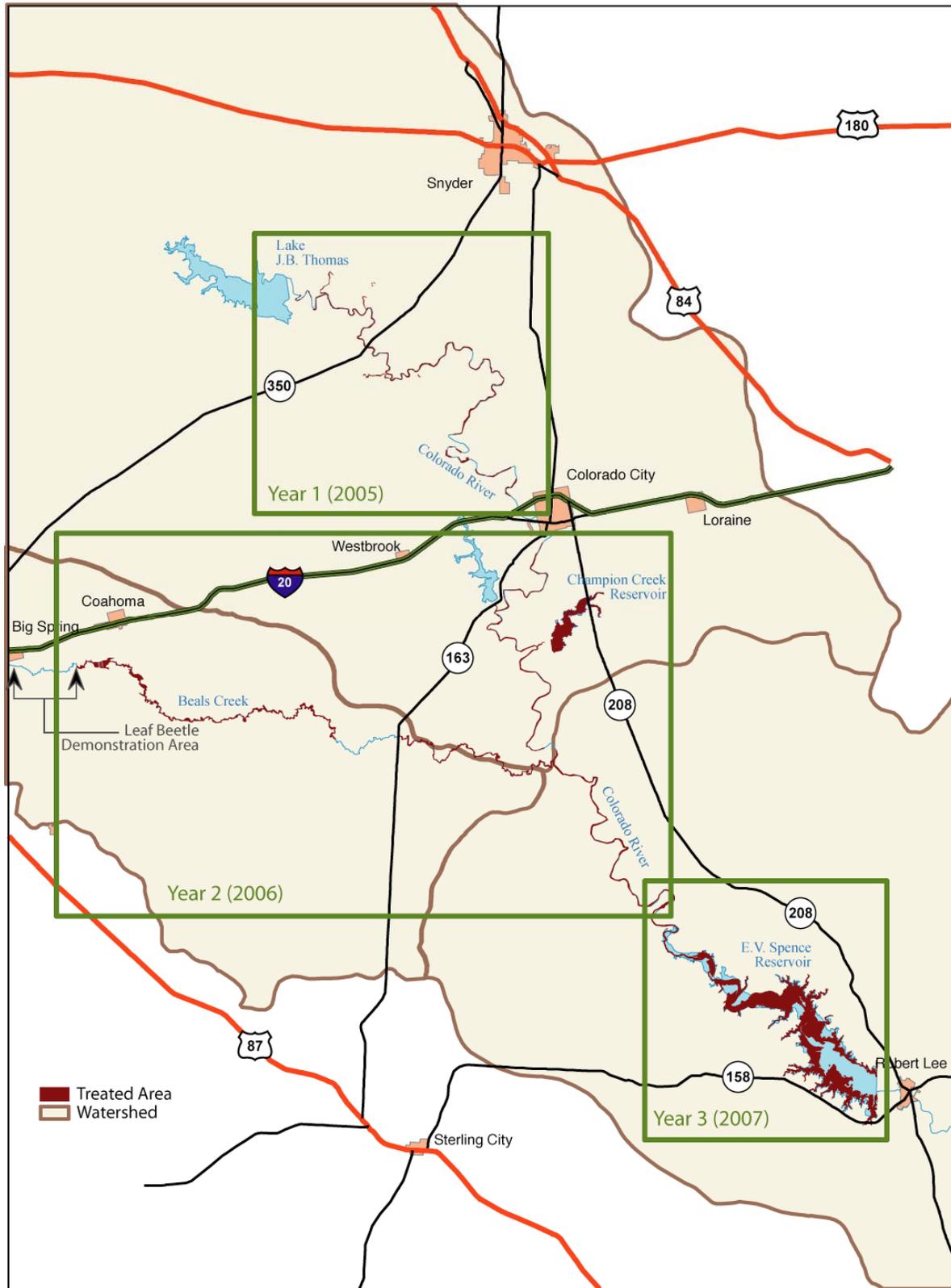
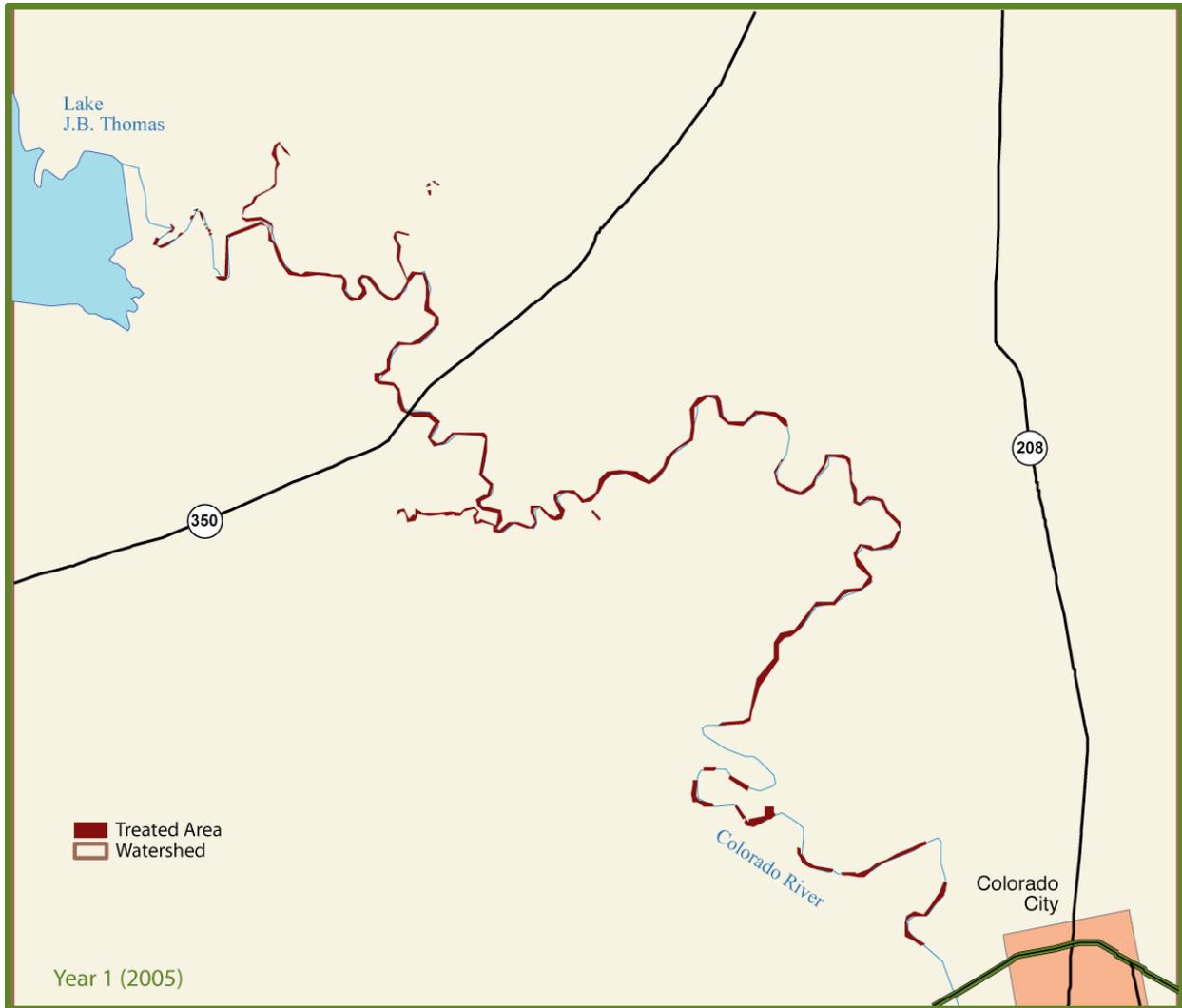


Figure 2. Overview Map of Saltcedar Treatment Area

In August 2005, aerial application of Arsenal began along the Colorado River below Lake J.B. Thomas down to Colorado City (Figure 3). A total of 2,416 acres were treated from August 18, 2005 through September 4, 2005.



**Figure 3. Year 1 (2005) Saltcedar Treatment Area**

During the second year of spraying, approximately 1500 acres were treated starting just south of Colorado City along the Colorado River, Beals Creek, and the Champion Creek Reservoir basin (Figure 4). Spraying began on August 28, 2006 and ended on October 7, 2008.



**Figure 4. Year 2 (2006) Saltcedar Treatment Area**

During the final year of the project, 7,475 acres of saltcedar were treated between August 16, 2007 and September 22, 2007. Treatment included spraying areas along the Colorado River beginning where the 2006 treatment ended down to the dam and included the E.V. Spence lake basin (Figure 5).

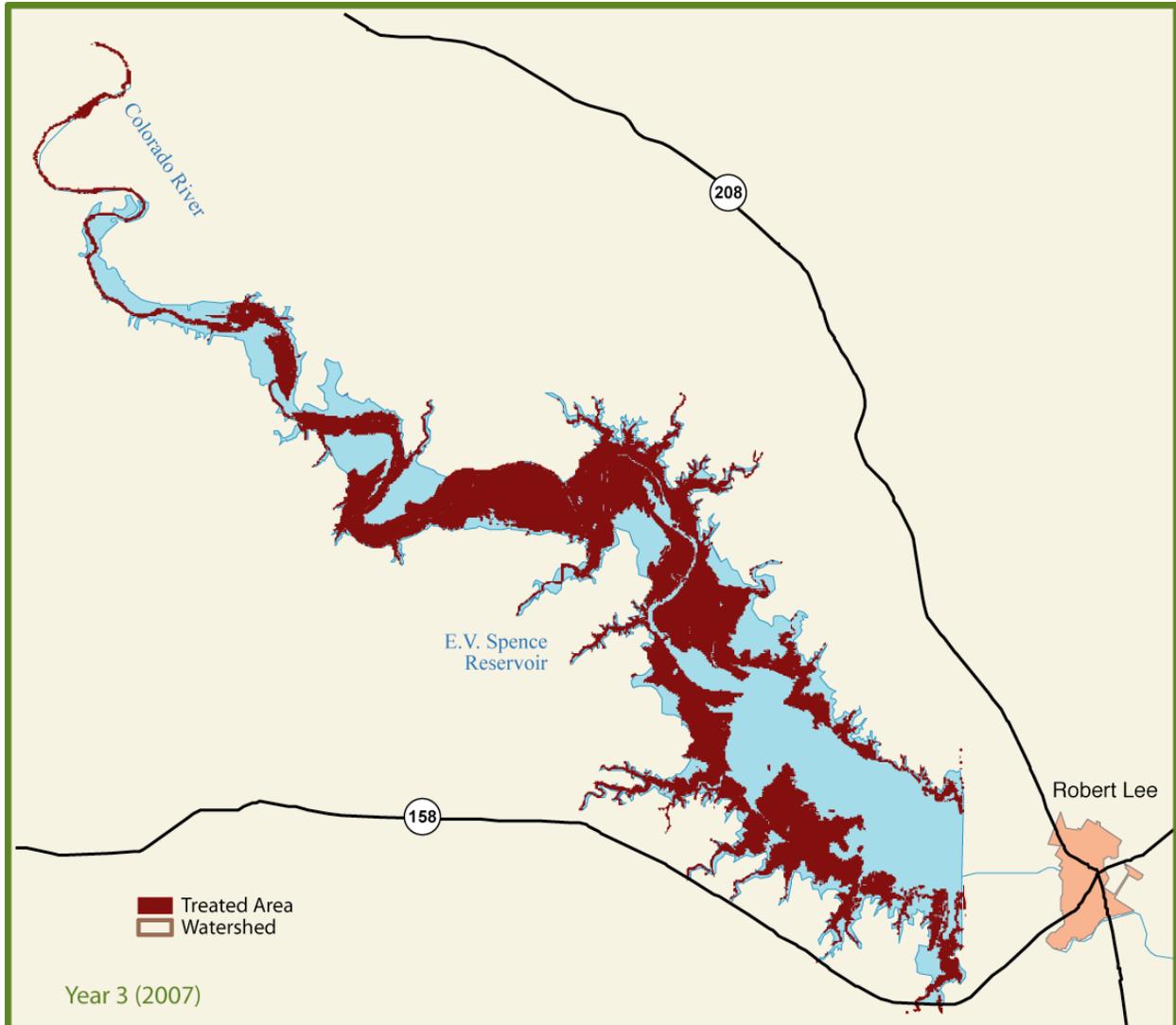


Figure 5. Year 3 (2007) Saltcedar Treatment Area

## Conclusion

The primary objective of this effort was to aid in implementing the I-Plan for Sulfate and TDS TMDLs in the E.V. Spence Reservoir by chemically treating saltcedar in riparian areas along the Colorado River and its tributaries in an effort to reduce nonpoint source (NPS) pollution loadings resulting from invasive brush species on agricultural lands. During all three years of spraying, 11,391 acres of saltcedar were treated from below Lake J.B. Thomas to the E.V. Spence Reservoir lake basin (Figure 7.).

At this time it is too early to distinguish the extent of the water quality improvement from this project, however there has been significant progress toward reaching the measures of success in the TMDL. Local efforts to manage nonpoint and point source pollution have led to the gradual reduction and compliance of chloride and sulfate levels. To date, TDS levels have improved, and are approaching water quality standards. The annual mean concentrations for chlorides and sulfate in 2005-6 were in compliance at all times, an enormous improvement from previous years. This is attributed to several factors including good rainfalls and exceptional work by the CRMWD to accurately manage their diversions using real-time water quality monitors. The mean concentration for TDS was in compliance 33% and 75% of the time during 2005 and 2006, respectively. The annual mean concentrations of all constituents in 2007 were very similar to levels in 2005. See Figure 6 for a record of the annual mean concentrations of these constituents since 1968. CRMWD will continue to monitor the water quality of Lake Spence to further determine the success of implementation efforts.

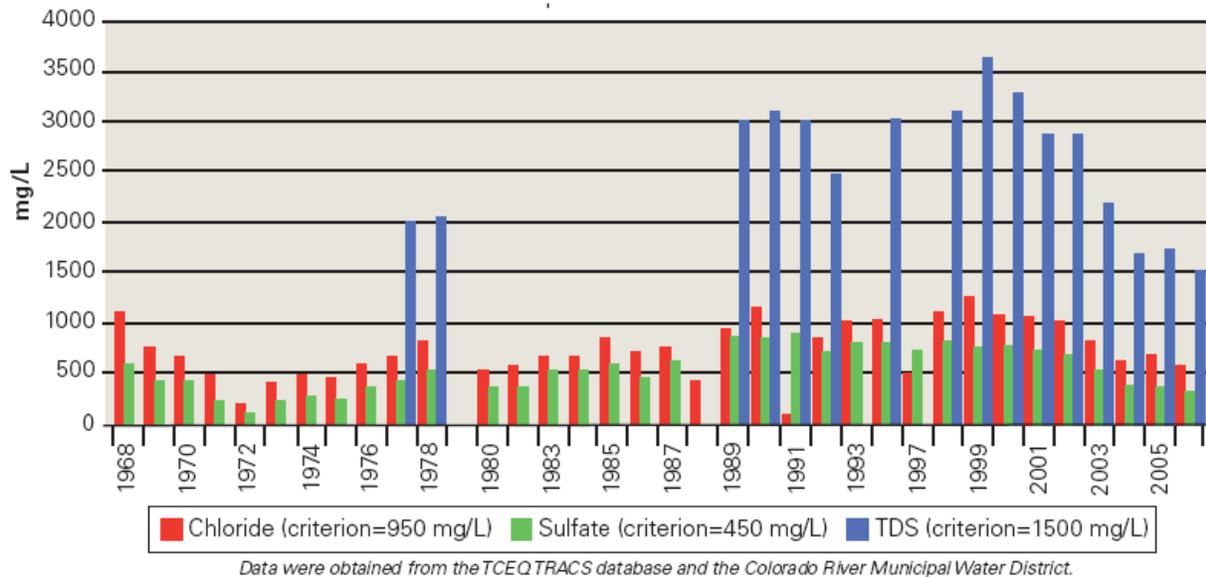


Figure 6. Annual Mean Salt Concentrations in the E.V. Spence Reservoir

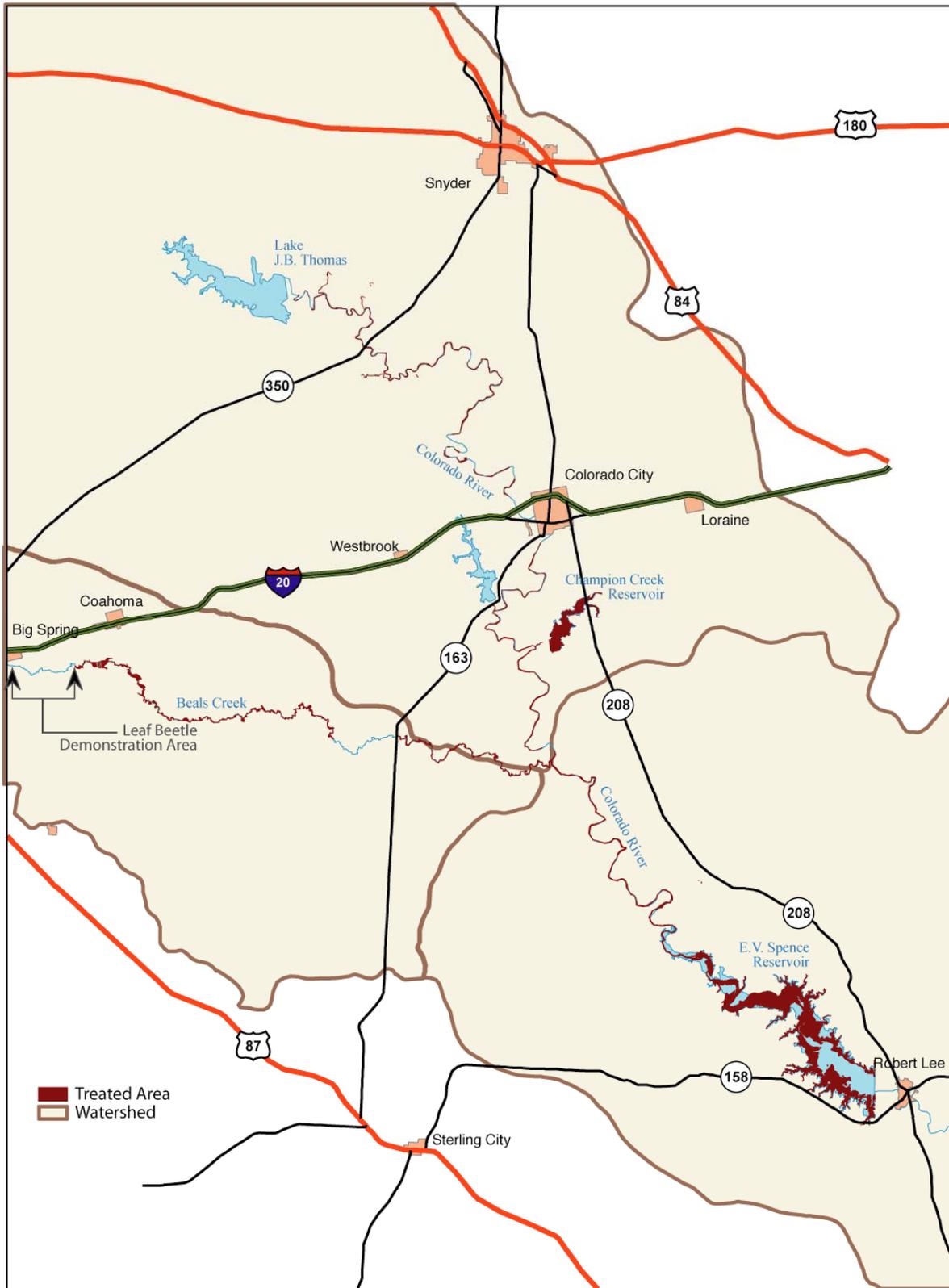


Figure 7. Years 1-3 (2005-2007) Saltcedar Treatment Area