Chapter 1. Introduction

by Curtis E. Uptain and Beatrice A. Olsen

1.1. Background

"Land Retirement," defined here as the removal of land from irrigated agricultural production, is a means by which drain water accumulation can be substantially reduced. Drain water reduction can be imperative because irrigated agriculture in areas with shallow groundwater and no drainage outlet can sustain drainage water with high salt concentrations that can, in turn, inhibit plant growth. These conditions are characteristic of large portions of the center and western side of the San Joaquin Valley, as evidenced by the more than 708,200 hectares (ha) or (1,750,000 acres [ac]) of agricultural land in the valley that are considered to be drainage-impaired (Figure 1-1).

The salt content of irrigation water increases as water evaporates, passes over saline soils, or occurs through plant uptake. Where drainage is adequate, salts can be flushed from the root zones by sufficient rainfall or irrigation. However, this seldom eliminates the long-term accumulation of salinity. Short-term flushing of salts from soils results in excess drain water with high salt concentrations. Adverse effects to plants, fish, and wildlife can occur from saline drain water when present at the surface or in downstream tributaries. In areas lacking good drainage, repeated irrigation may raise the water table. When the water table reaches the root zone of plants, capillary action often carries water close to the soil surface, where it evaporates and leaves a surface salt residue.

Additionally, high concentrations of trace elements that occur naturally in westside San Joaquin Valley soils, including selenium, boron, molybdenum, and arsenic, are problematic. Selenium is of a primary concern because it is widely distributed throughout the valley and has proven to be toxic to certain vertebrate species, especially in aquatic habitats. Decades of irrigation have transferred soluble selenium from the upper soils to the shallow groundwater.

The Central Valley Project (CVP), with its massive system of dams, reservoirs, canals, power plants and other facilities, began providing irrigation water for San Joaquin Valley agriculture in 1951. The San Luis Unit and the State Water Project of the CVP, which were authorized in 1960, expanded water deliveries to approximately 404,700 ha (1,000,000 acres) by1968. By 1979, fewer than 61,500 ha (151,750 acres), or about 2 percent, remained uncultivated. The majority of the watershed was converted to agricultural production or urbanized. Most of the remaining undeveloped land is located in the foothills of the Coast

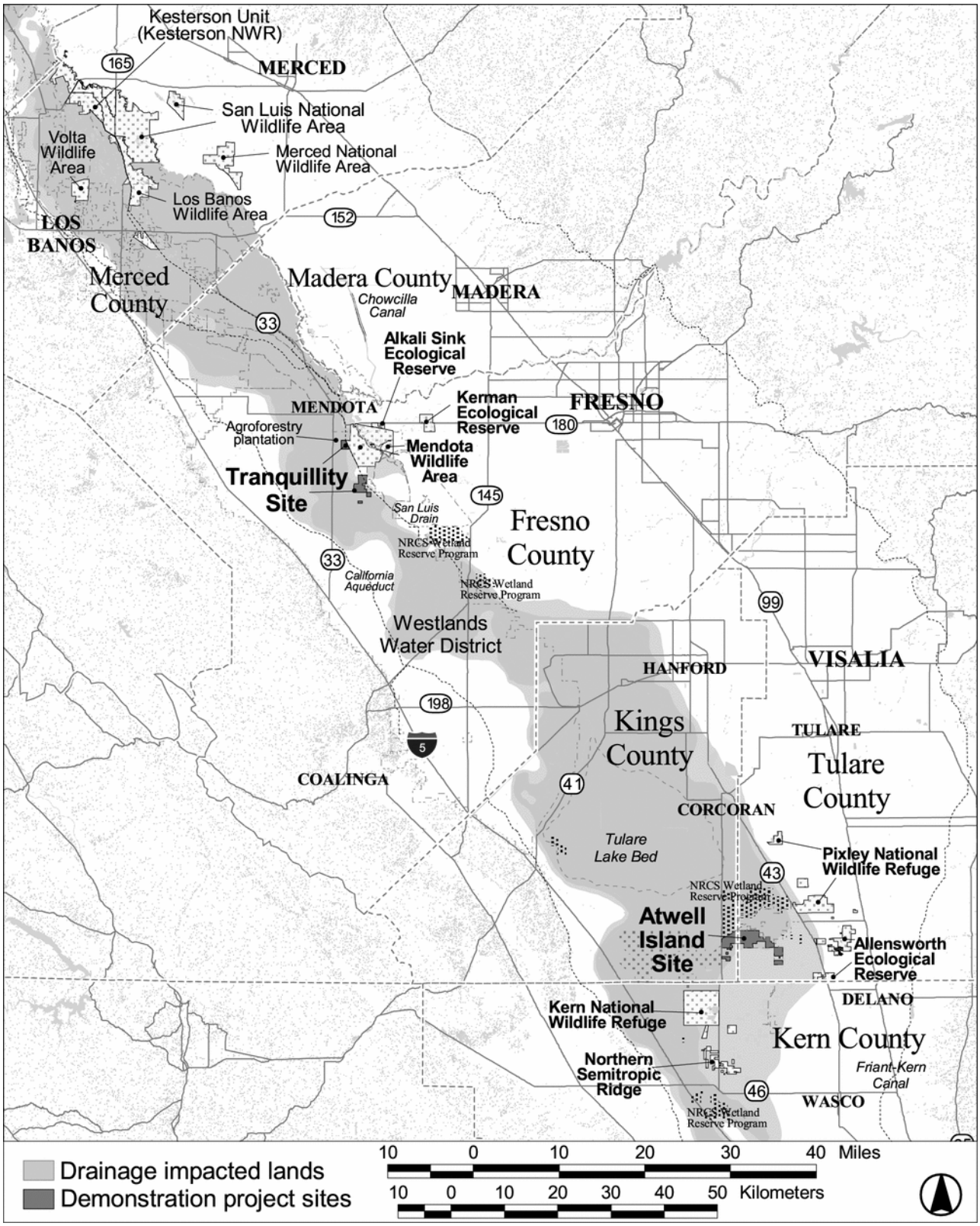

Figure 1-1. Drainage-impaired lands in the San Joaquin Valley.

Range and in the extreme southern portion of the valley. This change in land use resulted in the loss of native wetland, saltbush scrub, alkali sink, and California prairie habitats and contributed to the listing of numerous endemic species of plants and wildlife (FWS 1998).

The San Joaquin Valley Drainage Program (SJVDP), established in 1984, combined federal and state efforts to investigate drainage issues and identify possible solutions. The program estimated that 161,800 to 225,000 ha (400,000 to 554,000 acres) would become unsuitable for irrigated agriculture by 2040 if no actions were taken to remedy drainage problems. One recommended action to reduce drainage-related problems was the selective retirement of irrigated lands characterized by low productivity, poor drainage and high selenium concentrations in the shallow groundwater.

The Central Valley Project Improvement Act (CVPIA), enacted in 1992 as Public Law 102-575 Title 34, Section 3408(h), authorized the purchase of land, water, and other property interests from willing sellers who received CVP water. Such lands would achieve the program goals to reduce drainage, enhance fish and wildlife resources, and make water available for other CVPIA purposes. CVPIA did not authorize a recommended quantity of acres for permanent land retirement. The Land Retirement Program (LRP) was developed cooperatively by an interagency Department of the Interior team with representatives from the Bureau of Reclamation (Reclamation), the U.S. Fish and Wildlife Service (FWS), and the Bureau of Land Management (BLM) (See Appendix 1). Additional background information on the CVPIA Land Retirement Program can be found in a variety of reports (USDI 1997, USDI 1999, Selmon et al. 2000, Uptain et al. 2001, 2002, and 2004) and web sites (see http://usbr.gov/mp/cvpia).

1.2. Development, Implementation, and Scope of the Land Retirement Demonstration Project

During the comment period for the Land Retirement Program Draft Environmental Assessment (EA), concerns were raised about the magnitude of the project and the lack of knowledge about the positive and negative effects of retiring agricultural land on a large scale (USDI 1999). Although land retirement was featured in the FWS Recovery Plan for Upland Species of the San Joaquin Valley (FWS 1998), FWS had concerns that the high selenium levels would be unsafe for listed species. The Land Retirement Demonstration Project (LRDP) was implemented to provide site-specific scientific data to guide the implementation of the LRP and develop tools to predict potential benefits and impacts of retiring land from irrigated agriculture. The FWS Biological Opinion (BO) for the LRDP raised specific concerns about the scope and degree of land retirement impacts on groundwater levels, groundwater and surface water quality, soil chemistry, and biota. There was a need to monitor selenium loads at different trophic levels for corresponding groundwater levels and quality (FWS 1999).

The Land Retirement Demonstration Project was designed and implemented as a 5-year project to address the concerns expressed in the Biological Opinion by accomplishing five goals:

- Provide site-specific scientific data to determine the effects of land retirement on drain water volume, groundwater depth and quality, soils, and biota.

- Perform contaminants analysis regularly on surface and groundwater, soils, vegetation, invertebrates, and vertebrates.

- Evaluate techniques to determine effective, safe, and economical means for upland habitat restoration that contain self-sustaining native upland communities, using adaptive management principles (Holling 1978, Walters and Holling 1990) to maximize efficiency of the restoration research program.

- Educate stakeholders about the Land Retirement Program effects of land retirement and habitat restoration techniques.

- Evaluate the need for continued use of acquired water on Demonstration Project lands.

Other requirements of the Biological Opinion were met and are addressed in Appendix 2.

In this report, the physical setting for the LRDP sites, monitoring methods employed for physical parameters, and a conceptual model of the groundwater system are presented in Chapter 2. Reclamation implemented a monitoring plan that utilized approved sampling protocols and analysis of physical factors, including surface water, groundwater, and soils (CH2M Hill 1999). Groundwater monitoring data are compared against performance criteria set forth in the Biological Opinion (FWS 1999).

A resource monitoring plan (Selmon et al. 1999) that outlined the focus of habitat restoration research and established wildlife monitoring protocols was prepared by the California State University, Stanislaus, Endangered Species Recovery Program (ESRP). The plan included a Habitat Restoration Study (HRS) to monitor four restoration treatments and the vegetative and wildlife response to those treatments. Twenty study plots were established and a wide-range of data were collected over the 5 years (See Section 4.2.1 for experimental design description). Selenium levels in a variety of trophic levels were monitored. Results of the LRDP are reported here that represent the culmination of the 5-year research and monitoring efforts implemented in 1999 and concluded in 2003. Although habitat restoration research and active site restoration efforts were accomplished, the results of those tasks will be presented in other reports.

The Land Retirement Demonstration Project has two project sites, the Tranquillity and the Atwell Island sites (Figure 1-1, shown earlier). The full 5-year study was completed only at the Tranquillity site. Accordingly, this report primarily focuses on data obtained at the Tranquillity site, but does include information from Atwell Island on the physical impacts of land retirement (Chapter 2) and on selenium levels in biota (Chapter 3). Only at the Tranquillity site were 5 years of data collected for the Habitat Restoration Study (Chapter 4). Activities at Atwell Island included baseline sampling prior to installation of treatments in 2001 and 1 year of post-treatment sampling conducted in early 2002. Due to reductions in CVPIA funding, all responsibilities for restoration research, site management, and monitoring of biota and selenium levels were reassigned from ESRP to BLM in 2002. BLM will report Atwell Island site activities and research in 2007.

Appropriate habitat restoration must accompany land retirement to maximize benefits for wildlife and endangered species. Land retirement without habitat restoration often leads to large fields infested with weeds and pests that impact neighboring agriculture and require extensive and continuous management. Although land retirement has the potential to enhance wildlife values and improve ecological systems in the San Joaquin Valley, it is recognized that land uses other than wildlife habitat may take precedence on some lands. Some land uses, particularly grazing and dryland farming, can be compatible with and may even contribute to habitat values for wildlife.

Although the goals of the LRDP focus primarily on requirements described in the Biological Opinion, restoration activities were expanded to include the collection of more than 100 native upland plant species from Ecological Reserves and isolated, small remnants of native habitat within an 80 km (50 mile) radius of the Tranquillity site. Seed collected from local plant genotypes have been planted in an on-site nursery and are yielding large quantities of seed for use in restoration research and other restoration efforts. Seed is cleaned, processed, and stored in our mechanized seed-cleaning facility. Research continues to be conducted on planting, propagation, weed control, and harvesting techniques. The replicated research trials that we are conducting are directly applicable to large-scale restoration efforts. A list of current research activities are provided in Appendix 3. The results of these efforts will be reported at a later date.

1.3. Tranquillity Project Site Location and Description

The LRDP study sites are located in two geographically and physiographically different drainage-impaired basins. The Tranquillity site is located in western Fresno County (Figure 1-2) and the Atwell Island site is located in Kings and Tulare Counties (see Figure 1-1). In the fall of 1998, the Land Retirement Team (LRT) purchased 666 ha (1,646 acres) in western Fresno County. By late 2001, a total of 845 ha (2090 acres) had been acquired, of which 239 ha (591 acres) were purchased with water.

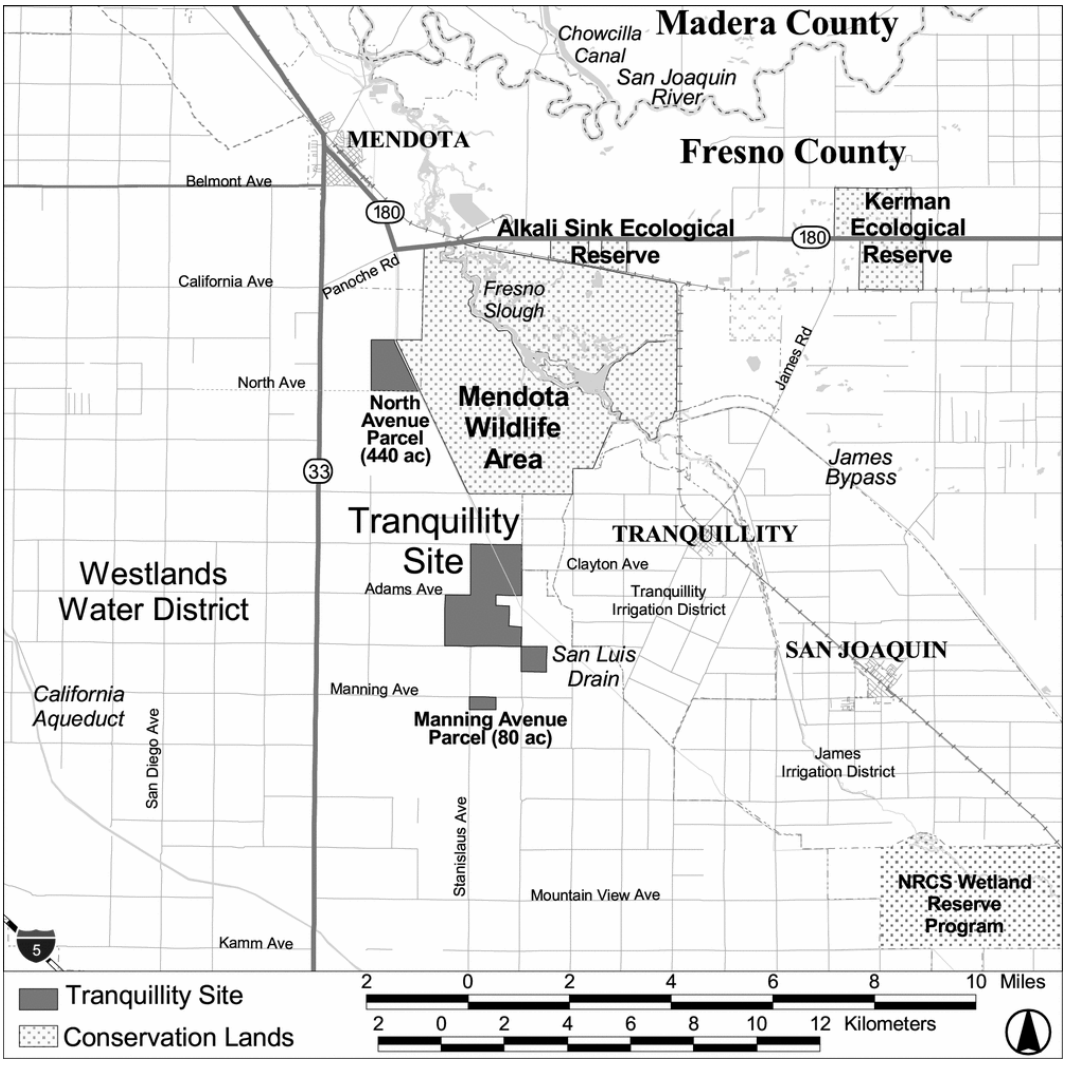

Figure 1-2. Location of the Tranquillity site including the 178 ha (440 ac) North Avenue parcel and the 16 ha (40 ac) Manning Avenue parcel.

The 178 ha (440 acre) North Avenue Parcel was obtained in late 2001 and was previously fallowed and grazed by sheep. The land initially purchased in 1998 had previously been in agricultural production, primarily cotton, tomatoes, grain, and sugar beets. The remaining acreage had been idled for longer than 5 years and contained sufficient plant cover. For weed and erosion control, and to provide as homogeneous a plant cover as possible for the research plots, barley was planted on approximately 486 ha (1,200 acres) in 1999.

The site is immediately surrounded by agricultural fields, although in the last few years more of these fields have been idled under the land retirement program initiated by Westlands Water District (WWD). The San Luis Canal, which

previously transported drainage water to Kesterson National Wildlife Refuge (NWR), traverses the site.

The 3,468 ha (8,570 acre) Mendota Wildlife Area is located adjacent to the eastern boundary of the North Avenue Parcel and within 4.8 kilometers (km) (3 miles) north of the HRS site. The 377 ha (932 acre) Alkali Sink Ecological Reserve (ER) and the 718 ha (1,775 acre) Kerman ER are located within 16 km (10 mile [mi]) of the HRS site. These areas contain remnants of the once widespread alkali sink, saltbush scrub, and annual grassland habitats.

1.4. Literature Cited

CH2M Hill. 1999. Quality assurance project plan, Land Retirement Demonstration Project, soil, groundwater, and surface water monitoring. 41 pp.

Holling, C.S., ed. 1978. Adaptive environmental assessment and management. Wiley, New York. 377 pp.

San Joaquin Valley Drainage Program. 1990. Fish and Wildlife Resources and Agricultural Drainage in the San Joaquin Valley, California. Vols. I, II. 707pp. +appendices.

Selmon, M., P. Kelly, and C. Uptain. 1999. Resource monitoring plan for the Land Retirement Demonstration Project in western Fresno County. 36 pp.

Selmon, M., P. Kelly, C. Uptain, and S. Lee. 2000. Land Retirement Demonstration Project, 1999 annual report. Unpubl. report prepared for the Interagency Land Retirement Team, Fresno, California. 84 pp.

Uptain, C., K. Dulik, P. Brandy, M. Selmon, P. Kelly, D. Williams, S. Lee, and J. Brummer. 2001. Land Retirement Demonstration Project, 2000 annual Report. Unpubl. report to the Interagency Land Retirement Team, Fresno, California. 113 pp.

Uptain, C., N. Ritter, S. Lee, S. Laymon, K. Kreitinger, S. Phillips, A. Harpster, J. Smith, A. Howard, S. Messer, D. Newman, P. Kelly, and D. Williams. 2002. Land Retirement Demonstration Project, year three, 2001 annual report. Unpubl. report to the Interagency Land Retirement Team, Fresno, California. 138 pp.

Uptain, C.E., N.P. Ritter, S.L. Lee, J. Brummer, S.A. Laymon, K.R. Garcia, A.J. Howard, G. Basso, K.E. Kreitinger, S. E. Phillips, S.R Messer, D.P. Newman, E.M. Magill, L.L. Williams, P.A. Kelly, and D.F. Williams. 2004. Land Retirement Demonstration Project: Year four 2002 annual report. Unpubl. Report to the United States Dept. of the Interior, Land Retirement Team, Fresno, California. 274 pp.

U.S. Department of the Interior. 1997. Central Valley Project Improvement Act Section 3408(h): Land Retirement Program guidelines. Unpubl. report by the Interagency Land Retirement Team, Fresno, California. 19 pp.

U.S. Department of the Interior. 1999. Final Environmental Assessment: Central Valley Project Improvement Act Land Retirement Program Demonstration Project. Unpubl. report by the Interagency Land Retirement Team, Fresno, California. 127 pp.

U.S. Fish and Wildlife Service. 1998. Recovery plan for upland species of the San Joaquin Valley, California. Portland, Oregon. 319 pp.

U.S. Fish and Wildlife Service. 1999. Biological Opinion formal section 7 consultation for the Central Valley Project Improvement Act Land Retirement Program Demonstration Project. Reference No. 1-1-99-0125. Sacramento, California. 64 pp.

Walters, C.J. and C.S. Holling. 1990. Large scale management experiments and learning by doing. Ecology 71:2060-2068.