

## **1. INTRODUCTION AND BACKGROUND**

In December 1994, the federal government promulgated new water quality requirements for San Francisco Bay and the Sacramento and San Joaquin river systems under the federal Clean Water Act and set critical habitat requirements for the delta smelt under the Endangered Species Act. Attaining these requirements necessitates increased fresh water flow through the San Francisco Bay/Delta and will reduce the amount of water available to California's agricultural and urban users. California's State Water Resources Control Board (SWRCB) is currently conducting water rights hearings to determine how these reductions will be split between urban and agricultural users and among agricultural users.

The impact of water supply reductions on agriculture is of key concern to policymakers, farmers, and other stakeholders. Analyses of the agricultural impact of water supply reductions usually rely on economic models of water use. It is hard to verify the accuracy of these models, however. This report attempts to provide some insight into how water cutbacks might affect agriculture in the San Joaquin Valley.<sup>1</sup> To this end we examine

- what effects might be expected from economic theory
- previous empirical research on the effects of water supply reductions
- the effects of reduced water supplies in the San Joaquin Valley during the 1986–1992 drought
- predictions of two models commonly used to estimate the effects of water supply cutbacks.

In the remainder of this section, we first provide background on the water quality regulations that affect the San Francisco Bay/Delta. We then discuss how much these regulations might affect agricultural water supplies and how these reductions compare to cutbacks during the 1986–1992 drought. We conclude by outlining the remainder of the report.

### **WATER QUALITY REGULATIONS FOR THE SAN FRANCISCO BAY/DELTA**

The San Francisco Bay/Delta is the hub of California's water system. Water flows into the delta from the Sacramento and San Joaquin river basins. Between 1980 and 1992, approximately 21 million acre-feet per year flowed out to the ocean on average, and approximately 5 million acre-feet was exported south to the San Joaquin Valley and Southern California (California Department of Water Resources—CDWR, 1994, p. 250). Annual outflows and exports vary significantly depending on the amount of rainfall. The federal Central Valley Project (CVP) and the State Water Project (SWP) are the principal water exporters from the delta.

The primary water quality regulations for San Francisco Bay are

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<sup>1</sup>The San Joaquin Valley covers the southern half of California's Central Valley.

- Decision 1485 (D-1485) issued by California's State Water Resources Control Board in 1978
- the biological opinion for winter-run Chinook salmon issued by the National Marine Fisheries Service (NMFS) in 1991
- the Central Valley Project Improvement Act of 1992 (CVPIA)
- water quality standards and the designation as a critical habitat for the delta smelt issued by the U.S. Environmental Protection Agency (EPA) and the U.S. Fish and Wildlife Service (USFWS) in December 1994.

D-1485 required that the CVP and SWP make operational adjustments to keep delta water quality and fresh-water outflow within specified limits. Fish and wildlife resources continued to decline after 1978, however, and EPA, NMFS, and the USFWS responded with more-stringent environmental regulations. In the case of the NMFS, decline of winter-run Chinook salmon, which is listed as a threatened species, prompted action under the Endangered Species Act. EPA and USFWS responded to the continued decline of a wide range of species with action under the Clean Water Act and Endangered Species Acts. With the passage of the CVPIA, Congress also set aside 800,000 acre-feet of the approximately 8 million acre-feet diverted by the CVP annually for environmental uses.

### **IMPACT OF THESE REGULATIONS ON DIVERSIONS TO SAN JOAQUIN VALLEY AGRICULTURE**

What these regulations will mean for water supplies to San Joaquin Valley agriculture depends on the still ongoing water rights process. Reductions to the San Joaquin Valley are expected to be substantial. An analysis done in 1994 by EPA suggested that deliveries to San Joaquin Valley agriculture would fall 600,000 acre-feet on average and 1.3 million acre-feet in critically dry years relative to the requirements under D-1485 (U.S. EPA, 1994, Table 5-2).<sup>2,3</sup> More-recent analyses by the SWRCB project that deliveries to San Joaquin Valley agriculture will drop 367,000 acre-feet in an average water year and 815,000 acre-feet in a critically dry year (California SWRCB, 1997, p. V-3). These reductions will mostly likely be concentrated in certain portions of the San Joaquin Valley—those with the most junior water rights—and will vary considerably depending on the type of water year.

Farmers in the southern San Joaquin Valley faced severe reduction in surface water supplies during the 1986–1992 drought. As will be discussed in more detail below, surface water supplies fell over 3 million acre-feet (nearly 75 percent) in Fresno and Kern Counties between 1985 and 1991, the worst year of the drought.<sup>4</sup> Farmers partially offset this decline by increasing groundwater use, but overall water use still fell approximately 1.2 million acre-feet (18 percent) in the two counties between 1985 and 1991.

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<sup>2</sup>We adjusted the EPA estimates to include the NMFS requirements. We assumed that the entire increment in water cutbacks due to the NMFS requirements is borne by agriculture. EPA did not assume that any of the 800,000 acre-feet set aside by the CVPIA would be available to offset the reductions to agriculture.

<sup>3</sup>Critically dry years are roughly the 10 percent of years with the lowest water exports.

<sup>4</sup>Fresno and Kern Counties are the two largest counties in the southern San Joaquin Valley.

The large reduction in water use during the drought provides an opportunity to examine how farmers respond to water supply cutbacks. As will be discussed in Section 2, caution must be taken in inferring the effects of regulatory cutbacks from the effects of drought cutbacks. Drought is a temporary phenomenon whereas regulatory cutbacks are likely to be permanent. Nevertheless, the response of farmers during the drought may provide some lessons on how they might respond to permanent water cutbacks.

## **OUTLINE OF REPORT**

In Section 2, we first discuss the types of response we might expect to water supply cutbacks and fill in the theory with description of the crop production opportunities available to farmers in the San Joaquin Valley. We then review the existing empirical literature on farmer response to water supply cutbacks, both in the San Joaquin Valley during the drought and in other settings. In Section 3, we examine new data on the impact of water supply reductions in the San Joaquin Valley during the drought by comparing changes in agricultural activity in counties that saw large declines in water use (Fresno and Kern) with counties where there was little change. Our analysis is based on countywide data collected from county agricultural commissioners, California's Employment Development Department, and the U.S. Bureau of Reclamation. In Section 4, we describe two models that have been commonly used to simulate farmer response to regulatory reductions and use them to project the impact of the water supply reductions observed during the drought. We then compare the projections to the actual changes in agricultural activity observed during the drought. The report concludes by summarizing the main lessons learned from the analysis.