United States General Accounting Office

GAO

Report to the Chairman, Subcommittee on Water and Power, Committee on Energy and Natural Resources, U.S. Senate

April 1994

WATER SUBSIDIES

Impact of Higher Irrigation Rates on Central Valley Project Farmers

GAO/RCED-94-8

GAO

United States
General Accounting Office
Washington, D.C. 20548

Resources, Community, and
Economic Development Division

B-252899

April 19, 1994

The Honorable Bill Bradley
Chairman, Subcommittee on Water and Power
Committee on Energy and Natural Resources
United States Senate

Dear Mr. Chairman:

This report responds to your request that we estimate the impacts on farmers' profits of the higher irrigation rates mandated in the 1992 Central Valley Project Improvement Act (P.L. 102-575) and of further rate increases under various scenarios, estimate the financial benefits to the federal government of increasing irrigation rates, and determine the ways farmers can mitigate the impacts of increased rates.

As arranged with your office, unless you publicly announce its contents earlier, we plan no further distribution of this report until 30 days after the date of this letter. At that time, we will send copies to the Secretary of the Interior; the Commissioner, Bureau of Reclamation; the Director, Office of Management and Budget; and other interested parties. We will also make copies available to others on request.

This report was prepared under the direction of James Duffus III, Director, Natural Resources Management Issues, who can be reached at (202) 512-7756 if you or your staff have any questions. Major contributors to this report are listed in appendix V.

Sincerely yours,

Keith O. Fultz

Keith O. Fultz
Assistant Comptroller General

Executive Summary

Purpose

Irrigators within the Department of the Interior's Bureau of Reclamation's Central Valley Project (CVP) have received federally subsidized water for up to 40 years under fixed-rate water service contracts. However, the fixed rates no longer function as intended; they do not cover the Bureau's operation and maintenance costs and have not been sufficient to repay virtually any of the $1 billion in the construction costs owed. Moreover, environmental and water use problems have been associated with irrigation practices carried out under these contracts. Studies by agricultural economists suggest that higher water prices would increase irrigation efficiency and conservation, thereby reducing environmental degradation caused by irrigation and freeing up water currently used for irrigation for other uses. However, raising irrigation rates is a complex issue that requires the consideration of such factors as the potential impacts on farmers and local agricultural economies.

The Chairman of the Subcommittee on Water and Power, Senate Committee on Energy and Natural Resources, asked GAO to (1) estimate the impacts on farmers' profits of the higher irrigation rates mandated in the 1992 CVP Improvement Act and of further rate increases under various scenarios, (2) estimate the financial benefits to the federal government of increasing the irrigation rates, and (3) determine the ways farmers can mitigate the impacts of increased rates. To estimate the impacts on farmers' profits, GAO created budgets for two hypothetical farm operations designed to represent the major commodities grown in farms in the two major regions of the Central Valley—the Sacramento Valley and the San Joaquin Valley. The budgets were based on a computer program and production costs developed by the University of California at Davis. Other information was provided by cooperative extension service officials, agricultural economists, and farmers in two major irrigation districts. The budgets do not consider the effect of other possible actions that could affect water availability, such as reallocations of water from irrigation that may occur under the CVP Improvement Act, the Endangered Species Act, or other environmental requirements. The scope of GAO's work did not include an examination of the effect of higher irrigation rates on local economies.

Background

Located in California's Central Valley Basin, the CVP is the Bureau's largest water resource project. Historically, the CVP has provided about 6 million acre-feet—or about 2 trillion gallons—of water each year for irrigation and has helped make California's Central Valley one of the most productive agricultural areas in the world. The CVP's water is marketed by the

Secretary of the Interior under long-term contracts authorized by the Reclamation Project Act of 1939 and supplied to state-established water and irrigation districts for irrigation and other purposes. The Bureau has begun renewing contracts as they expire. Over one-fourth of the remaining contracts will expire by the end of 1996.

CVP irrigation rates vary and are intended to repay a share of the capital costs associated with the construction of irrigation facilities and operation and maintenance costs owed the federal government. Districts charge farmers distribution costs as well. Farmers not receiving CVP water pay a wide variety of rates, depending on the source of the water. Federal irrigation rates are considered to be subsidized because they do not cover interest on the federal government's costs incurred in constructing the irrigation component of project facilities. As water service contracts continue to be renewed in coming years, a 1986 statutory requirement provides that the renewed contract rates—referred to as cost-of-service rates—provide for the repayment of capital costs by the year 2030 and full payment of operation and maintenance costs each year. The rates will not cover interest payments on capital costs, however. A full-cost rate for all water users would recover both the capital and interest costs but would require changes in reclamation law.

In an August 1991 report,[1] GAO documented significant environmental and water use problems associated with irrigation practices carried out under water service contracts in the CVP. GAO recommended that the Congress amend reclamation law to allow contract renewals for lesser quantities of water and shorter periods of time. GAO also recommended that the Secretary of the Interior determine the impacts of renewing contracts and demonstrate the extent to which problems can be mitigated by changes in contract terms, including market mechanisms such as raising rates and easing water transfers.

In October 1992, the Congress passed the CVP Improvement Act. The act raises irrigation rates through a tiered rate structure that charges up to the full-cost rate for only the final 20 percent of the water received. Revenues raised from higher irrigation rates will be placed in a restoration fund to mitigate environmental damage in the Central Valley. If fund receipts are not sufficient to meet the amounts required under the act, the Secretary will assess a fee of up to $6 per acre-foot on irrigation water to help make up the difference. The act also requires environmental impact analysis

[1]Reclamation Law: Changes Needed Before Water Service Contracts Are Renewed (GAO/RCED-91-175, Aug. 22, 1991).

before renewing long-term contracts, limits contract terms to 25 years, reallocates water to environmental purposes, and allows water transfers to new uses. GAO currently is analyzing issues associated with water transfers in 17 western states and will report these findings separately in an upcoming report.[2]

Results in Brief

Increased CVP irrigation rates would negatively affect irrigators and positively affect the U.S. Treasury and water use efficiency. The rate increases mandated in the CVP Improvement Act reduced farm profits for GAO's hypothetical San Joaquin Valley farm by 11 percent and reduced the profits of the Sacramento Valley farm by 4.3 percent.

Increasing the irrigation rates to provide for a 100-percent increase in the repayment of capital costs would decrease profits by a total of 18.3 percent for the San Joaquin farm and 5.7 percent for the Sacramento farm compared with profits at the cost-of-service rates. Charging farmers the costs to fully repay all capital costs with interest would decrease profits by a total of 34 and 6.9 percent for the San Joaquin and Sacramento farms, respectively. Both farms would remain profitable under all simulated rate increases.

Each farm using CVP water is unique, and actual impacts of higher irrigation rates on CVP farms depend on farmers' individual circumstances. For example, economic studies GAO reviewed indicate that reduced profits will be expressed in decreased land values and therefore decreased land rental costs. Decreased rental costs will partially offset increased water costs. However, those who own land will lose some equity in their landholdings. Some farmers with low profits or with high debt and reduced equity in their land may not be able to maintain viable farms. Information from agricultural lenders in California indicates that the effect on California's overall farm economy is not likely to be severe. Despite higher irrigation rates and water shortages during the recent drought, the overall farm economy remained strong. Other economic variables, such as interest rates, the export market, and the value of the U.S. dollar, affected the farm economy more than water rates.

If irrigation rates were increased beyond the requirements of the CVP Improvement Act, the CVP's outstanding debt would be retired more quickly and federal revenues would be increased. If irrigators paid the

[2]Water Transfers: More Efficient Water Use Possible If Problems Are Addressed, (GAO/RCED-94-35).

full-cost rate, the present value of the amount repaid would be $800 million more than would have been repaid without interest payments.

Studies completed by economists at California universities and lending institutions and GAO's discussions with farmers, agricultural economists, water district officials, and others indicate that increased irrigation rates give farmers incentive to change their farm management practices and reduce water use to mitigate increased water costs. Farmers may improve their irrigation practices, adopt more efficient irrigation technologies, or change crops to adjust to higher water costs and conserve water.

Principal Findings

Increased Water Rates Will Reduce Farm Profits, but the Hypothetical Farms Remain Profitable

To determine the impact of increased CVP irrigation rates on CVP farm profits, GAO simulated farm operations for two hypothetical farms. One farm reflects 1990 water rates and production data for cotton, wheat, tomatoes, and garlic—commonly grown commodities in the San Joaquin Valley. The other farm reflects 1990 data for rice—the primary crop grown in the Sacramento Valley. Farm profits were measured without adjusting for possible changes in farming practices farmers might make in response to higher irrigation rates or changes in land values associated with higher irrigation rates. Profits were also measured without considering possible reallocations of water from irrigation to other uses.

The budgets showed that CVP irrigation costs represented from 1 to 6.6 percent of the total cost of crop production for these farms. The rate increases mandated in the CVP Improvement Act, including the maximum $6 per acre-foot charge, reduced farm profits for GAO's hypothetical San Joaquin Valley farm by 11 percent, from $248,411 to $221,406, and reduced the profits of the Sacramento Valley farm by 4.3 percent, from $49,882 to $47,732. The impacts on the Sacramento farm are less than those on the San Joaquin farm primarily because the Sacramento farm is less dependent on CVP water.

GAO then increased the capital portion of irrigation rates in 25-percent increments, up to 100 percent. When the capital portions of the rates were increased 100 percent and the $6 per acre-foot charge was included, profits decreased by a total of 18.3 percent for the San Joaquin Valley farm

and 5.7 percent for the Sacramento Valley farm from the profits with the cost-of-service rates.

GAO also increased the irrigation rates up to the full cost and included the $6 charge—the maximum rate increase examined. The San Joaquin Valley farm's profits decreased by 34 percent, to $160,911, and the Sacramento Valley farm's profits decreased by 6.9 percent, to $46,436 under this scenario. Both hypothetical farms would remain profitable under all scenarios.

Each farm using CVP water is unique, and the actual impacts on CVP farms depend on farmers' individual circumstances. For example, the economic literature GAO reviewed indicates that for farmers who lease land, reductions in land rental costs will partially offset the increase in water costs. However, those who own land will lose some equity in their landholdings as a result of decreased land values, and some farmers with high debt and reduced equity or with low profits may not be able to maintain viable farms. Reduced equity reduces farmers' borrowing capacity for loans. Local economies that rely on farmers may be harmed. The effect on California's overall farm economy is not likely to be severe, however. Information from agricultural lenders on farm profits and loan losses indicates that during California's drought from 1987 to 1992, farmers encountered water shortages and higher water costs, but such costs had little effect on farm loan losses. While higher water costs have affected farm profits and may be significant for individual farmers, the strong farm economy during the drought indicates that higher costs have not affected the farm economy overall as much as other key economic variables such as interest rates and commodity prices.

Federal Revenues Could Be Significantly Enhanced

The capital portion of the irrigation rates is used for repaying the estimated $1 billion in capital costs that are allocated to be repaid by CVP irrigators. Under a 1986 statutory requirement, the Secretary of the Interior is to adjust the rates if they are not adequate to recover capital costs by the year 2030.

GAO analyzed the effect on federal revenues of raising the capital portion of the cost-of-service rates in 25-percent increments, up to 100 percent, assuming full contract delivery levels continue. Depending on the increases, the irrigators' allocated capital costs could be repaid 4 to 12 years earlier. Therefore, the present value of the repayment would increase from $35 million to $114 million. If irrigators paid full-cost rates

for water, which include both the capital costs owed and the interest on them, the present value of the amount repaid would be $800 million more than would have been repaid between now and 2030 without interest under the existing rate schedule.

A legislative change would be needed to require the Secretary to recover capital costs before 2030 and to charge interest on capital costs. However, the 1986 statute does not preclude the Secretary from collecting capital costs at an earlier date. But if interest were charged for contracts already renewed, it might give rise to irrigators' claims that the United States breached its contracts, subjecting the government to claims against it for damages. Moreover, the more contracts that are renewed, the more difficult it may become to effect change because the terms in already renewed contracts may be viewed as the norm.

Farmers Can Mitigate the Impacts of Increased Water Rates

GAO's review of the economic literature and discussions with farmers, agricultural economists, agricultural extension agents, water district officials, and others consistently indicate that farmers have a number of options for reducing the impact of higher rates. For example, farmers might improve irrigation efficiency through better irrigation practices such as leveling fields, more accurate irrigation scheduling, and reusing runoff-irrigation water. Modern technologies such as sprinkler or drip systems control the amount, time, and place of water applications and reduce losses to evaporation or runoff. Farmers might also switch crops to mitigate increased water costs and reduce water use. However, some farmers will not be able to change the type of crops that they grow because of limitations in the soil and salinity problems.

Whether it is profitable for a farmer to change to a more efficient irrigation system or shift crops in response to higher water costs depends on such site-specific variables as the type of soil and topography and other factors affecting farm profitability. It is difficult to predict to what extent farmers will switch to various irrigation systems or switch crops.

Matters for Congressional Consideration

Whether irrigation rates should be increased beyond current requirements is a policy decision for the Congress. If the Congress decides to pursue the issue of increasing irrigation rates, the Congress may wish to consider in its deliberations such factors as (1) the extent to which farmers can absorb increased irrigation costs, (2) the potential adverse impacts on farmers and local economies, (3) the increased revenues to the U.S.

Treasury that could be generated, (4) the ability of farmers to mitigate the effects of the price increases, (5) the environmental and water supply benefits resulting from higher irrigation rates, (6) the impacts of future water supply reductions, and (7) whether the increases should apply to already renewed contracts. Other options, such as using water markets in which rights to use water are bought and sold, may achieve similar benefits but would affect farmers differently.

Agency and Other Comments

In order to obtain the views of affected groups, GAO requested and received comments on a draft of this report from the Bureau of Reclamation and the Central Valley Project Water Association, which represents water and irrigation districts that contract for water from the CVP. The Association asked GAO to include comments provided by the Westlands Water District.

The Bureau said that the report provides a useful and credible analysis of some of the potential financial effects of changes in the price of CVP irrigation water. The Bureau indicated that in general, it accepts the report as corroboration of several of the key assumptions embodied in the 1992 CVP Improvement Act.

In general, the Association and Westlands said that GAO's analysis and conclusions are flawed primarily because (1) the budgets are not based on water delivery levels provided in 1990 during the drought and do not consider future reductions in supply resulting from the CVP Improvement Act and other environmental requirements, (2) GAO did not examine impacts on local economies resulting from increased water rates, and (3) the hypothetical farms are not representative of all farms in the Central Valley.

GAO recognizes that drought and future water supply reductions may affect California farmers and local agricultural communities. However, GAO was asked to examine the impact of higher irrigation rates on farmers' profits, not the impact of drought and reduced water supplies or the effects on local economies. Moreover, if budgets had been based on water delivery levels provided under drought conditions, GAO would have modeled profits for an atypical year, and the results would reflect the impacts of rate increases under drought conditions, rather than under normal conditions. In addition, future reductions in deliveries to CVP farmers as a result of the CVP Improvement Act and the Endangered Species Act are unknown. Because the Bureau indicated that its estimates of possible water supply reductions over the next 5 years were very rough, GAO did not use these

data. The report recognizes that impacts on farmers could be greater if changes in the water supply also occurred. The impacts of reductions in the water supply from drought or environmental requirements are significant issues, and GAO has added the impact of water supply reductions to the factors to be considered by the Congress. GAO also recognizes that local economies may be affected by changes in water rates and has added local economic impacts to the factors to be considered by the Congress. However, the absence of an analysis of these issues does not invalidate the analysis of the impacts of higher rates on farmers' profits.

The farm budgets were designed to represent farm operations for the major commodities grown in two major regions of the Central Valley. The budgets were not intended to be representative of all farms in the Central Valley. GAO believes that the budgets provide an indication of the effects of increased irrigation rates on farms with similar characteristics to the hypothetical farms. Budget information was combined with data on the agricultural economy during the drought and information from discussions with irrigation specialists, farmers, cooperative extension officials, and economists about the potential impact of higher irrigation rates. The combined data and information indicate that other factors more greatly affect the agricultural economy than irrigation rates and that some farmers may change farming practices to mitigate their reductions in profit. Whether all farms in the Central Valley are represented or not does not affect the report's conclusions that increased irrigation rates will negatively affect farmers' profits and positively affect the U.S. Treasury and water use efficiency.

The Association and Westlands Water District also provided technical corrections, and changes have been made where appropriate. (See apps. II through IV for the comments received and GAO's response to the comments.)

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Tables

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Abbreviations

ASCS	Agricultural Stabilization and Conservation Service
CVP	Central Valley Project
GAO	General Accounting Office
GCID	Glenn-Colusa Irrigation District
O&M	Operation and Maintenance
RRA	Reclamation Reform Act

Introduction

The Department of the Interior's Bureau of Reclamation plans, constructs, and operates water resource projects to, among other things, provide irrigation water to arid and semiarid lands in the 17 western states. Construction, operation, and maintenance of these projects are financed with federal funds. The Bureau provides most of its irrigation water to state-established water and irrigation districts that obtain the water under contracts and distribute it to farmers. Through service or repayment charges, the Bureau, over time, recoups a portion of the federal government's costs in providing the water.

The Central Valley Project and Water Use in California

The Central Valley Project (CVP), located in California's Central Valley Basin, is the Bureau's largest water resource project and consists of numerous dams, reservoirs, canals, and pumping and power-generating facilities. The Central Valley Basin includes the valleys formed by the Sacramento River in the north and the San Joaquin River in the south and extends nearly 500 miles. The two river systems join at the Sacramento-San Joaquin Delta and flow through San Francisco Bay to the Pacific Ocean. Irrigation has made California's Central Valley one of the most productive agricultural areas in the world. Historically, the CVP has provided about 6 million acre-feet[1] of irrigation water each year to approximately 3.8 million acres of cropland. This amount represents about 85 percent of the total water available through the CVP. Water is also used for municipal and industrial uses, fish and wildlife, recreation, and power generation.

The CVP's water is marketed by the Secretary of the Interior to water and irrigation districts (districts) under the Reclamation Project Act of 1939 (43 U.S.C. 485), as amended. The Secretary, through the Bureau of Reclamation, has entered into 238 water service contracts with districts in the Central Valley Basin to provide CVP water for irrigation. These contracts generally were written for 40-year periods. Interior has begun renewing the contracts as they expire.

Most of California's developed water supplies from federal, state, and private sources are used for irrigation. As California's population continues to grow, additional demands for water, such as for municipal use, are expected to grow rapidly. The state of California reported that in 1989, approximately 79 percent of its developed water was used for irrigation, 17 percent for municipal and industrial uses, 3 percent for

[1]An acre-foot is the volume of water necessary to cover 1 acre to a depth of 1 foot—about 326,000 gallons.

environmental purposes, and 1 percent for recreation and other uses. Sources of water include the California State Water Project—a state system of dams, reservoirs, and aqueducts that delivers 2.4 million acre-feet annually—as well as direct diversions from rivers and streams, deliveries from U.S. Army Corps of Engineers reservoirs, deliveries from local water district reservoirs, and groundwater pumping.

Central Valley Project Irrigation Rates Vary Greatly

Federal irrigation rates are considered to be subsidized because they do not include interest on the federal government's costs incurred in constructing the irrigation component of the project facilities. Farmers receiving water from the CVP currently pay varying rates depending on (1) the type of contract established between the Bureau and the district for the repayment of costs owed the federal government and (2) the distribution costs charged by the districts. Generally, there are three different federal rate structures: the fixed contract rate, the full-cost rate, and the cost-of-service rate. Districts then add charges to these rates to cover districts' operation and maintenance costs and distribution systems. Farmers not receiving CVP water pay a variety of water rates, depending on the source of the water.

Most CVP farmers currently pay the fixed contract rates that were established in the original CVP irrigation contracts to cover the entire 40-year term of the contracts. These rates were intended to repay the capital costs of CVP facilities without interest and to pay irrigation operation and maintenance (O&M) costs through a fixed charge on each acre-foot of water delivered. However, the contracts' low fixed rates cannot pay growing operation and maintenance costs due to inflation and have not been sufficient to repay virtually any of the construction costs owed. Combined with interest-free repayment for over 40 years, the federal government has recovered very little of its actual costs. According to Bureau figures, irrigators owe approximately $1 billion in capital costs.[2]

The full-cost rate resulted from amendments to reclamation law in the Reclamation Reform Act (RRA) of 1982 (43 U.S.C. 390aa to zz-1) and includes repayment of O&M costs, as well as the federal government's capital costs allocated to irrigation and unreimbursed O&M expenses, with interest. The act increased the acreage limit from 160 owned acres to 960 acres of owned or leased land that a farmer could irrigate with subsidized water. Some districts and farmers taking advantage of the expanded

[2]The $1 billion is the sum of the nominal costs of construction over many decades. No interest was accrued, therefore, no adjustments were made for inflation or the opportunity costs for federal funds invested.

acreage limits agree to pay the Bureau a rate at least sufficient to cover the Bureau's O&M costs. Those farmers wanting to irrigate leased land over the 960-acre limit are charged the full-cost rate for the additional acreage.

The cost-of-service rate is the contract rate for water districts after they renew their contracts. Under a 1986 statutory requirement, irrigators using CVP water must repay their portion of capital costs without interest by the year 2030 and pay O&M deficits[3] accruing on or after October 1, 1985, with interest. Irrigators are required to pay annual O&M costs each year. Farmers in districts that have renewed their original 40-year contracts pay the cost-of-service rate. By the end of 1996, over one-fourth of the original 40-year contracts will have expired and be subject to these new rates.

Table 1.1 illustrates different rates in three of the largest districts. Some farmers pay the fixed contract rate plus the district's rate for distribution costs. Some farmers who farm more than 960 acres pay the district's rate plus the CVP's full-cost rate for leased acreage in excess of 960 acres. Once irrigation contracts are renewed, farmers pay the cost-of-service rate plus the district distribution charges. District rates vary depending on the type of distribution systems used and pumping requirements. As shown in table 1.1, in some cases the Bureau rates may be only a small portion of the total rates paid for irrigation water.

Table 1.1: Sample 1992 Water Rates Per Acre-Foot

District	Fixed contract rate	CVP full-cost rate for farms in excess of 960 acres	Cost-of-service rate	District distribution charges	Range of farmers' water rates
Westlands	$8.00	$45.79	$20.13	$14.48	$22.48 to $60.27
Arvin-Edison	$3.50	$33.12	$19.10	$43.50 to $93.50	$47.00 to $126.62
Glenn-Colusa[a]	$2.00	$11.50	$6.73	$5.17[b]	$7.17 to $16.67

[a]Rates listed are those charged for CVP water. They do not reflect water received under water rights held by the district prior to construction of the CVP.

[b]Glenn-Colusa charges farmers by the acre for water, not by the acre-foot. The distribution charges are estimated based on 7.8 acre-feet of water required to grow rice.

[3]As of 1992, about 76 percent of CVP contracts were operating with an annual O&M deficit.

CVP Improvement Act Increases Future Water Rates

In October 1992, the Congress passed the CVP Improvement Act (Title XXXIV, P.L. 102-575), which increases irrigation rates. Section 3405(d) provides that all contracts for a term longer than 3 years entered into, renewed, or amended after the act was passed are subject to tiered water pricing. Under this approach, the rates will be based on how much of the total amount of water available under its contract a district receives. The first 80 percent of a district's contract water will be charged at the district's cost-of-service rate. The next 10 percent will be charged at a rate halfway between the cost-of-service rate and the full-cost rate. The final 10 percent will be charged the full-cost rate; that is, the rate for the final 10 percent of the water delivered will include both capital and interest on the capital costs. Table 1.2 illustrates how the Westlands Water District's 1992 cost-of-service rate would increase from $30.86 per acre-foot to $35.74 per acre-foot under the act, once its existing contract expires in 2007 and it enters into a new contract.

Table 1.2: CVP Improvement Act's Effect on the 1992 Westlands Water District's Cost-of-Service Rate

Amount of water delivered	Applicable rate (per acre-foot)
80% of the contract total	$30.86
81-90% of the contract total	$47.12
91-100% of the contract total	$63.37
Weighted average price for all contract water	$35.74

Revenues from the tiered pricing component of irrigation rates will be placed in a restoration fund of up to $50 million annually for fish and wildlife. If fund receipts are not sufficient to meet the amounts required under the act,[4] the Secretary will assess a fee of up to $6 per acre-foot on irrigation water and $12 per acre-foot on municipal and industrial water.[5] Some farmers may avoid much of the price increases under the act by maintaining valuable wildlife habitat. Farmers who produce a crop that provides significant habitat for waterfowl, as determined by the Secretary, are not subject to tiered pricing. Furthermore, the act provides farmers with incentives of up to $2 million annually, either directly or through credits against contractual obligations, to keep fields flooded during appropriate periods during the year for waterfowl habitat. How these incentives will be distributed will be determined by the Secretary.

[4]The act requires that funds be sufficient to meet amounts appropriated by the Congress each year until fiscal year 1998. If $50 million per year has not been appropriated on an average annual basis, the Secretary will increase surcharges in fiscal year 1998 and each fiscal year thereafter to generate $50 million per year on a 3-year rolling average basis for each fiscal year following enactment of the act.

[5]Surcharges are indexed to October 30, 1992.

Conversely, the act charges additional fees to districts receiving water diverted from the San Joaquin River. These districts, located in the CVP's Friant Unit, must pay a surcharge of $4 per acre-foot for all water delivered on or before September 30, 1997, in addition to other fees or increased rates. The surcharge increases in increments up to $7 per acre-foot for water delivered after September 30, 1999, until the Secretary completes, and is authorized to implement, a plan that includes reestablishing and sustaining anadromous fisheries in the San Joaquin River.

Other Rates in the Central Valley Vary Greatly

Farmers not receiving CVP water pay a wide variety of water rates, depending on the source of the water. Some rates are higher than CVP rates, while others are lower. Although some farmers pay rates much higher than others, they continue to farm. Farmers receiving water from the State Water Project must pay the full cost of the water, including the capital costs of project facilities with interest and distribution systems. Those located in the southern region of the Central Valley who receive State Water Project water may pay twice as much as their neighbors receiving CVP water. For example, farmers within the Wheeler-Ridge Maricopa Water Storage District paid as much as $200 per acre-foot in 1992 for water from the State Water Project. In contrast, the most expensive rate for farmers in the adjoining Arvin-Edison Water Storage District receiving nonfull-cost CVP water was about $100 or less per acre-foot. These rates represent the extreme range of different rates paid for CVP and the State Water Project irrigation water. Table 1.3 provides examples of the various rates farmers pay for non-CVP water.

Table 1.3: 1992 Water Rates for Farmers Not Receiving CVP Water

Water district	Retail cost of water (per acre-foot)	Source of water
Wheeler-Ridge Maricopa	$100-$200	State Water Project.
Alta Irrigation District	$19.48	Kings River via Pine Flat Dam (Corps of Engineers Dam).
Modesto Irrigation District	$4.13	Don Pedro Reservoir (a nonfederal reservoir and dam).
Central California Irrigation District	$8.37	Receives water from the Bureau's Delta-Mendota Canal in exchange for river-rights water.

Farmers without adequate sources of surface water often pump groundwater. Many farmers rely on groundwater for some of their water. Generally, groundwater costs are higher than surface water and vary by how far the water must be pumped. Pumping costs range from around $20

to over $75 per acre-foot for energy and may cost $350,000 or more to install a well. When surface water prices exceed groundwater pumping costs, farmers will pump groundwater to replace surface water. As more water is pumped, water levels can decline and groundwater pumping costs can increase.[6]

Water Use Problems in the CVP

We documented significant environmental and water use problems associated with irrigation practices carried out under CVP water service contracts in our 1991 report.[7] These problems include environmental degradation from selenium[8] poisoning and increasing salinity, the production of subsidized crops with subsidized water, and inadequate water supplies for fish and wildlife. Furthermore, with water dedicated to irrigation in contracts, water cannot be used to meet emerging demands in California such as urban use. To address these concerns, we recommended that the Secretary of the Interior determine the impacts of renewing CVP contracts for the same quantities of water for long terms. We recommended that the analysis include a demonstration of the extent to which problems associated with water service contracts can be mitigated by changes in contract terms, including consideration of market mechanisms such as raising irrigation rates, to promote more efficient water use and conservation. We also recommended that the Congress amend reclamation law to allow contract renewals for lesser quantities of water and shorter periods of time. Since the completion of our report, the CVP Improvement Act was passed, which not only raises irrigation rates but requires environmental impact statements before long-term contract renewal, limits contract terms to 25 years, dedicates 800,000 acre-feet of water to fish and wildlife and encourages water markets by allowing CVP farmers and districts to voluntarily resell some agricultural water supplies to other uses, such as municipal, industrial, and environmental purposes.

Objectives, Scope, and Methodology

The Chairman of the Subcommittee on Water and Power, Senate Committee on Energy and Natural Resources, asked us to: (1) estimate the impacts on farmers' profits of the higher irrigation rates mandated in the 1992 CVP Improvement Act and of further rate increases to recover the

[6]Excessive groundwater pumping can result in overdraft of the groundwater supply and land subsidence, in which land collapses.

[7]Reclamation Law: Changes Needed Before Water Service Contracts Are Renewed (GAO/RCED-91-175, Aug. 22, 1991).

[8]Selenium is a trace element that occurs naturally in soil and is needed in small amounts to sustain life. However, high concentrations of selenium attributed to drain-water runoff from agriculture have been linked to waterfowl deformities, embryo mortality, and death in adult birds.

capital costs before 2030 and to recover the interest on construction costs, (2) estimate the financial benefits to the federal government of increasing the irrigation rates, and (3) determine the ways farmers can mitigate the impacts of increased water rates.

Our review considered increasing water rates as an option to improve irrigation efficiency and conserve water in the CVP and increase federal revenues. We did not address other options to achieve these benefits such as changing water allocations or using water markets. These options would impact farmers differently. We currently are analyzing issues associated with the development of water markets in the 17 western states and will report our findings separately in an upcoming report.[9] We did not examine the effects of higher irrigation rates on local economies. Such a review was beyond the scope of our work.

To determine the impact of increased CVP irrigation rates on CVP farm profits, we created farm budgets designed to represent farm operations for major commodities grown in two regions of the Central Valley: the San Joaquin Valley and the Sacramento Valley. We estimated the effect of increased rates as mandated in the CVP Improvement Act, further rate increases to recover costs before 2030, and increases to recover interest on capital costs. We used a computer program developed by the University of California at Davis to create the farm budgets and used 1990 production data representative for commodities grown in the two districts. We used the Bureau of Reclamation's 1990 cost-of-service rates for two of the largest districts in the CVP—the Westlands Water District and the Glenn-Colusa Water District—as our base irrigation rate.

Inputs to the farm budgets were provided by agricultural extension service officials, agricultural economists, and farmers in the Westlands and Glenn-Colusa districts. The farmers were recommended to us as knowledgeable about various farming practices and alternatives by agricultural extension service officials and the Director of Irrigation Training and Research, Agricultural Training Department at California Polytechnic State University at San Luis Obispo. Production cost data were provided largely by the University of California at Davis. We chose the commodities examined in our budgets on the basis of district crop reports and interviews with officials from the U.S. Department of Agriculture's Agricultural Stabilization and Conservation Service (ASCS), the University of California Cooperative Extension Service, and farmers recommended to us to reflect the most commonly produced crops in each

[9] Water Transfers: More Efficient Water Use Possible If Problems Are Addressed, (GAO/RCED-94-35).

district. We based crop acreage on reclamation law acreage limitations, 1990 district crop reports, ASCS support program policies, and other factors affecting production decisions. The budgets reflect the impact of irrigation rate increases with current CVP contract deliveries but do not consider the impact of possible reductions in water supplies resulting from drought or implementation of the CVP Improvement Act, the Endangered Species Act, or other environmental requirements.

Our inputs were reviewed by university professors, the farmers, officials from ASCS, and the California Cooperative Extension Service. The farm budgets are discussed in detail in appendix I.

To determine the benefits to the federal government of increased irrigation rates beyond those required by the CVP Improvement Act,[10] we increased the capital portion of the water rates, that is, the portion attributed to repaying CVP facilities. We increased the capital portion of irrigation rates for each irrigation and water district by 25-percent increments up to 100 percent at the date of contract renewal. Increasing the rate would accelerate repayment of the $1 billion in capital costs owed. We used the Bureau's figure for the amount of capital costs owed by irrigators. We also used Bureau data indicating districts' contract expiration dates and annual water deliveries to determine when the CVP contracts will be renewed and the capital rates necessary to repay the project by 2030. We then calculated the present value of the repayment at higher irrigation rates and compared it with the present value of the repayment at the current rate. The current rate does not consider inflation and the real rate of interest forgone to the government.

To determine how farmers can mitigate the impacts of higher irrigation rates, we reviewed the literature addressing the effects of increasing agricultural water rates on farm management and irrigation practices and technologies. Our economists examined the methodology of the studies presented in the literature to identify those studies on which we could base sound conclusions. We met with officials from several districts, the Bureau of Reclamation, ASCS, and the Western Farm Credit Bank and interviewed the farmers recommended to us in the Westlands Water District and Glenn-Colusa Irrigation District. We also interviewed agricultural economists from Stanford University; the Universities of California at Davis, Berkeley, and Riverside; the California State Universities at Fresno and Chico; as well as California Polytechnic State

[10]The capital portion goes to repay costs allocated to the CVP's irrigation functions. CVP cost allocation is explained in our report entitled Bureau of Reclamation: Central Valley Project Cost Allocation Overdue and New Method Needed (GAO/RCED-92-74, Mar. 31, 1992).

University, San Luis Obispo; and the Bank of America, a major agricultural lender. We worked with a number of these economists in developing our methodology and reviewing the accuracy of the information in our report.

Significant studies and reports used in conducting our work are listed in the Selected Bibliography at the end of this report.

Our work was conducted between October 1991 and December 1993 in accordance with generally accepted government auditing standards.

Agency and Other Comments

We requested and received comments on a draft of this report from the Bureau of Reclamation and the Central Valley Project Water Association, which represents approximately 90 water and irrigation districts that contract for water from the Central Valley Project. The Central Valley Project Water Association asked us to include comments provided by the Westlands Water District. Comments we received and our responses are summarized at the end of chapter 4 and presented in full in appendixes II, III, and IV. We have made changes to the report where appropriate.

Increased Water Rates Will Reduce Farm Profits and Increase Federal Revenues

Using farm budgets designed to represent farm operations for the major commodities grown in two regions, we simulated the impacts on CVP farmers' profits of raising CVP irrigation rates, under various scenarios. These budgets represent hypothetical farms at one moment in time and hold constant all factors affecting farm profit except irrigation rates. We determined that increasing the rates in accordance with the CVP Improvement Act and up to full cost would decrease farm profits, but the hypothetical farms would remain profitable. Economic studies show that the loss indicated by our models will be expressed through reduced land values. Some farmers with low profits, or with high debt and reduced equity, may not be able to maintain viable farms. However, information from agricultural lenders indicates that the effect on California's overall farm economy is not likely to be severe. If irrigation rates were increased beyond the requirements of the CVP Improvement Act, the CVP's outstanding debt would be retired more quickly and federal revenues would be increased. However, impacts on farmers would be greater than those resulting from the CVP Improvement Act.

Farm Budgets Indicate That Higher Irrigation Rates Impact Profits to Varying Degrees

To determine the impact of increased CVP irrigation rates on CVP farm profits, we created farm budgets designed to represent farm operations for five major commodities grown in two regions of the Central Valley: the San Joaquin Valley and the Sacramento Valley. Farming practices differ greatly between these two valleys primarily because of different soil conditions.

Budgets Represent Hypothetical Farms With All Factors Except Water Held Constant

Each farm in the CVP is unique, and actual impacts of higher irrigation rates will vary from those calculated in our budgets. Other types of farms exist in the Central Valley, such as orchards and vineyards, that produce high-value crops. Farms that produce low-value pasture crops such as alfalfa also exist in the Central Valley. While our budgets should not be construed as indicative for all farms, we believe that they provide an indication of the effects of increased irrigation rates on farms with similar characteristics to our simulated farms.

The budgets indicate the profits[1] generated by the five commodities at one point in time, keeping all variables except irrigation rates constant. Therefore, profits were measured without adjusting for possible changes

[1]Farm profits are defined as gross returns minus production costs. Production costs include skilled and unskilled labor costs for all work on the farms but do not include an allowance for farmers' management skills. The budgets reflect profits before reductions for taxes.

in farming practices farmers might make in response to higher irrigation rates, such as changing the type of crops planted, installing new irrigation technologies, and reducing water application rates. These changes could reduce impacts on profits. Profits also do not consider the changes in land values associated with higher irrigation rates. The value of farm land represents the present value of future income that can be generated from the highest and best use of the land. If water rates increase, then present and future farm incomes will decrease, reducing the value of the land to farmers. The amount of the reduction will depend upon changes to farm practices that farmers make to adjust for higher water costs. We did not include these factors because of the difficulty of predicting changes to farming practices in response to higher rates and in determining how land values would change.

Actual impacts on farmers over time will depend upon the individual farmer's circumstances and adjustments made in response to higher irrigation rates. For example, along with decreased land values will be lower land rents for farmers who lease land. Lower rents should offset higher water costs for farmers who lease land, at least in part. However, some farmers could experience a short-term reduction in profit until lower land values are reflected in rental leases. In contrast, those who own land will experience the loss associated with higher water costs by losing some equity in their landholding as a result of decreased values.

Changes in variables other than irrigation rates, such as commodity prices and other production costs, can affect farm profitability as well. Our budgets do not account for changes other than those in irrigation rates. For example, we did not consider reductions in irrigation water deliveries that may occur under the Endangered Species Act, the CVP Improvement Act, or other environmental requirements because these reductions are uncertain; therefore, all conclusions are based on farmers receiving their current contractual delivery levels. It is unknown how the Secretary will implement the CVP Improvement Act's provision mandating 800,000 acre-feet for fish and wildlife. The Bureau has developed rough estimates of possible reductions over the next 5 years to meet environmental requirements and estimates that some farmers may receive 50 to 65 percent of their current contractual supply. However, the Bureau stresses that these figures are very uncertain. We chose not to include changes based on highly uncertain estimates of water supply reductions.

As water deliveries to some farms decrease as a result of environmental requirements, irrigation costs per acre-foot could increase further and

impacts on farmers could be greater. Irrigation costs per acre-foot can increase as water deliveries decrease because the fixed O&M costs apply to fewer acre-feet of water. Furthermore, farmers may increase groundwater pumping to make up for reduced surface supplies. Groundwater costs often are substantially higher than surface water costs.

Table 2.1 is a summary budget of the costs, returns, and profits for each of the five commodities simulated in the budgets. All costs are based on 1990 prices, the most recent year for which complete data are available. The water rate used was the base 1990 cost-of-service rate for the Westlands Water District in the San Joaquin Valley and the Glenn-Colusa Irrigation District in the Sacramento Valley. These are among the largest districts in the Central Valley. Acreage for each crop is based upon the ratio of each crop's production acreage to total production acreage in the district, in addition to other factors affecting production decisions. For example, garlic production is dependent on the availability and acreage requirements of garlic processor contracts.[2] Districts in the Sacramento Valley that receive CVP water through the Tehama-Colusa and Corning Canals have significantly different cropping patterns and CVP water charges from the Glenn-Colusa Irrigation District. Therefore, our Sacramento Valley farm budget does not reflect conditions in these districts.

Table 2.1 shows a profit for all commodities except wheat. Farmers plant wheat as a rotational crop, despite its low value, because it provides an opportunity for weed control and land leveling after harvest and helps control some soil organisms. In addition, farmers may plant wheat as a means for maximizing the benefit of winter rainfall. Tables I.2 through I.6 provide more detailed commodity budgets. (See app. I.)

[2]Garlic is one specialty crop grown in the Westlands Water District—others include onions, melons, and certain vegetables. We used garlic as a proxy for other specialty crops grown in the district.

Table 2.1: Summary Budget of 1990 Costs and Returns Per Acre for Hypothetical Farms

	Costs and returns per acre				
	San Joaquin Valley Farm				Sacramento Valley Farm
	Cotton	Tomatoes	Garlic	Wheat	Rice
Production acreage	500	225	160	75	320
Yield per acre	1360[a] pounds	35.50 tons	9.51 tons	2.87 tons	76 cwt[b]
Gross return	$1,192.85	$1,799.14	$1,428.40	$403.52	$854.24
Production costs:					
Preharvest	$297.76	$521.21	$259.48	$165.38	$225.20
Irrigation[c]	$135.62	$114.51	$142.50	$74.35	$48.71
Harvest	$171.88	$511.87	0.0[d]	$30.00	$163.27
Overhead	$200.30	$140.92	$111.97	$96.94	$49.68
Land rent	$217.92	$217.92	$217.92	$217.92	$211.50
Total production costs	**$1,023.48**	**$1,506.43**	**$731.87**	**$584.59**	**$698.36**
Profit per acre	$169.37	$292.71	$696.53	$(181.07)	$155.88

[a]The yield per acre for cotton includes 1,360 pounds of acala-lint and 2,275 pounds of seed.

[b]Cwt, defined as a hundredweight or 100 pounds, is a standard measure for rice.

[c]The costs for irrigation include both the cost of water and labor to apply the water.

[d]The processor harvests the garlic and incurs the processing costs. The gross return is the price received by the farmer.

CVP Water Is a Relatively Small Production Cost

Our farm budgets revealed that the cost of CVP water is a small portion of total production costs. On the basis of the cost-of-service rate, the cost of CVP water would range from 1 to 6.6 percent of the total production costs for the five selected commodities.[3] The majority of farm production costs are for all other production factors, including land rent, and preharvest and harvest costs such as fertilizer, electricity, labor, and machinery. The significance of water costs varies with each crop. Generally, the greater the percentage of production costs represented by water, the greater the significance of water costs. Profits for farmers growing crops such as wheat, rice, or cotton, which have a relatively low value per acre, will be

[3]The 1990 water rate used for the San Joaquin Valley farm was $35 per acre-foot, which included $19 per acre-foot for the CVP cost-of-service rate and $16 per acre-foot for Westlands Water District charges. Glenn-Colusa Water District charges farmers for water by the acre instead of a cost per acre-foot as customary in other CVP water districts. The district allows 7.8 acre-feet of water per acre to grow rice and in 1990 charged $43.35 per acre. However, only a small portion of the water used is CVP water. We calculated the CVP rate per acre-foot to be $6.73.

influenced more by increases in water costs because water represents a larger portion of the crop's value.[4]

Table 2.2 shows for the five commodities the total production costs, the cost of CVP water per acre, and CVP water as a percentage of total costs.

Table 2.2: Comparison of 1990 CVP Water Costs Per Acre to Total Per-Acre Production Costs of Hypothetical Farms

	Cotton	Tomatoes	Garlic	Wheat	Rice
CVP water costs per acre	$57	$57	$48	$38	$7
Total production costs per acre	$1,023	$1,506	$732	$585	$698
Percent of water costs to total	5.6	3.8	6.6	6.5	1.0

We assumed for the San Joaquin Valley farm that all water used in crop production was delivered from the CVP, not from other sources. However, for the Sacramento Valley farm, we calculated CVP rates only for that portion of water actually received from the CVP. Most rice farmers in the Sacramento Valley held water rights from the Sacramento River before the CVP was built and now receive this water through CVP facilities, but the water is not considered CVP water. Many of these farmers supplement their original supply with CVP water. For example, Glenn-Colusa receives about 720,000 acre-feet of river-rights water and 105,000 acre-feet of CVP water. Any changes in Bureau rates would not affect the cost of owned river-rights water.

Farm Profits Decrease as Water Rates Increase

To demonstrate the impact of higher irrigation rates on farm profits, we compared profits using the cost-of-service rate with profits at higher rates. The higher rates analyzed were: (1) the CVP Improvement Act tiered rates with and without the $6 charge applied, (2) increases in the capital portion of these rates in increments of 25 percent up to 100 percent with the $6 charge applied, and (3) the full-cost rate—which includes interest on the capital costs owed—with and without the $6 charge applied. Under the CVP Improvement Act, the additional charge may or may not be applied and may equal any amount up to $6 per acre-foot. Therefore, adding $6 to each rate illustrates the maximum impact under each scenario. All of these rates are higher than the fixed contract rate that most farmers currently pay for water, but the cost-of-service rate will be the base rate when the contracts are renewed.

[4]A crop's value is equal to the amount of the commodity produced per acre times its selling price—the revenue generated from the crop.

Table 2.3 shows the impact on the total farm profits of our hypothetical farms of increasing the water rates from cost-of-service through full cost.

Table 2.3: Decrease in Farm Profits of Hypothetical Farm Budgets as a Result of Increased Water Cost

	San Joaquin Valley Farm		Sacramento Valley Farm	
Water rates	**Profit on operations**	**Decrease in profit (percent)**	**Profit on operations**	**Decrease in profit (percent)**
Cost-of-service rate	$248,411	[a]	$49,882	[a]
CVP Improvement Act rate (excluding $6/acre-foot charge)	$237,756	4.3	$49,652	0.5
CVP Improvement Act rate (including $6/acre-foot charge)	$221,406	10.9	$47,732	4.3
CVP Improvement Act rate plus 25% increase in capital[b]	$216,801	12.7	$47,563	4.6
CVP Improvement Act rate plus 50% increase in capital[b]	$212,168	14.6	$47,396	5.0
CVP Improvement Act rate plus 75% increase in capital[b]	$207,563	16.4	$47,226	5.3
CVP Improvement Act rate plus 100% increase in capital[b]	$202,958	18.3	$47,060	5.7
Full cost (excluding $6/acre-foot charge)	$177,261	26.8	$48,356	3.1
Full cost with $6/acre-foot charge	$160,911	34.2	$46,436	6.9

[a]Data not applicable.

[b]The increase in capital contributions includes the $6 per acre-foot charge for the Restoration Fund.

Table 2.3 shows the following:

- On the basis of the per-acre returns for each commodity and the acreage in production, we calculated farm profits at $248,411 for the San Joaquin Valley farm and $49,882 for the Sacramento Valley farm.
- When CVP Improvement Act rates are applied, profits decreased by about 4 and 11 percent for the San Joaquin Valley farm to $237,756 and $221,406, respectively, depending on whether the additional $6 per acre-foot charge is applied. Profits declined less than 1 percent for the Sacramento Valley farm when the $6 charge is not applied because the act's tiered pricing requirements increased CVP rates by less than $1, and only a small portion of Sacramento Valley farm water is CVP water. If the tiered pricing is not applied, the profit would remain at its base level. This will occur under the act for crops that provide habitat for waterfowl in their fields, such as rice.[5] When the maximum $6 charge is applied, profits decreased by 4.3 percent to $47,732.

[5]The CVP Improvement Act waives application of tiered pricing for any project water delivered to produce a crop that the Secretary of the Interior determines will provide significant and quantifiable habitat values for waterfowl in fields where the water is used and the crops are produced.

- When water rates are increased beyond the CVP Improvement Act requirements to repay the capital costs sooner, profits decreased more substantially. At a 100-percent increase in capital costs, profits decreased from $221,406 to $202,958 for the San Joaquin Valley farm—an additional decrease of 7.4 percent. Profits decreased from $47,732 to $47,060 for the Sacramento Valley farm—an additional decrease of 1.4 percent. These increased rates include the maximum $6 charge. Decreases in profits from higher capital rates would be less without this charge.
- When the rates are increased to reflect the full cost for water, profits declined to $177,261, or 27 percent less than the cost-of-service rate, for the San Joaquin Valley farm. Profits declined to $48,356, or 3.1 percent less for the Sacramento Valley farm. This decrease in profit at full cost is less than the decrease at previous rates that include the maximum $6 charge because the difference between the full-cost rate and the cost-of-service rate for Glenn-Colusa water is between $4 and $5 dollars. Therefore, including the additional $6 charge in the other lower rates adds to water costs substantially.
- When the full-cost rate and the maximum $6 per acre-foot charge were considered, profits declined for the San Joaquin Valley farm and the Sacramento Valley farm to $160,911 and $46,436, respectively. These profits are 34 and 7 percent lower than profits at the cost-of-service rate.

We assumed that crop prices will not increase in response to higher water costs and that CVP farmers are forced to absorb the increased costs. This is most likely for commodities for which the farmers have a relatively small share of the market, such as cotton and rice. For these crops, the farmers cannot pass along the cost increases to the consumers in the form of higher commodity prices because others in the market can maintain lower prices. Any crop price increases would reduce the effect of increased water rates on farmer profits.

Under each scenario, although profits declined, the production of all commodities remained profitable at full cost except wheat. Even before raising the cost of water, however, wheat did not generate a profit. The greatest impact on farm profits (34 percent) occurred when irrigation rates were increased from the cost-of-service to full-cost plus the $6 charge for the San Joaquin Valley farm. Impacts on profits were much less (7 percent) for the Sacramento Valley farm because only a portion of the water delivered from the CVP is subject to rate increases. In general, because the capital portion of the irrigation rate in both the San Joaquin and Sacramento Valleys is usually the smallest component of the rate, large increases in this portion of the rate will not increase the overall rates

paid by irrigators significantly. For example, the CVP Improvement Act rate we calculated for Westlands Water District was $38.95[6] per acre-foot. The capital repayment portion was $6.77. By doubling the capital portion—an increase of 100 percent—the overall rate increased to $45.72 per acre-foot, an overall increase of 17 percent.

Drought Evidence Suggests That Central Valley Agriculture Will Continue With Higher Irrigation Rates

As production costs—such as water—increase and farm profits or land values decrease, farm viability can be affected. Other production costs, such as fertilizer or labor costs, may also vary and affect farm viability. Some farmers with low profits or with high debt and reduced equity may not be able to maintain viable businesses if water costs increase. For farmers with low profits, a small increase in costs could cause the farm to become unprofitable. Similarly, farmers with high debt who experience reduced equity as a result of higher irrigation rates may be unable to cover their operating costs plus debt payments, as reduced equity reduces their borrowing capacity for loans. Local economies that rely on income from these sources can be harmed also, as property tax revenues and incomes decline.

However, data on California farms during the 6-year drought from 1987 through 1992 indicate that the effect of increased irrigation rates on California's overall farm economy is not likely to be severe. These data indicate that the effect of water price increases on farm viability is likely to be small relative to other factors. For example, during the drought farmers encountered water shortages and higher costs for water, but losses on farm loans during the drought declined from levels in the middle 1980s.

Farm water costs were greater during the drought than in prior years for several reasons. Because of water shortages, the Bureau cut water deliveries to some of its agricultural districts to 25 percent of normal in both 1991 and 1992. The water farmers received was more expensive per acre-foot delivered because the fixed O&M costs applied to fewer acre-feet of water. For example, the Westlands Water District's 1989-90 rate was $30.45 per acre-foot and increased to $35.04 per acre-foot for 1990-91. Furthermore, farmers increased groundwater pumping during the drought to make up for reduced surface supplies. Groundwater costs, which include the cost of drilling a well, installing a pump, and paying for

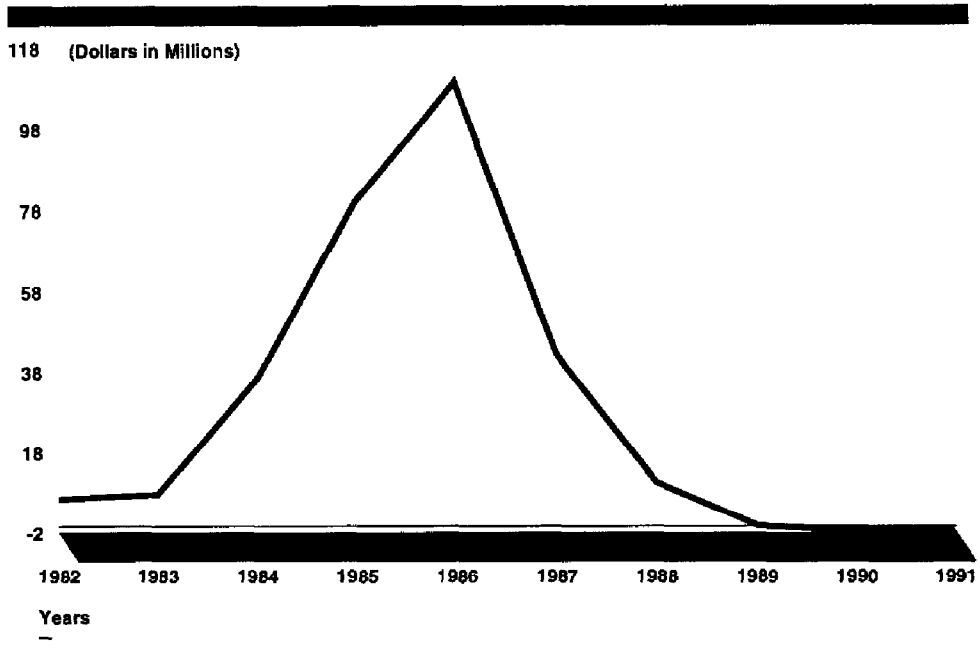
[6]The rate is based on 1990-91 rates supplied by the Westlands Water District and increased by the tiered pricing provisions of the CVP Improvement Act. The $38.95 rate consists of $6.77 in capital costs owed, $3.91 for tiered pricing under the CVP Improvement Act, $12.26 for Bureau O&M, and $16.01 for irrigation district fees.

electricity to pump the water, often are substantially higher than surface water costs.

Despite higher water costs, information from agricultural lenders indicates that California's farm economy remained stronger during the drought than during the mid-1980s, a period of relatively stable water costs but declining farm sale values. According to a report by the Bank of America, a major agricultural lender in California, higher water costs caused by the drought have impacted farm profits and may be significant for individual farmers. However, the strong farm economy during the drought indicates that higher costs have not affected the farm economy overall as much as other key economic variables, such as interest rates, the export market, and the value of the U.S. dollar. These factors contributed to the decline of the farm economy in the mid-1980s.

Similarly, data from agricultural lenders such as Western Farm Credit Bank suggest that other factors have affected the financial stability of farmers more than higher water costs. Data on loan losses for member lending institutions within the Central Valley for the period 1982 through 1991 revealed that Western Farm Credit suffered severe loan losses during the middle 1980s, a period of relatively stable water prices. Figure 2.1 illustrates that this trend was reversed during the drought period of 1988 through 1991, even though the cost of water increased. Other factors appear to have affected farm profitability more substantially than water costs.

Figure 2.1: Western Farm Credit Loan Loss Data for 1981-92



While some farmers may not be able to maintain viable farms, most land will continue to be farmed. As irrigation rates increase, the value of the land declines to reflect the income it can now generate. Some farmers may not be able to maintain their farms, but other farmers can purchase or lease this land at its reduced value. With lower land values, land production costs are lower and farming can be profitable. This is illustrated by the fact that farmers currently pay a wide range of irrigation rates in the Central Valley, yet continue to remain viable.

In the past year, land values in the Central Valley have been declining for a variety of reasons, including uncertainty over water deliveries caused by the drought and future environmental restrictions. Increased irrigation rates would cause these values to decline further. In addition, as water deliveries to CVP farmers are reduced because of environmental requirements, land values will decrease further and more land will go out of production than would by rate increases alone. However, marginal land that produces lower-value crops is the land most likely to be taken out of production and the retirement of marginal land will have a less significant impact on the farm economy than retirement of more productive land.

Increasing Capital Portion of CVP Irrigation Rates Can Enhance Federal Revenues

The capital portion of the irrigation rate is used to repay the estimated $1 billion in capital costs that are allocated to be repaid by users of CVP irrigation facilities. Under a 1986 statutory requirement, the Secretary is to adjust rates if the rate in effect is not adequate to recover costs owed by the year 2030. By increasing the capital portion of the irrigation rate, we accelerated the repayment of the $1 billion in capital costs owed.

This acceleration increases the present value of the repayment due to the time value of money. The present value of the $1 billion in capital costs owed is about $200 million[7] if paid under the existing rate schedule between now and 2030. Under this rate schedule, a portion of the total $1 billion costs owed is paid each year, without considering inflation or interest forgone to the government.

We calculated the present value of the repayment at higher irrigation rates and compared it with the present value of the repayment at the current rate, assuming that current CVP delivery levels continue. We did not adjust the operation and maintenance portion of the rates because these will be adjusted annually as costs fluctuate. Doubling the capital portion of 1990 irrigation rates speeds up recovery of capital costs owed by 12 years and increases the present value of the repayment by $114 million. The results of our analysis are shown in table 2.4.

Table 2.4: Enhanced Federal Revenues and Earlier Repayment Period If Capital Portion of Water Rates Is Increased

Dollars in millions

Percentage increase in capital portion of rates	Enhanced revenues (present value)	Years of repayment saved
25	$35	4
50	$65	8
75	$91	10
100	$114	12

If irrigators paid the full-cost rate, which includes interest on the capital costs owed, then the present value of the amount repaid would be the full amount allocated to irrigation, about $1 billion, or $800 million more than would have been repaid without interest. The impacts on farmers' profits and land values would be greater at this rate than at smaller price increases. An increase in irrigation rates to full cost would result in a 34-percent decline in profit for our hypothetical San Joaquin Valley farm, if

[7]We calculated the present value of the approximately $1 billion over 37 years at an estimated Treasury bond rate of 8 percent. Present value is calculated in 1992 dollars.

the $6 surcharge is included, and a 27-percent decline without the surcharge.

Legislation to Increase Irrigation Rates

As present legislation only requires that the Secretary recover costs by the year 2030, a legislative change would be needed to require the Secretary to recover such costs at an earlier date. However, the 1986 statute does not preclude the Secretary from collecting capital costs at an earlier date. In addition, a fundamental change in reclamation law would be needed to generally charge interest on irrigation capital costs. If such changes were to apply to contracts already renewed, it might give rise to irrigators' claims that the United States breached its contracts and may subject the federal government to claims against it for damages. Moreover, the more contracts that are renewed, the more difficult it may become to effect change because terms in already renewed contracts may be viewed as the norm.

Farmers Can Mitigate the Impacts of Increased Water Rates

Studies completed by economists at California universities and lending institutions and our discussions with farmers, agricultural economists, district officials, and others indicate that increased irrigation rates give farmers incentive to change their farm management practices and reduce water use. Farmers may reduce water use by changing irrigation practices and technologies and changing crops grown.

Farmers May Increase Irrigation Efficiency

Some farmers may increase irrigation efficiency and reduce water use through improved irrigation practices and technologies. Farmers change their irrigation practices or install more efficient technologies if the benefits from increased efficiency, such as lower water costs and higher yields, are at least equal to the costs of the improvements.

Increased Irrigation Efficiency and Decreased Water Use Can Be Achieved by Improved Practices and Technologies

Increased irrigation efficiency can be realized through improved irrigation practices or technologies. Irrigation efficiency is defined as the percentage of irrigation water applied to a field that is beneficially used by the plants. The greater the efficiency, the less water is lost to runoff, to evaporation, or to the ground below a level usable by the crop. With higher efficiency, farmers use less water to produce a crop and, therefore, pay for less water.

Most CVP farmers use less efficient gravity-flow surface irrigation systems rather than more efficient pressurized systems. Surface irrigation relies upon on-farm canals or ditches to distribute water through channels. A channel may be a narrow furrow,[1] such as those used for row crops or as wide as an entire field, such as those used for rice. Farmers can increase efficiency and save water by adopting new management practices for surface irrigation systems. The water savings achieved by improved surface irrigation practices varies depending on the soil type and type of crops grown on a given farm. These practices include, among others,

- shortening the furrow lengths for row crops to reduce losses to the soil,
- replacing siphon tubes and ditches with pipes to control the release of water into furrows,
- using specialized equipment to schedule irrigation based on soil moisture,
- leveling fields to control runoff, and
- re-using runoff water after it reaches the end of the field.

[1]Furrow irrigation is used in relatively level basins and consists of shallow channels formed between rows of crops. The furrows generally run parallel to the maximum field slope. Water from a ditch or pipe enters the upper end of the furrows and runs the length of the row. When water reaches the lower end of the row, some will run off the field if it is not blocked.

Pressurized systems such as sprinkler or drip irrigation are generally more efficient than surface irrigation systems and generally save more water because they allow the farmers to irrigate more frequently, improve irrigation uniformity, and reduce water losses to deep percolation and runoff. The systems may also improve crop yields.

Table 3.1 shows water application efficiencies for various types of irrigation systems.

Table 3.1: Water Application Efficiencies of Various Irrigation Systems

Type of irrigation system	Attainable efficiencies
Furrow	60 - 75%
Sprinkler	65 - 90%
Drip	75 - 90%

Source: California State University at Fresno.

Table 3.2 compares the water savings that may be achieved by changing irrigation technologies from conventional furrow irrigation. The data were generated by research done in the San Joaquin Valley[2] for cotton production.

Table 3.2: Comparison of Water Requirements for Growing Cotton With Various Irrigation Practices and Technologies

Type of irrigation practice or technology	Water used per acre (acre-feet)	Water saving over furrow irrigation as a percent
Furrow	3.69 - 4.17	0
Furrow with shortened runs	3.18 - 3.57	13.8 - 14.4
Sprinkler	2.79 - 3.13	24.4 - 24.9
Drip	2.41 - 2.63	34.7 - 36.9

Increased Cost of Water Must Justify the Cost of Efficient Irrigation Systems

Efficient irrigation systems can be costly. Pressurized systems in particular are expensive to install and maintain and generally require electrical energy to operate pumps to maintain system pressure. For example, while the cost to install shortened furrows is about $17 per acre with no additional maintenance costs, the costs to adopt a movable sprinkler irrigation system range from $100 to $500 per acre. Similarly, the costs to adopt drip irrigation may range from $250 to over $1,500 per acre.

[2]Margriet Caswell, Erik Lichtenberg, and David Zilberman. "The Effects of Pricing Policies on Water Conservation and Drainage," American Journal of Agricultural Economics (Nov. 1990).

Irrigation experts from universities and districts agree that farmers will not incur the cost of purchasing, installing, and maintaining more efficient irrigation systems unless associated costs are recovered through the benefits and cost savings resulting from greater efficiency. Farmers can recover costs if the improved irrigation systems use less water, improve yields, or reduce other costs such as drainage management or irrigation labor. Whether or not it is profitable for a farmer to change to a more efficient irrigation system in response to higher water costs depends on a number of site-specific variables affecting farm profitability, such as type of soil, topography, microclimate, and type of crops. Therefore, it is difficult to predict if and how many farmers will switch to various irrigation systems.

According to a report presented to the California Energy Commission in 1992,[3] farmers did switch to more efficient irrigation systems during California's recent drought. From 1989 through 1991 farmers responded to the California drought by increased groundwater pumping, which provided irrigation water generally at a higher cost than CVP water. Concurrently, farmers improved their surface irrigation practices or installed pressurized systems. Results of the survey showed that farmers

- shortened furrow lengths on about 13,000 acres,
- installed new pressurized sprinkler irrigation systems on 59,050 acres, and
- introduced new pressurized drip irrigation systems on 21,090 acres.

The study concluded that farmers chose the technologies that were more water efficient.

The Arvin-Edison Water Storage District is an example of a district that has expensive CVP water and efficient irrigation systems. In 1992, the cost of Arvin-Edison's CVP water ranged from $47 to $129 per acre-foot as compared with the Central California Irrigation District where the average cost of water was about $8 per acre-foot. According to researchers at Stanford University, the Arvin-Edison distribution system contains lined canals, ditches, and pipelines that reduce water loss due to seepage or

[3]Economic Implications of Increasing Electrical Rates to Agricultural Class Customers: Water Scarcity, Technology Substitutions, Farm Income, and Environmental Pollution in a Stylized Region in the San Joaquin Valley California, Ariel Dinar, Department of Agricultural Economics, University of California at Davis (1992).

evaporation.[4] Furthermore, farmers make extensive use of sprinkler and drip irrigation systems for vegetables, orchards, and vineyards.

Conversely, according to the same study, the Central California Irrigation District, which has cheaper irrigation water than Arvin-Edison, uses less efficient systems. The distribution system consists of unlined canals or ditches, and the predominant irrigation methods are furrow or flood. While very little use of drip irrigation was reported, farmers are starting to improve their irrigation practices by using shorter furrow runs.

Farmers May Change Crops Grown in Response to Higher Irrigation Rates

In general, shifting to less water-consuming crops is one option that some farmers may be able to use to reduce the impact of higher water costs on profits. Economic theory indicates that if all factors affecting farm profitability remain constant, but water rates increase, farmers may be able to minimize their reduction in profits by switching production to less water-consuming crops. While not all farmers may switch, overall, changes to less water-consuming crops would be expected to occur in response to higher irrigation rates, if other factors remain constant. Economic theory also indicates that some farmers may respond to higher water costs by fallowing some of their less productive land. As water costs increase, it may not be possible to cover the costs of operations on less productive land. Since lower-value crops tend to be grown on less productive land, fallowing such land would reduce the acreage devoted to low-value crops.

Specifically, in the CVP, our discussions with farmers, agricultural economists, and agricultural extension agents, and our review of empirical economic studies indicate that farmers in the CVP might shift to high-value crops that consume less water in response to higher water costs. Many high-value crops also are less water-intensive. Some farmers may fallow some land in response to higher water costs. Water-intensive crops would decline in acreage in response to higher water costs, with the greatest decrease occurring in low-value, water-intensive crops.

Studies show that during California's recent drought, which raised irrigation rates, farmers increased production of high-value crops and decreased production of low-value crops. Yet many factors other than irrigation rates also influence the mix of crops farmers grow, and some of these factors also changed during the drought, such as commodity prices.

[4]An Economic Analysis of Water Availability in California, Central Valley Agriculture Center for Economic Policy Research, Stanford University. (Feb. 14, 1992). Sandra O. Archibald, Ph.D., Principal Investigator; Thomas K. Kuhnle, M.A.; Robin Marsh, Ph.D.; Mary Renwick, M.A.; Barton Thompson, Jr., M.B.A., J.D.

According to a 1992 study conducted by Stanford University,[5] farmers in the CVP's Westlands Water District significantly increased production of some high-value crops, such as tomatoes and garlic, since 1988, the second year of the drought. According to Westlands Water District's crop reports, an increase in high-value crop acreage has occurred since 1978, but this trend accelerated during the drought. Conversely, cotton—lower in value than tomatoes and garlic—showed a 28-percent decline from 1988 to 1991, and wheat—a relatively low-value crop—has decreased in acreage during the same period by 45 percent. Cotton requires more water than garlic, and approximately the same amount as tomatoes, but wheat is less water-intensive than these crops. Farmers also improved their irrigation efficiency in addition to shifting crops, and factors other than irrigation rates may have influenced crop choice during the drought.

Factors such as changes in commodity prices and the opening of new markets can have a greater impact on crop choice than irrigation costs. For example, a farmer generally will not plant tomatoes without a marketing agreement with a tomato processor because of the risk of not being able to sell such a perishable crop. Therefore, it is difficult to predict when and how many farmers will switch crops and to which crops they will switch.

Furthermore, some farmers will not be able to change the type of crops they grow in response to higher irrigation rates. For example, about 300,000 acres in the Sacramento Valley are only suitable for growing rice, and rice farmers on this land cannot grow other crops profitably. The soil consists of thick clay, which does not allow water to penetrate. Such land is excellent for growing rice, which requires flooded fields, but will not support other crops. The farmers we interviewed indicated that they cannot profitably grow other commodities on their land. Similar situations exist in parts of the San Joaquin Valley where soil salinity is so great that only salt-tolerant crops such as cotton can be grown. This land usually has high salinity and poor drainage, which keeps salty water in the root zone, causing some crops to grow more slowly, while others die.

Changes in Farming Practices Justified at Full Cost for Hypothetical Farm

We used the farm budget for the San Joaquin Valley farm to demonstrate possible changes in farming practices farmers could make to offset the impact of increased water costs. In general, farmers will make changes that will minimize losses caused by higher water rates and, therefore, result in the most profit possible. On our hypothetical farm, one change in

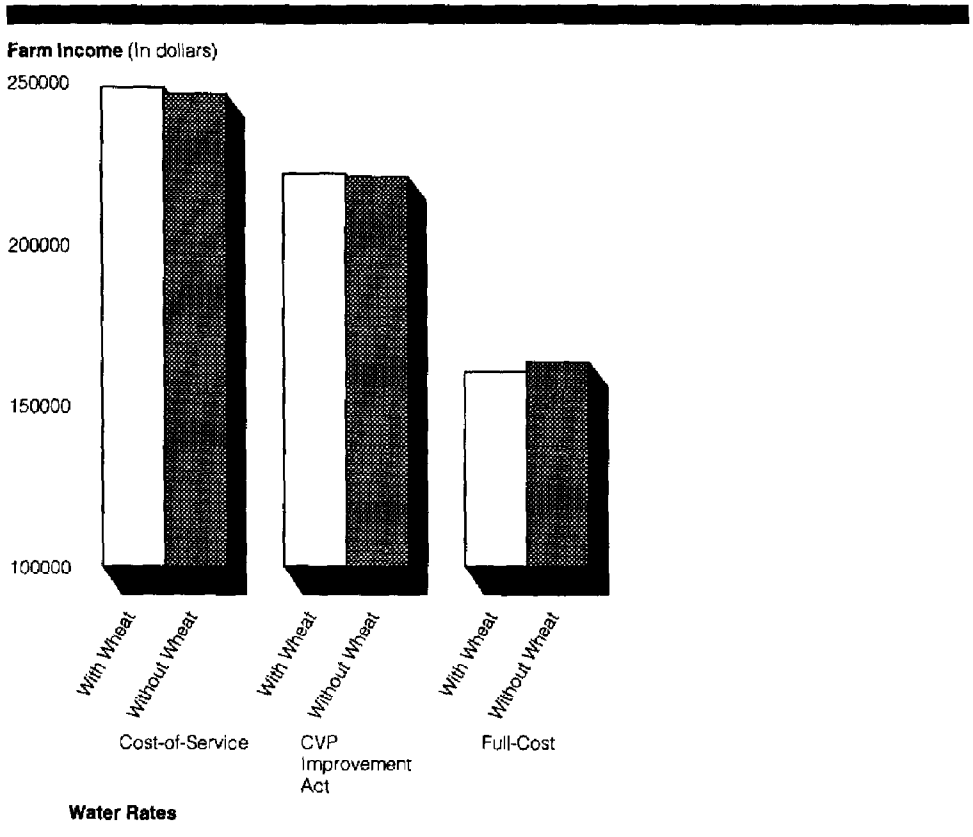
[5]Ibid.

farm practices minimized losses when water rates reached full cost. Other changes might be advantageous at different price increases for other farms because of the site-specific variables affecting farm profitability.

We considered eliminating wheat production and improving irrigation efficiency by shortening furrow lengths to reduce losses caused by higher water rates. We also considered adopting sprinkler or drip irrigation systems but found that the cost to install and maintain drip and sprinkler improvements exceeded the saving resulting from reduced water use at all price increases. Such systems would have to result in higher crop yields to justify the expense. We did not determine possible yield increases resulting from installing these systems.

We found that at full cost with the $6 per acre-foot charge, it was more profitable for the farmer to stop producing wheat than to produce it. Shortening furrows did not provide any additional benefit. Wheat was not profitable in our budgets at any of the water rates used but is planted by farmers as a rotational crop. At most water rates, growing wheat allows the farmer to generate enough revenue to cover the operating costs for growing the wheat and some land rental costs. At full cost with the $6 charge, wheat revenues were not great enough to cover all operating costs, and it was more profitable not to produce wheat. Some Central Valley farmers used this strategy during the drought and fallowed land used to grow crops such as wheat when surface water was unavailable and they had to rely on expensive groundwater. Eventually, farmers who fallow wheat would have to realize the benefits of planting wheat some other way. We did not include that additional cost in our calculations. Figure 3.1 shows the farm profits for our hypothetical San Joaquin farm at various water rates.

Figure 3.1: Increased Water Rates Impact on Income With and Without Wheat Production



There may be other alternatives that could be taken on our hypothetical farm to reduce the cost of fallowed land, such as planting another crop that would cover the land rental costs and the operating costs of planting, rather than fallowing former wheat acreage. Furthermore, we did not consider possible profits farmers might make from transferring the right to use conserved water to those who value it more highly. The CVP Improvement Act allows the transfer of CVP water to any water user in California for any purpose recognized as beneficial, and sellers can retain profit from transfers. This option may help mitigate price increases further.

Conclusions and Matters for Congressional Consideration

Conclusions

Always a scarce resource, water is becoming increasingly valuable in California as the urban population continues to grow and environmental awareness about fish and wildlife needs increases. Raising irrigation rates can help meet new demand by providing incentives for more efficient water use. Higher rates encourage farmers to conserve water, thereby reducing irrigation drainage with subsequent reductions in environmental damage to water, soil, and wildlife. Conservation would also make water available for other uses such as municipal and industrial use or fish and wildlife.

Clearly, much has changed in the West since the subsidies were initially established in the Reclamation Act of 1902. Estimates of the current cost of federal water subsidies in the western United States are substantial, with the Bureau of Reclamation placing the cost at $2.2 billion in 1986. An important factor in determining whether subsidies are still warranted is the question of whether the irrigators could pay more of the cost of the water delivered.

On the basis of our farm budgets, repayment analysis, literature review, and discussions with agricultural economists, cooperative extension officials, irrigation experts, and farmers, we found that increased CVP irrigation rates would have positive impacts on the U.S. Treasury and water use efficiency and negative impacts on irrigators. The benefits to deficit reduction, the environment, and other California water users resulting from higher rates must be balanced against the adverse impacts on farmers' profits.

Increasing irrigation rates beyond the levels mandated in the CVP Improvement Act would enhance federal revenues and contribute to deficit reduction. Charging the irrigators the full cost of the water would result in an $800 million increase in the present value of the repayment of federal revenues. Smaller increases, as little as a 25-percent increase in the capital portion of the rate, for example, would increase the present value of the repayment by $35 million.

Increasing irrigation rates will negatively affect farmers, however. Our farm budgets, designed to represent farm operations for major commodities grown in the Central Valley, showed how profits for two hypothetical farms decline as irrigation rates increase up to full cost. Despite this decline, both hypothetical farms remain profitable, even without considering changes in farming practices to reduce water use or decreased land rental costs resulting from higher rates. Impacts on

individual farmers will vary. Each farm in the CVP is unique, not every farm has the same profit margins, and decreases in profit from increased irrigation costs will vary from those calculated for our hypothetical farms. Some farmers with low profits or with high debt and reduced equity may not be able to maintain viable farms.

While some farmers may be hard hit, studies suggest that the effect of irrigation rate increases on California's farm economy is not likely to be severe. In the long run, most land will continue to be farmed as land values and prices adjust to reflect higher water costs. This is seen in the different water rates farmers currently pay in the Central Valley, while farming profitably. Moreover, data from California's recent drought indicate that farmers have encountered water shortages and higher water costs with little impact on farm loan default rates.

Furthermore, farmers who conserve water can benefit by reducing their water costs and transferring use of conserved water to others. Under the CVP Improvement Act, individuals or districts receiving CVP water can transfer water to any other California water user or water agency for any beneficial use recognized by California state law. This will allow farmers to transfer water to other agricultural users, municipal and industrial users, and natural resource agencies or nonprofit conservation groups who desire additional supplies, at a profit. We are analyzing issues associated with the development of water markets in the 17 western states and will report these findings separately.

A legislative change would be needed to require the Secretary to charge interest on capital costs or recover these costs before 2030; although the 1986 statute does not preclude the Secretary from collecting capital costs at an earlier date. If reclamation law were changed and the change were to apply to contracts already renewed as well as to those coming up for renewal, it might give rise to irrigators' claims that the United States breached its contracts and could subject the government to claims against it for damages. Therefore, decisions regarding higher irrigation rates should be made before the Bureau renews additional long-term contracts. The Bureau will be able to continue its long-term contract renewal once environmental impact statements required under the CVP Improvement Act are completed.

Matters for Congressional Consideration

Whether irrigation rates should be increased beyond current requirements is a policy decision for the Congress. If the Congress decides to pursue this issue of increasing irrigation rates, the Congress may wish to consider in its deliberations such factors as: (1) the extent to which farmers can absorb increased irrigation costs, (2) the potential adverse impacts on farmers and local economies, (3) the increased revenues to the U.S. Treasury that could be generated, (4) the ability of farmers to mitigate the effects of the price increases, (5) the environmental and water supply benefits resulting from higher irrigation rates, (6) the impacts of future water supply reductions, and (7) whether the increases should apply to already renewed contracts. Other options, such as using water markets in which rights to use water are bought and sold, may achieve similar benefits but would impact farmers differently.

Agency and Other Comments

In order to obtain the views of affected groups, we requested and received comments on a draft of this report from the Bureau of Reclamation and the Central Valley Project Water Association, which represents water and irrigation districts that contract for water from the Central Valley Project. The Association asked us to include comments provided by the Westlands Water District.

The Bureau said that the report provides a useful and credible analysis of some of the potential financial effects of changes in the price of CVP irrigation water. The Bureau indicated that, in general, it accepts the report as corroboration of several of the key assumptions embodied in the 1992 CVP Improvement Act.

In general, the Association and Westlands said that our analysis and conclusions are flawed primarily because (1) the budgets are not based on water delivery levels provided in 1990 during the drought and do not consider future reductions in supply resulting from the CVP Improvement Act and other environmental requirements, (2) we did not examine impacts on local economies resulting from increased water rates, and (3) the hypothetical farms are not representative of all farms in the Central Valley.

We recognize that drought and future water supply reductions may impact California farmers and local agricultural communities. However, we were asked to examine the impact of higher irrigation rates on farmers' profits; not the impact of drought and reduced water supplies, or the effects on local economies. Moreover, if budgets had been based on water delivery

levels provided under drought conditions, we would have modeled profits for an atypical year, and the results would reflect the impacts of rate increases under drought conditions, rather than under normal conditions. In addition, future reductions in deliveries to CVP farmers as a result of the CVP Improvement Act and the Endangered Species Act are unknown. Because the Bureau indicated that its estimates of possible water supply reductions over the next 5 years were very rough, we did not use these data. The report recognizes that impacts on farmers could be greater if changes in water supply also occurred. The impacts of reductions in water supply from drought or environmental requirements are significant issues, and we have added the impact of water supply reductions to the factors to be considered by the Congress. We also recognize that there may be impacts to local economies resulting from changes in water rates and have added local economic impacts to the factors to be considered by the Congress. However, the absence of an analysis on these issues does not invalidate the analysis of the impacts of higher rates on farmers' profits.

The farm budgets were designed to represent farm operations for the major commodities grown in two major regions of the Central Valley. The budgets were not intended to be representative of all farms in the Central Valley. We believe that the budgets provide an indication of the effects of increased irrigation rates on farms with similar characteristics to the hypothetical farms. Budget information was combined with data on the agricultural economy during the drought and discussions with irrigation specialists, farmers, cooperative extension officials, and economists to discuss the potential impact of higher irrigation rates. These data indicate that other factors have greater impact on the agricultural economy than irrigation rates and that some farmers may change farming practices to mitigate their reductions in profit. Whether or not all farms in the Central Valley are represented does not affect the report's conclusions that increased irrigation rates will negatively affect farmers' profits and positively affect the U.S. Treasury and water use efficiency.

The Association and Westlands Water District also provided technical corrections, and we have made changes in response to these comments where appropriate. The full text of the comments we received and our responses are presented in appendixes II through IV.

Data Sources and Methodology for Farm Budgets

To determine the impact of increased Central Valley Project (CVP) irrigation costs on farm profitability, we developed farm budgets designed to represent farm operations for the major commodities grown in two regions of the Central Valley: the San Joaquin Valley and the Sacramento Valley. The University of California at Davis, a leading university in California agricultural research, developed the computer program we used to create the farm budgets. The program, Budget Planner, assists growers in preparing budgets for individual crops and combinations of crops. The program calculates costs, break-even points, and net returns for varying crop yields and selling prices. The program allocates costs for machinery, labor, and materials to individual crops and operations. The program also provides summaries of equipment, investment, and overhead costs.

The Budget Planner estimates the financial effects of changes in farming practices and economic climates. For example, by developing budgets for hypothetical situations, the user can compare the costs or the net returns that might be expected with different cropping patterns, types of fertilizer, or equipment complements. The program can help growers anticipate the effects of changes in interest rates, selling prices, yields, and many other cost factors.

We obtained information from officials with the University of California Cooperative Extension Service, the Westlands Water District and Glenn-Colusa Irrigation District, and the Department of Agriculture's Agricultural Stabilization and Conservation Service (ASCS). We interviewed farmers recommended to us by the Cooperative Extension Service and the Director of Irrigation Training and Research, Agricultural Training Department, at California Polytechnic State University at San Luis Obispo, as knowledgeable about various farming practices and alternatives. Table I.1 provides a summary of the costs and returns per acre we calculated from our farm budgets.

Table I.1: 1990 Costs and Returns Per Acre of Hypothetical Farms

	Costs and returns per acre				
	San Joaquin Valley Farm				Sacramento Valley Farm
	Cotton	Tomatoes	Garlic	Wheat	Rice
Production acreage	500	225	160	75	320
Yield per acre	1,360[a] pounds	35.50 tons	9.51 tons	2.87 tons	76 cwt[b]
Water usage per acre (in acre-feet)	3.0	3.0	2.5	2.0	7.8
Gross returns	$1,192.85	$1,799.14	$1,428.40	$403.52	$854.24
Production costs					
Preharvest	297.76	521.21	259.48	165.38	225.20
Irrigation[c]	135.62	114.51	142.50	74.35	48.71
Harvest	171.88	511.87	0[d]	30.00	163.27
Overhead	200.30	140.92	111.97	96.94	49.68
Land rent	217.92	217.92	217.92	217.92	211.50
Total costs	**$1,023.48**	**$1,506.43**	**$731.87**	**$584.59**	**$698.36**
Net returns above Total Costs	$169.37	$292.71	$696.53	($181.07)	$155.88

[a]The yield per acre for cotton includes 1,360 pounds of acala-lint and 2,275 pounds of seed.

[b]Cwt is defined as a hundredweight or 100 pounds.

[c]The cost of irrigation includes water at the cost-of-service rate and labor to apply the water.

[d]The processor harvests the garlic. The farmer does not incur harvest costs.

Selection Criteria and Data Sources

We created farm budgets for two hypothetical farms: one from the San Joaquin Valley and the other from the Sacramento Valley. Commodities grown and farming practices differ greatly between the San Joaquin and Sacramento Valleys primarily because of different soil conditions. We used data from the Westlands Water District in the San Joaquin Valley and the Glenn-Colusa Irrigation District in the Sacramento Valley for some variables. The Westlands Water District is the largest user of CVP water, and the Glenn-Colusa Irrigation District is one of the largest users of CVP irrigation water in the northern part of the Central Valley.

Crop Acreage

We based crop selection and acreage on reclamation law, 1990 crop reports from Westlands Water District and Glenn and Colusa counties, ASCS program policies, and other factors affecting production decisions. For example, to comply with the provisions of the Reclamation Reform

Act of 1982, farmers can only receive subsidized water on 960 planted acres. Therefore, the total size of our farms did not exceed 960 planted acres.

The San Joaquin Valley farm consisted of 960 planted acres and 86 acres of fallow land. We selected those crops listed in the Westlands crop report with the highest production acreage—cotton, wheat, processed tomatoes, and processed garlic operations. Garlic is one of several specialty crops grown in the Westlands Water District—others include onions, melons, and certain vegetables. We used garlic as a proxy for other specialty crops. With the exception of garlic, the ratio of each crop's production acreage to the total production acreage was representative of those ratios for Westlands Water District.

Factors other than crop ratios also affected crop acreage. For example, processed garlic production is dependent on the availability of garlic processor contracts. According to a garlic processor we interviewed, the acreage required to obtain a contract is 160 acres. Because of the 160-acre requirement, the ratio of the budget's garlic acreage to total production acreage was higher than the ratio in the Westlands Water District.

Because cotton was the predominant crop in the Westlands Water District, cotton was the primary crop used in our budget. However, cotton acreage also was based on the ASCS Cotton Support Program. ASCS assists in the stabilization, support, and protection of farm income and prices for selected commodities.[1] Based on a yield of 1,360 pounds per acre, 500 production acres and 75 fallow acres are needed to receive the maximum support payment. We used the acreage necessary to receive the maximum support payment.

Wheat and tomato acreage were based primarily on production acreage in the Westlands Water District. Tomato production totaled 225 acres. Wheat is part of the ASCS Support Program and consisted of 75 production acres and 11 fallow acres. This acreage brought the total production acreage to 960—the maximum amount that can receive subsidized water. Farmers told us that in some instances it is not cost-efficient to grow wheat, but farmers plant it as a rotational crop, despite its low value, because it provides an opportunity for weed control and land leveling after harvest and helps control some soil organisms.

[1]The ASCS Support Programs require that farmers leave fallow or not farm a specified amount of land to receive support payments.

To determine the crops used in the Sacramento Valley, we obtained crop production reports for Glenn and Colusa Counties. Their primary crop was rice. Farmers we interviewed in the Glenn-Colusa Irrigation District said that most rice farmers can only grow rice due to the composition of their soils. Therefore, our crop budget was for rice production.

The acreage allocated to rice was based on ASCS' Rice Support Program. According to ASCS, to obtain the maximum support payment, a husband and wife together need approximately 320 production acres and 56 fallow acres. The fallow acreage is based on a 5-year average of the crop's acreage reduction requirements—which vary from year to year—as specified in the Support Program. The production acreage and support payment are based on a yield of 7,600 pounds per acre, the average yield for Colusa County. We based our farm acreage on the amount necessary to receive the maximum support payment.

Water Rates

The water rates used in both budgets are subsidized rates based on the Bureau's 1990 cost-of-service water rate and the CVP Improvement Act rate. The cost-of-service rate would recover CVP capital costs by 2030, operation and maintenance (O&M), and any past O&M deficit accrued with interest. The CVP Improvement Act rate consists of tiered pricing with the first 80 percent of water deliveries charged at the cost-of-service rate, the next 10 percent at the difference between the cost-of-service rate and full cost, and the last 10 percent charged at the full-cost rate. The full-cost rate includes interest on the capital costs owed.

The CVP Improvement Act allows the Secretary of the Interior to charge up to $6 per acre-foot in addition to the tiered pricing to enhance the CVP Restoration Fund. We added this cost for additional analysis. We included the water districts' distribution and O&M costs in all irrigation rates.

In our budget for the San Joaquin Valley farm, we used the 1990 Westlands Water District's cost-of-service rate as the base rate and adjusted it to reflect tiered pricing in analyzing the impact of the CVP Improvement Act. Thus the rate we used when examining the impact of the CVP Improvement Act was $38.95 per acre-foot. This included $6.77 in capital costs to repay project facilities, $12.26 for Bureau O&M, $3.91 for tiered pricing and $16.01 for district costs. For additional analysis, we added the $6 surcharge that could apply under the CVP Improvement Act.

In our budget for the Sacramento Valley farm, we used the 1990 Glenn-Colusa Irrigation District cost-of-service rate as the base rate. We then increased it to include tiered pricing to analyze the impact of the CVP Improvement Act. We applied CVP rates only to that percentage of Glenn-Colusa water that is received from the CVP. Most of the water used to grow rice in the Sacramento Valley is not CVP water. Farmers held water rights before the CVP was built and now receive their water through CVP facilities. Many farmers supplement their original supply with CVP water. For example, Glenn-Colusa receives about 720,000 acre-feet of non-CVP water through CVP facilities and supplements this with 105,000 acre-feet of CVP water. The Bureau can only increase the irrigation rates on the supplemental supply. The CVP irrigation rate we used was $44.07 per acre. This included $2.10 in capital costs allocated to project facilities, $4.63 for Bureau O&M, $0.72 for tiered pricing, and $36.62 for district costs. The remaining water was charged primarily the irrigation district rate.

We then increased only the capital portion of the rates for each district by increments of 25 percent up to 100 percent. For example, we raised the $6.77 capital portion of the Westlands irrigation rate by 25 percent increments. At a 100-percent increase, the capital portion of the rate was $13.54, and the total rate, which includes operation and maintenance costs and district distribution costs, increased to $45.72. This excludes the $6 surcharge that could apply under the CVP Improvement Act. We also increased the irrigation rates for each district up to the full-cost rate, with and without the $6 surcharge.

The budgets reflect full CVP water deliveries and do not consider the possible impact of reduced supplies resulting from drought or implementation of the CVP Improvement Act.

Other Data Sources

The University of California at Davis (U.C. Davis) was our primary source of farm budget data for all the costs of production, such as the kind of equipment required for each commodity, labor costs, and the types of chemicals needed. We used 1990 data because only 1990 data were available for all commodities we included in our hypothetical farms. Land values were based on interviews with farmers and Cooperative Extension Service agents. Crop yields were based on 1990 county and state averages provided by U.C. Davis and the California Rice Industry Association. Crop values, or returns per acre, were based on 5-year county and ASCS support price averages provided by U.C. Davis, ASCS, and the Fresno County

Department of Agriculture. U.C. Davis and the Glenn-Colusa Irrigation District provided crop water usages.

Assumptions

To develop the San Joaquin and Sacramento Valleys' hypothetical farm budgets, we made various assumptions pertaining to the costs of growing the commodities. For example, budget costs assume operating years with normal water supplies and do not consider drought conditions. The cost for the land is based on cash rents.

Land rental costs for each farm include both production and fallow acreage because farmers must fallow a certain amount of their land to receive their ASCS Support Program payments. Farm budgets outline production costs and revenues on a per-acre basis. However, while fallowed land incurs rental costs, it does not generally incur other production costs or generate revenue because it is not producing a crop. To include the cost of fallowed acreage in our farm budget, we calculated a land rental cost per production acre rather than per total acreage by dividing the total costs incurred for all land by the number of production acres. For example, land in the San Joaquin Valley is rented for $200 per acre for the 960 production acres and 86 fallow acres. This results in a cost of $217.92 per production acre. Similarly, the land in the Sacramento Valley is rented for $180 per acre for 320 production acres and 56 fallow acres. This results in a cost of $211.50 per production acre.

We also assumed that surface water is used for both farms; no groundwater is included. We assumed that the irrigation method used in the San Joaquin Valley farm is furrow and that used in the Sacramento Valley is flood. This assumption was based on numerous studies and surveys on irrigation practices in the Central Valley and on discussions with farmers in both districts.

We assumed that equipment used in farm operations is either owned by the farmers or leased. On the basis of discussions with farmers and agricultural extension agents, the cost of owned equipment in the San Joaquin Valley is valued at 60 percent of new equipment; the cost in the Sacramento Valley is valued at 50 percent. Costs of owned equipment are allocated to each crop based on the number of hours the machinery is used in the crop's production. Straight line depreciation is used.

Harvesting operations can be performed by the farmer, contractor, or processor. On the basis of discussions with farmers, cotton is harvested by

the farmer; wheat, tomatoes, and rice are harvested by contractors; and garlic is harvested by the processor.

Review

U.C. Davis economists, agronomists, and farm advisors from the Cooperative Extension Service reviewed our farm budgets. In addition, San Joaquin and Sacramento Valley farmers and officials from the California Rice Industry Association examined the budgets. Generally, if the reviewers found our costs for an item, such as fertilizer, to be less than their experience, we increased our costs to ensure that our profit estimates were conservative rather than excessive. While operational practices described in the budgets are typical for the associated crops and areas, not all farmers may use these same practices due to variations in farm operations.

Results

Summary budgets, which outline the production costs for each of the commodities used in the hypothetical farm budgets, are presented in tables I.2 through I.6. We used the CVP Improvement Act tiered pricing rate without the $6 per acre-foot surcharge. Table I.7 provides a sample of a more detailed budget for cotton production. Crop selections and acreage allocations used in the budgets may vary from actual farm operation.

The impacts of increased irrigation rates on net returns—or profits—based on these farm budgets are presented in table 2.3.

Table I.2: 1990 Costs Per Acre to Produce Rice

	Operation time (hr/acre)	Labor costs	Fuel & repair costs	Material costs	Custom work & rental costs	Total cost
Preharvest						
Soil preparation	0.77	$8.80	$8.31	$1.17	$29.50	$47.78
Chemical applications	0.09	1.03	1.04	102.34	23.59	128.00
Planting	0	0	0	19.13	11.12	30.25
Miscellaneous	0.15	1.71	0.66	0	0	2.37
Interest on operations						16.80
Subtotal						**225.20**
Irrigation[a]	0.80	5.36	0	44.07	0	49.43
Total preharvest costs						**274.63**
Harvest costs	0.21	5.72	0.23	0	157.32	163.27
Total operational costs						**$437.90**
Overhead						
Interest and depreciation on investment						21.07
Miscellaneous						28.61
Land rent						211.50
Subtotal						**261.18**
Total						**$699.08**

Note: Labor rate: $9.50/hr. skilled labor and $6.70/hr. field labor.

Interest rate: 12.20%.

Yield per acre (cwt): 76.

[a]CVP Improvement Act tiered pricing rate without the $6 per acre-foot surcharge.

Table I.3: 1990 Costs Per Acre to Produce Cotton

	Operation time (hr/acre)	Labor costs	Fuel & repair costs	Material costs	Custom work & rental costs	Total cost
Preharvest						
Soil preparation	1.79	$20.01	$22.16	0	$25.00	$67.17
Chemical applications	0.22	2.45	2.79	$132.25	39.75	177.24
Planting	0.18	1.98	2.83	11.20	0	16.01
Miscellaneous	0.42	4.69	5.87	0	0	10.56
Interest on operations						26.78
Subtotal						**297.76**
Irrigation[a]	5.00	30.50	0	116.85	0	147.35
Total preharvest costs						**445.11**
Harvest costs	1.38	22.50	32.38	9.50	107.50	171.88
Total operational costs						**$616.99**
Overhead						
Interest and depreciation on investment						144.48
Miscellaneous						55.82
Land rent						217.92
Subtotal						**418.22**
Total						**$1,035.21**

Note: Labor rate: $9.38/hr. skilled labor and $6.10/hr. field labor.

Interest rate: 12.20%.

Yield per acre (lbs): 1,360 lint and 2,275 seed.

[a]CVP Improvement Act tiered pricing rate without the $6 per acre-foot surcharge.

Table I.4: 1990 Costs Per Acre to Produce Wheat

	Operation time (hr/acre)	Labor costs	Fuel & repair costs	Material costs	Custom work & rental costs	Total cost
Preharvest						
Soil preparation	0.84	$9.40	$15.39	0	0	$24.79
Chemical applications	0.15	1.69	2.07	$68.25	$20.32	92.33
Planting	0.26	2.89	4.65	19.50		27.04
Miscellaneous	0.42	4.69	5.87	0	0	10.56
Interest on operations						10.66
Irrigation[a]	.70	4.27	0	77.90	0	82.17
Total preharvest costs						**247.55**
Harvest costs	0	0	0		30.00	30.00
Total operational costs						**$277.55**
Overhead						
Interest and depreciation on investment						63.52
Miscellaneous						33.42
Land rent						217.92
Subtotal						**314.86**
Total						**$592.41**

Note: Labor rate: $9.38/hr. skilled labor and $6.10/hr. field labor.

Interest rate: 12.20%.

Yield per acre: 2.87 tons.

[a]CVP Improvement Act tiered pricing rate without the $6 per acre-foot surcharge.

Table I.5: 1990 Costs Per Acre to Produce Tomatoes

	Operation time (hr/acre)	Labor costs	Fuel & repair costs	Material costs	Custom work & rental costs	Total cost
Preharvest						
Soil preparation	1.11	$12.37	$25.54	0	0	$37.91
Chemical applications	0.70	8.04	10.58	$75.90	$22.50	117.02
Planting	0.68	7.69	8.97	135.00	169.55	321.21
Miscellaneous	0.42	4.69	5.87	0	0	10.56
Interest on operations						34.51
Irrigation[a]	1.54	9.39	0	116.85	0	126.24
Total preharvest costs						**647.45**
Harvest costs	0.59	6.64	8.23	0	497.00	511.87
Total operational costs						**$1,159.32**
Overhead						
Interest and depreciation on investment						107.10
Miscellaneous						33.82
Land Rent						217.92
Subtotal						**358.84**
Total						**$1,518.16**

Note: Labor rate: $9.38/hr. skilled labor and $6.10/hr. field labor.

Interest rate: 12.10%.

Yield per acre: 35.5 tons.

[a]CVP Improvement Act tiered pricing rate without the $6 per acre-foot surcharge.

Table I.6: 1990 Costs Per Acre to Produce Garlic

	Operation time (hr/acre)	Labor costs	Fuel & repair costs	Material costs	Custom work & rental costs	Total cost
Preharvest						
Soil preparation	1.74	$19.47	$31.53	0	0	$51.00
Chemical applications	0.48	4.65	2.74	$153.58	$13.50	174.47
Planting[a]	[b]	[b]	[b]	[b]	[b]	[b]
Miscellaneous	0.42	4.69	5.87	0	0	10.56
Interest on operations						23.45
Irrigation[c]	9.00	54.90	0	97.38	0	152.28
Total preharvest costs						**411.76**
Harvest costs[a]	[b]	[b]	[b]	[b]	[b]	[b]
Total operational costs						**$411.76**
Overhead						
Interest and depreciation on investment						79.44
Miscellaneous						32.53
Land rent						217.92
Subtotal						**329.89**
Total						**$741.65**

Note: Labor rate: $9.38/hr. skilled labor and $6.10/hr. field labor.

Interest rate: 12.20%.

Yield per acre: 9.51 tons.

[a]The garlic processor does the planting and harvesting.

[b]Data not applicable.

[c]CVP Improvement Act tiered pricing rate without the $6 per acre-foot surcharge.

Table I.7: Commodity Budget for Cotton (1990 Costs to Produce 500 Acres in the San Joaquin Valley)

		Cash and labor costs per acre				
Operation	**Operation time (hours/acre)**	**Labor costs**	**Fuel & repairs**	**Material cost**	**Custom/rent**	**Total cost**
Preharvest operations:						
Deep rip	0.08	$0.86	$2.09	0	0	$2.95
Primary discing	0.14	1.58	3.07	0	0	4.65
Preplant NH3	0	0	0	$19.52	$5.00	24.52
Apply herbicide	0.12	1.38	0.93	8.26	0	10.57
Incorporate herbicide w/disc	0.10	1.07	1.86	0	0	2.93
Make beds	0.15	1.65	2.19	0	0	3.84
Make ditch	0.06	0.68	1.02	0	0	1.70
Irrigate[a]	5.00	30.50	0	116.85	0	147.35
Close ditch	0.06	0.68	0.86	0	0	1.54
Plant	0.18	1.98	2.83	11.20	0	16.01
Uncap beds	0.15	1.65	1.21	0	0	2.86
Cultivate	1.15	12.91	11.72	0	0	24.63
Hand weeding	0	0	0	0	25.00	25.00
Apply miticide	0	0	0	18.00	5.00	23.00
Insect control	0	0	0	11.11	5.00	16.11
Layby cultivate/herbicide	0	0	0	19.82	6.25	26.07
Apply growth regulator	0	0	0	15.38	5.00	20.38
Sidedress fertilizer	0	0	0	24.78	8.50	33.28
Defoliate cotton	0	0	0	15.38	5.00	20.38
Pickup use	0.27	3.00	4.04	0	0	7.04
Truck use	0.15	1.69	1.83	0	0	3.52
Total cultural costs	**7.61**	**$59.63**	**$33.65**	**$260.30**	**$64.75**	**$418.33**
Harvest:						
Harvest	0.65	$7.32	$21.79	0	0	$29.11
Build module	0.44	11.91	5.32	$9.50	0	26.73
Ginning	0	0	0	0	$107.50	107.50
Total harvest costs	**1.09**	**$19.23**	**$27.11**	**$9.50**	**$107.50**	**$163.34**
Postharvest:						
Cut stalks	0.10	$1.13	$1.55	0	0	$2.68
Cross disc	0.19	2.14	3.72	0	0	$5.86
Total postharvest costs	**0.29**	**$3.27**	**$5.27**	**0**	**0**	**$8.54**
Capital 12.20% interest on operating						$26.78
Total operating costs per acre		**$82.13**	**$66.03**	**$269.80**	**$172.25**	**$616.99**

(continued)

Operation	Operation time (hours/acre)	Cash and labor costs per acre				
		Labor costs	Fuel & repairs	Material cost	Custom/rent	Total cost
Cash overhead costs:						
Land rent						$217.92
Research and promotion						5.70
Pink bollworms						4.30
Classing HVI						3.76
National Cotton Council						1.07
Western Cotton Growers						0.11
Office expense						25.00
PCA contract fee						3.26
Set aside						6.75
Property taxes						3.77
Equipment insurance						1.89
Investment repairs						0.21
Total overhead costs						**$273.74**
Total cash costs per acre						**$890.73**

	Investment			
	Per producing acre	Depreciation[b]	Interest[b]	Total cost
Non-cash overhead:				
ATV, 4WD	$6.77	$1.22	$0.45	$1.67
Fuel wagon	1.56	0.14	0.10	0.24
Shop tools	10.42	0.63	0.70	1.33
Equipment	666.89	96.49	44.75	141.24
Total non-cash overhead costs	**$685.64**	**$98.48**	**$46.00**	**$144.48**
Total costs per acre				**$1,035.21**
Gross values of production per acre				$1,192.85
Gross values of production per lb.				$0.76
Gain/loss from operations per acre				$157.64

Note: Data Inputs-Labor rates: $9.38 per hour for skilled labor and $6.10 per hour for field labor.

CVP Improvement Act rate plus water district costs: $38.95 per acre-foot.

Water required per acre: 3.0 acre-feet.

Interest rate: 12.20 percent.

Yield in pounds per acre: 1,360 - lint, 2,275 - seed.

Crop value per pound: $0.76 - lint, $0.07 - seed.

Crop value per acre: $1,033.60 - lint, $159.25 - seed.

Gain from operations: $157.64 per acre.

[a]CVP Improvement Act tiered pricing rate without the $6 per acre-foot surcharge.

[b]Annual cost.

Comments From the Bureau of Reclamation

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, D.C. 20240

FEB 3 1994

Mr. James Duffus III
Director, Natural Resources
Management Issues
United States General Accounting Office
441 G Street, NW.
Washington, D.C. 20548

Dear Mr. Duffus:

The Bureau of Reclamation (Reclamation) offers the following comments on the draft General Accounting Office report "Water Subsidies: Impact of Higher Irrigation Rates on Central Valley Project Farmers."

The report provides a useful and credible analysis of some of the potential financial effects of changes in the price of irrigation water service from the Central Valley Project (CVP). In general, the Bureau accepts the report as corroboration of several of the key assumptions embodied in the Central Valley Project Improvement Act (PL 102-575). The report identifies the cost of irrigation water as but one of many costs of production for CVP irrigators. It takes the additional step of showing that farm profitability can be sustained following increases in CVP irrigation water service rates. Profitability can be maintained by changing other factors, such as water conservation measures, or the development of water markets, both of which are high priority initiatives of the Bureau to improve the efficiency of water use while sustaining farm income.

Now on p. 13.
See comment 1.

Reclamation offers the following comments relating to specific portions of the text:

Page 13, footnote 2. When authorizing additional units to the Central Valley Project (CVP), the Congress declared that they be operationally and financially integrated with the rest of the CVP. As new units were brought into service, their construction costs were added to the existing CVP construction costs. Inflation is taken into account, since newer units were constructed with "inflated" dollars. No legislation authorized indexing upward the construction cost repayment obligation of older units.

Now on p.21.
See comment 2.

Page 25, footnote 1. In the discussion of farm budgets in Appendix I, it appears that production costs do not include a return on the farmer's equity (equipment). What assumptions were made concerning equity and debt/equity ratios? Are profits to be interpreted as a return to management and equity?

Now on p. 49.
See comment 3.

Page 66, paragraph 3. If the "fallowed land" discussed in this paragraph is part of the land in the "irrigation rotation," and will be planted in the following growing season, weeds must be controlled so that crops can be planted. Weed control costs need to be added to the budgets.

Now on pp. 51-55.
See comment 4.

Pages 69-73. Total production costs for each of the five crops differ from those shown in Table 2.1 (page 28). For each crop, the difference is attributable to different irrigation costs.

If you have any questions concerning these comments, please contact Luis Maez at (303) 236-9892.

Sincerely,

Elizabeth Ann Rieke

Elizabeth Ann Rieke
Assistant Secretary
for Water and Science

cc: Assistant Secretary - Policy, Management and Budget
Attention: Phillip Haymond

GAO's Comments

1. We agree that no legislation has authorized indexing upward the construction cost repayment obligation of older units. However, because repayment costs are not indexed upward to their present value, they do not include consideration of inflation over the years and the interest that federal funds could have earned elsewhere. Dollars do not have the same value decades after their expenditure that they had when they were spent.

2. Production costs do include a return to the farmer's equity (equipment). In our budgets, we applied an interest cost to the cost of all equipment, whether owned or leased. This cost represents a cost of capital for leased equipment and an interest cost for purchased equipment. Because farmers would not have to pay this cost for any owned equipment, it represents a return on farmers' equity that is subtracted from the budget to arrive at the profit. In our budgets, equipment represents the only equity—all land is leased.

As indicated in the footnote, our definition does not include an allowance for returns for management.

3. We included weed control costs for the San Joaquin Valley farm as set-aside costs for keeping land fallow. We have revised our Sacramento Valley farm budget to include these costs as well.

4. Irrigation costs differ between table 2.1 and the costs shown in appendix I because irrigation costs shown in the appendix include the CVP Improvement Act tiered pricing rates. Rates shown in table 2.1 include the cost-of-service rate.

Comments From the Central Valley Project Water Association

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

CENTRAL VALLEY PROJECT WATER ASSOCIATION

Mr. James Duffus III
Director, Natural Resources
Management Issues
General Accounting Office
Washington, D.C. 20548

September 17, 1993

SUBJECT: Water Subsidies: Impacts of Higher Irrigation Rates on Central Valley Project Farmers

Dear Mr. Duffus,

Thank you for the opportunity to provide our comments on the subject report. While you will find our comments critical, we trust you will also find them helpful in improving your final product. We ask that they be included in your report, along with the comments of Westlands Water District, in their entirety.

Enclosed you will find our specific views as we reviewed the report on a page-by-page basis. We have identified significant technical and substantive concerns which draw into question the validity of the study. Unless you correct these errors (which can only be accomplished with major revision), the report cannot credibly support any effort to modify federal policy regarding the management of the Central Valley Project.

See comment 1.

The report is devoid of empirical data which would provide the reader with an understanding of what is actually occurring in the field today. The report uses hypothetical farms in the CVP which are not representative of a typical farmer's use of project water, crop pattern, budget or water district costs. For example, over the last few years, irrigation rates and the actual cost of water to farmers have increased dramatically. As a result of a six year drought, Endangered Species Act restrictions and Central Valley Project Improvement Act requirements, we are experiencing a fundamental financial realignment that is straining both water district and on-farm budgets.

See comment 2.

Delano-Earlimart Irrigation District provides an excellent example of the changes that districts throughout the project have experienced. From 1952 to 1986, the per acre cost of project water (assuming full project deliveries to filter out drought impacts) ranged from $11.25 to $16.36. In 1987 the cost jumped to $30.82; in 1993 it is $94.90; and for 1994 the projected cost is $120.40 per acre.

See comment 3.

With regard to the Sacramento Valley discussion, the report is thoroughly misleading because the authors use a rice farm in the Glenn-Colusa Irrigation District (GCID) as representative of CVP agricultural water users in that area. By doing so, they completely ignore the service areas of the Tehama-Colusa and Corning Canals, which, although consisting of smaller individual districts, constitute more than 135, 000 acres of CVP service area that is almost entirely dependent on CVP water. By contrast, only about 12% of GCID's water supply is CVP water. The majority is water rights water for which the district only incurs its internal operating costs. The T-C area, larger than GCID and using more project water, would therefore better reflect the impacts of rate changes.

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Moreover, all the Sacramento Valley water rates in the report are deceiving because they are not representative. The project water which GCID and other Sacramento River water rights contractors purchase includes only cost components for CVP storage facilities. The T-C service area on the other hand, pays storage, conveyance, and direct pumping costs, and, on the Corning Canal, conveyance pumping, too. Of all the farmers in the Sacramento Valley, those in GCID and the other Sacramento River water rights settlement contractor districts are the most insulated from the effects of increases in CVP water rates.

GCID's blend of project and non-project water makes the water costs you report meaningless. Literally adjacent to GCID's boundaries are farms in a T-C contractor district. While the report asserts that GCID's water cost is only $48.99 per acre (Table 2.1), cost of service pricing in the CVP-dependent (T-C) district would be $183.00 per acre for the same crop. This represents 18% of production cost, rather than the 1% stated on Table 2.2. Using these numbers, a realistic rice production budget reflects a loss of $102.00 per acre instead of the report's conclusion of $157.00 per acre profit.

The focus on a rice-only farm will also mislead unsuspecting readers of the report. While rice is a significant crop in the Sacramento Valley, it is not demonstrative of the T-C service area (where, again, farmers are almost entirely dependent upon CVP water). Rice is at best the third most popular crop in the T-C service area, which has significant plantings of vine seeds, sugar beets, pasture, vineyards, processing tomatoes, wheat and alfalfa. Using an assortment of these crops would make the report more realistitc.

See comment 4.

The failure of the report even to recognize these realities demonstrates that it is an irrelevant analysis. Policy makers need an honest, accurate and comprehensive understanding of the impacts or potential impacts on real people of the policy choices they make. A theoretical analysis based on non-representative examples and using faulty assumptions entered into a computer driven economic model is of little validity or assistance to the policy process. Uninformed policy choices resulting from faulty analysis lead to unintended adverse impacts and damage.

See comment 5.

The fundamental changes we are experiencing and the water management implications of these changes deserve your analysis. For example, in the Delano-Earlimart situation identified above, the District has identified an alarming trend where many growers have turned to pumping groundwater because it is now cheaper than buying CVP water. If the district fails to re-distribute project water costs in a way that keeps the project supply economically viable, significant adverse developments are certain. Groundwater use and the related overdraft will increase; and as less project water is demanded, the remaining users will see their per acre foot costs spiral upward. Consequently, this will undermine repayment of distribution system and related project costs. Eventually, project-wide repayment implications will arise if districts cannot afford their project supply and related capital and operating repayment obligations.

See comment 6.

As significant as the above discussion is, it pales in comparison to the overriding economic reality faced by the CVP today: UNCERTAINTY. This new era of uncertainty emanates from statutory changes and new regulatory actions; almost exclusively instituted by the

Federal Government. Not only are current project operations and management uncertain, expectations for future operations are enormously so.

Although measuring the costs of uncertainty is most difficult, examination and illumination of the impacts is achievable. We urge you to dedicate staff resources to examine the many consequences associated with the present and future management of this major Federal asset. From a policy perspective, the most significant area in need of assessment relates to the social and economic impacts of current, and projected conditions of instability and uncertainty.

Already, the impacts of uncertainty on economic circumstances are visible throughout the CVP. Most vivid are the conditions (and future implications of these conditions) in the delta export service area of the project. While a number of factors are contributing to the economic disruption that is occurring, the lack of adequate project water and the uncertainty over future supplies are the dominant factors.

See comment 7.

Land values are inextricably tied to the availability of a dependable water supply. A land auction in Westlands Water District indicates that land values have declined 50% and more in significant portions of the delta-export service area. Future land auctions are now being organized as more farmers face financial insolvency. Your report ignores these developments.

In a vicious circle, the decline in land value has predictable outcomes: decreased credit availability, decreased investment, decreased economic activity, decreased employment opportunities, decreased tax revenue to support social service programs and increased demand on social services.

See comment 8.

Use of the experience of the Western Farm Credit Bank as evidence of farm profitability is pointless. Though it may be true that the Bank's loan losses went down in the drought period, while water costs went up, any cause and effect relationship between those two is imaginary. In fact, during that same period, the Bank significantly tightened its credit policies (largely due to escalating uncertainties in the supply of CVP water). Eliminating or reducing lending to farmers with uncertain water supplies is one sure way of reducing a bank's loan loss rate.

As an example, the Colusa-Glenn Production Credit Association a member of the Western Farm Credit Bank and a significant lender of short and intermediate term loans for farmers in Glenn and Colusa Counties, has significantly fewer loans in the Tehama-Colusa service area. Their credit policy no longer allows them to rely solely on the productivity of land served with CVP water, even at today's water rates, for loan security. In other words, a farmer cannot get an operating loan without security seperate from his operation! If the rosy picture of profits the report cites really existed, this would not be so.

Now on p. 4.

Your draft report (page 4, lines 107-113) deals with these realities in an insensitive and academic manner. You state:

> "For example, economic studies GAO reviewed indicated that reduced profits will be expressed in decreased land values and therefore decreased land rental costs. Decreased rental costs will partially offset increased water costs. However, those who own land will loose some equity in their landholdings. Some farmers with low profits, or with high debt and reduced equity in their land may not be able to maintain viable farms."

See comment 9.

Mr. James Duffus III
Director, Natural Resources
Page 4

The report then proceeds to discount the significance of this reality by referring to the broader health of, and economic factors affecting, agriculture statewide in California. That GAO did not examine closely the place in the State's social and economic fabric held by farmlands built and heretofore sustained by the Federal CVP, is a significant shortcoming. It is disturbing that the very real social and economic costs of double digit unemployment and the ruin of farm families and communities warrants only the statement that, "Some farmers with low profits, or with high debt and reduced equity in their land may not be able to maintain viable farms".

In closing, I should say that while you may view these comments as somewhat "overheated", they fairly reflect the frustration and anxiety we feel as we attempt to work with what is increasingly characterized as a dysfunctional water project.

Again, thank you for the opportunity to comment. We hope to be afforded the opportunity to comment on future draft reports you prepare.

Sincerely,

Jason Peltier

Now on p. 2.

See comment 10.

Now on p. 2.

See comment 11.

Now on p. 4.

See comment 12.

COMMENTS ON DRAFT OF GAO REPORT ENTITLED "WATER SUBSIDIES: IMPACTS OF HIGHER IRRIGATION RATES ON CENTRAL VALLEY PROJECT FARMERS"

PAGE 2 - LINES 10-12

GAO STATEMENT - "Studies by agricultural economists suggest that higher water prices would increase irrigation efficiency and conservation ..."

RESPONSE - A high level of irrigation efficiency and conservation are already being practiced in CVP service areas. Just what "studies" is GAO referring to? Are they specific to the CVP service areas? The statement may be true in some theoretical settings, but given the many complex and interrelated factors affecting CVP farm economics today, the statement is erroneous and irrelevant.

PAGE 2 - LINES 22-26

GAO STATEMENT - "To estimate the impacts on farmers' profits, GAO created budgets for two hypothetical farm operations designed to be representative of the major commodities grown in farms in the two major regions of the Central Valley - the Sacramento and the San Joaquin Valley."

RESPONSE - The hypothetical farms created by GAO are not representative of farms in the CVP service area. Many more farm budgets should be created representing a much wider range of farm sizes and crops grown. Use of a single rice farm in the Glenn-Colusa Irrigation District to represent all CVP service areas in the Sacramento Valley is especially misleading. Rice acreage comprises only about 12 percent of the acreage in the Tehama-Colusa Canal service areas, (which represent most of the CVP service in the Sacramento Valley). Further, the Glenn-Colusa Irrigation District receives only about 2 percent of its water supply from the CVP, which could lead to a hypothetical farm analysis with little relationship to the project. Hypothetical farms in districts receiving full service from the Tehama-Colusa Canal would be much more realistic. Numerous faulty assumptions are contained in the Westlands Water District example and are detailed in the comments from that district.

PAGE 4 - LINES 90-93

GAO STATEMENT - "The rate increases mandated in the CVP Improvement Act reduced farm profits for GAO's hypothetical San Joaquin Valley farms by 11 percent and reduced the profits of the Sacramento Valley farm by 4.3 percent."

RESPONSE - Crop yields used by GAO in its hypothetical farm budgets appear to be significantly higher than warranted. Use of lower yields would reduce the base or actual profits below those indicated by GAO. The higher water rates mandated by the CVP Improvement Act would thus result in greater percentage reductions in profits than those indicated by GAO. Faulty assumptions applied to non-representative farms makes your statement to be without merit.

See comment 13.

PAGE 4 - ALL

GAO STATEMENT - Summary of results of findings by GAO.

RESPONSE - GAO makes no reference to off-farm effects from reductions in farm prosperity. It should be explained that reductions in farm profits also results in reduced prosperity off the farms. Jobs are lost, fewer taxes are paid, and social problems increase. Rural school districts and fire districts are especially vulnerable. These effects are not addressed by GAO.

Now on p. 5.

PAGE 5 - LINES 137 AND 138

GAO STATEMENT - "Increased water taxes will reduce farm profits, but the hypothetical farms remain profitable."

See comment 14.

RESPONSE - The hypothetical farms might not remain profitable if average crop yields were used in the farm budget analysis. Cotton yields used in the GAO budget were about 23 percent higher than the average for Fresno, Tulare, Kings, and Kern Counties during the period 1981-1985, and almost 19 percent higher than for the Westlands Water District from 1984-1986.

The GAO tomato yields were almost 12 percent higher than those for Westlands during the 1984-1986 period. Rice yields used by GAO were about 14 percent higher than the average for Tehama, Glenn, Colusa and Yolo Counties during the 1981-1984 period.

See comment 15.

Farm sizes used by GAO also appear to be much larger than average which might result in higher profits because of economy of scale. The 960 acres used by GAO for its hypothetical San Joaquin Valley farm is about 45 percent larger than the average farm on the west side of the San Joaquin Valley which comprises about 660 acres. Farms on the east side of the San Joaquin Valley are generally smaller than those on the west side.

Now on pp. 7 and 42.

PAGES 7 AND 54

GAO STATEMENT - Listings of matters for congressional consideration.

See comment 16.

RESPONSE - Additional issues beyond those proposed by GAO should be brought before Congress for its consideration before further irrigation water rate increases are implemented. Primary among such considerations would be the effect that current legislation is having on local economies. Such effects include reduced land values, uncertainties, and inability to make capital improvements and other investments. These and other negative aspects of rate increases and reduced water supplies result in job losses on and off the farm and a general decline in the socio-economic level of local areas.

See comment 17.

Another effect that should be considered is the loss in tax revenues from farms and businesses when farm prosperity increases. The losses would apply to Federal and State income tax revenues as well as all tax levies at the local level.

- 2 -

Now on p. 14.

See comment 18.

PAGE 15 - TABLE 1.1 AND FOOTNOTES (a)

GAO STATEMENT - Table 1.1 implies that rates of $7.17 to $16.67 per acre-foot are paid for CVP water in the Glenn-Colusa Irrigation District.

Response - This presentation is misleading and does not accurately reflect rates for CVP water. Glenn-Colusa has long-standing water rights and receives most of its supply without change. About 10 percent of the total amount is purchased from the CVP.

Now on p. 16.

See comment 19.

PAGE 17 LAST PARAGRAPH

GAO STATEMENT - Language in this paragraph implies that rates of $200 and $100 per acre-foot are routinely paid by irrigation in the Wheeler-Ridge Manicopa and Arvin-Edison Water Storage Districts.

RESPONSE - This language is misleading. Such rates are seldom if ever paid by individual irrigations. Water supplies are purchased at such rates by the districts which then blend the costs with those of other supplies to arrive at affordable prices. Even with blending, the reality today is that the farm economy served by these districts is sick and high water prices along with uncertainty indicate an economic "shake out" is around the corner for many operators.

Now on pp. 16 and 17.

See comment 20.

PAGE 18 - FIRST PARAGRAPH

GAO STATEMENT - Groundwater pumping cost is discussed.

RESPONSE - The indicated groundwater pumping costs might be of a temporary nature. It should be noted that increased groundwater pumping usually causes the water level to decline, resulting in higher lifts and increased costs for pumping. When the decline continues, over time the groundwater supply is eventually exhausted or the costs become so high that groundwater use is no longer economically feasible.

It should also be noted that declining groundwater levels often result in land subsidence. This shifting in the land surface results widespread misalignment of structures such as canals, pipelines, roadways, etc. Additional expenses for land leveling also follow.

Now on pp. 23 and 40.

See comment 21.

PAGE 26 - LAST PARAGRAPH, AND PAGE 28 - TABLE 2.1

GAO STATEMENT - A profit is shown for all commodities except wheat.

RESPONSE - Profits might not be shown, on at least not to the same degree, if average crop yields and farm sizes had been used in the farm budgets, as already discussed in the response to the GAO statement on page 5, lines 137 and 138.

It should also be noted that garlic is not a significant crop in any of the CVP service areas.

Now on pp. 24 and 25.

PAGES 29 AND 30

See comment 22.

GAO STATEMENT - Discussion of CVP costs for water.

RESPONSE - Use of the Glenn-Colusa Irrigation District as representative of CVP service in the Sacramento Valley is unrealistic, as discussed in the response to GAO comments on page 2 - lines 22 through 26. The implication that CVP water users in the Sacramento Valley pay only $7 per acre, amounting to only one percent of their total cost of production, for irrigation water is wholly misleading. An analysis of farms within districts receiving full service from the Tehama-Colusa Canal would be much more realistic.

Now on p. 28.

PAGE 36 - FIRST TWO LINES AND FIRST FULL PARAGRAPH

GAO STATEMENT - Uses data from the middle 1980's to the present time for comparison with future conditions of higher irrigation water prices.

See comment 23.

RESPONSE - The comparisons are made with data which are not comparable. The so-called "agricultural depression" occurred during the early and mid 1980's. This was a period of great economic hardship for farmers nation-wide. By the late 1980's and early 1990's the farm economic conditions had improved, but a severe 7 year drought was affecting California agriculture.

The drought resulted in application of extreme measures by farmers trying to maintain high levels of production in the face of severe surface water restrictions. However, many of the measures applied during the drought were temporary in nature and could not be sustained for long periods of time. They are not comparable to conditions which would exist with a stable, long-term surface water supply.

Now on pp. 33 and 34.

PAGES 41-43 AND TABLE 3.1

GAO STATEMENT - "Farmers may increase irrigation efficiency."

See comment 24.

RESPONSE - CVP irrigators are still suffering from the effects of a 7 year drought period and persistent water shortages resulting from the Endangered Species Act and the Miller/Bradley legislation. Increases in irrigation efficiency have been pushed to near maximum during this period. Incremental improvements will continue to be made over time, but only when they are economically feasable. The Key here is increasing productivity per unit of input. Given the general conditions of inadequate water supplies, any "savings" would necessarily be directed to other lands and would not be available for environmental uses as some would contend.

Now on pp. 37 and 38.

PAGES 48 AND 49

GAO STATEMENT - "Changes in farming practices justified at full cost for hypothetical farms."

RESPONSE - Limits to opportunities to change farming practices were discussed above. Options for

See comment 25.

The GAO report seemed not to consider the fact that no such changes can be made when no market exists for the crops requiring less water. In addition, lower water use crops are generally lower value crops with less capital and labor inputs required. A broad shift to lower value crops would have adverse economic impacts on a local and regional basis.

Now on p. 40.

PAGE 52 - THIRD PARAGRAPH

GAO STATEMENT - This paragraph recounts GAO's conclusion regarding the effects of higher CVP water rates.

See comment 26.

RESPONSE - In its conclusions GAO fails to recognize that the positive effects to the U.S. Treasury would be partially offset by reductions in taxes paid by farms and businesses which profit from farm production. This negative effect would apply at State and local levels as well as the U.S. Treasury.

Now on p. 40.

PAGE 53 - FIRST FULL PARAGRAPH

GAO STATEMENT - GAO discusses the effect of rate increases on its hypothetical farms.

See comment 27.

RESPONSE - The hypothetical farms probably do not realistically represent conditions on CVP farms, as already discussed.

Now on p. 42.

PAGE 54 - LAST PARAGRAPH

GAO STATEMENT - GAO lists six matters for Congressional consideration before imposing higher irrigation water rates on CVP water users.

See comment 28.

RESPONSE - Additional items should be included in the list for consideration by Congress. Specifically, the effect on local economies, including job losses, should be carefully analyzed. Actions which affect farms also affect neighboring communities which are supported by production on the farms.

Congress should also consider the impact of recent legislation before imposing any new rate increases on restrictions on the CVP irrigators. Existing legislation has resulted in uncertainties regarding land values and farmers' abilities to meet outstanding financial obligations. These uncertainties inhibit capital improvements and other investments that farmers night otherwise be making. This slowing of the farm economy also extends off-farm to the local communities which are dependent upon the farms.

GAO's Comments

1. We obtained extensive empirical data on farmers' use of project water, crop patterns, and budget and water district costs for the farm budgets we created. The inputs were provided by the Cooperative Extension Service, the University of California at Davis, farmers in the Westlands Water District and Glenn-Colusa Irrigation District, and district crop reports. Our inputs were reviewed by university professors, the farmers, and officials from the U.S. Department of Agriculture's Agricultural Stabilization and Conservation Service and the Cooperative Extension Service.

2. We recognize that water supplies for many CVP farmers have been reduced in recent years because of the drought and that future supplies for some farmers also will be reduced under Endangered Species Act restrictions, the CVP Improvement Act, or other environmental requirements. We have added discussion of these factors in the report.

However, we did not include water supply reductions in our analysis for the following reasons: (1) Drought conditions experienced by farmers in recent years reflect an extreme situation. If we had based our budgets on water delivery levels provided under drought conditions, we would have modeled profits for an atypical year, and our results would have reflected the impacts of rate increases under drought conditions rather than reflect the impacts of rate increases under normal conditions. (2) Future reductions in deliveries to CVP farmers under the Endangered Species Act and the CVP Improvement Act are unknown. Because the Bureau was only able to provide us with very rough estimates of possible short-term reductions over the next 5 years, we did not use these data in our analysis. (3) We were asked to examine the impact of rate increases on farmers' profits—not the effect of reduced water supplies. Our analysis isolates the effect of increased rates on profits to the exclusion of other factors. While reduced supplies will affect farmers' profits, perhaps to a greater extent than increased rates, our review did not evaluate these impacts. We have added the impact of water supply reductions to the factors to be considered by the Congress.

3. We chose to use water rates and cropping patterns based on the Glenn-Colusa Irrigation District (GCID) for several reasons. First, GCID is the largest federal irrigation district in the Sacramento Valley, representing more irrigated acreage than any other single irrigation district. The irrigation districts that receive water from the Tehama-Colusa Canal represent fewer irrigated acres combined than the GCID, according to the Bureau of Reclamation's cropping reports for 1991. Tehama-Colusa districts had approximately 68,000 planted acres, with 94,000 acres in

irrigation rotation, while GCID had approximately 83,000 planted acres, with 126,000 acres in irrigation rotation. Districts that receive water from the Corning Canal had approximately 12,000 acres in irrigation rotation, of which approximately 6,000 acres were not irrigated. Furthermore, over 62,000 acres in GCID were in rice production—over three times the acreage of any type of crop grown by the districts served by the Tehama-Colusa Canal.

Different cropping patterns and different water rates among irrigation districts affect farm profits and the impact of higher rates on farmers. We revised the report to indicate specifically that our budgets do not apply to districts that receive all of their water from the CVP and do not grow the crops modeled in our budgets, such as those that receive CVP water through the Tehama-Colusa and Corning Canals.

4. We do not agree with this assessment of our analysis. As we indicated in the comments above, we relied on empirical data to create farm budgets representative of major commodities grown in two regions of the Central Valley.

5. It was not within the scope of our review to analyze such recent trends as increased groundwater pumping in certain districts. We agree that if surface water rates exceed groundwater costs, then farmers will pump more groundwater. We have added this information to the report.

6. While we agree that the CVP faces uncertainty from the recent statutory and regulatory changes, particularly the adequacy of water availability and future water supplies, these impacts were beyond the scope of our review. The report recognizes that the Congress will need to give appropriate weight to a host of factors in any decision to raise irrigation rates. We have added the impact of water supply reductions to the factors to be considered by the Congress.

7. We have revised the report to recognize that land values in the Central Valley have declined recently. However, the recent land auction in Westlands is not necessarily representative of future changes in land values throughout the CVP.

8. We do not state or infer that there is a cause and effect relationship between water costs and the Western Farm Credit Bank's reduction in loan losses. Our discussion of loan losses stresses that higher water costs during the drought did not significantly affect the overall farm economy. In

contrast, the high loan loss rate and weak farm economy present in the 1980s—a period of stable water rates—indicates that factors other than higher water costs did adversely affect the farm economy to a much greater extent.

9. We revised the report to recognize that the decline of some farms will affect local economies. However, we were asked to examine the impact of higher irrigation rates on farmers' profits, not on local economies. Because we did not analyze these impacts, we cannot discuss them extensively.

10. The studies related to higher water prices and increased irrigation efficiency and conservation are footnoted throughout the report. These studies specifically address Central Valley agriculture.

11. We recognize in our report that each farm in the CVP is unique and that actual impacts of higher irrigation rates will vary from those calculated in our budgets. We state that our budgets should not be construed as indicative for all farms in the Central Valley. The report has been revised to specifically note some types of farms in the Central Valley that we did not examine.

See comment 3 regarding our selection of the Glenn-Colusa Irrigation District.

12. We disagree that our crop yield assumptions are faulty. We relied upon yields provided by the County Commissioners for Fresno and Colusa Counties for 1990, the most recent year for which data were available at the time of our study. These counties include the Westlands Water District and the Glenn-Colusa Irrigation District.

13. References to the off-farm impacts have been added to the report. While we do not extensively discuss local economic impacts, our report clearly indicates that, based on the changes in farm profits and loan losses during the 6-year California drought, the impacts of increased water rates on the overall California farm economy will likely not be severe.

14. The Association references yields in the 1981-86 period. We used 1990 data, the most recent data available. See comment 12.

15. We recognize the difficulty in estimating the average farm size in the Central Valley. In their comments to us on this draft report, the Association and the Westlands Water District provided us different

averages in the CVP—one was for average farm size, the other for average landholdings. The Association indicated that the average farm size was 660 acres in the west side of the San Joaquin Valley and less than 660 on the east side. The Westlands Water District indicated that the average landholding was 865 acres. However, as indicated in previous GAO reports,[1] some landholdings of less than 960 acres are operated collectively as single large farms. Therefore, landholdings often are not an accurate indicator of farm size.

We used 960 acres as the farm size for the San Joaquin Valley farm because the Reclamation Reform Act limits subsidized water to 960 planted acres. We used 320 acres for the Sacramento Valley farm because according to ASCS, a husband and wife need about 320 acres to obtain the maximum support payment.

16. In the "Matters for Congressional Consideration" section, we have added the potential adverse impacts on local economies of raising water prices as an additional factor the Congress should consider.

17. At the state and federal level, tax revenues will not necessarily decline as a result of higher water rates, because adverse impacts on some sectors of the economy, such as Central Valley farmers, is offset by benefits in other sectors of the economy. For example, as agricultural land values decline in the Central Valley, land values and jobs can increase in areas that receive additional water resulting from increased conservation. Because decreases in farm profit are expressed in decreased land values, local property taxes may decline, and can be considered one of the local economic impacts resulting from higher water rates.

18. We have revised table 1.1 to state that the rates apply only to the water received from the CVP—not to water rights water held by the district.

19. Farmers in the districts told us that they pay such rates. We have added to the report a statement that these rates represent extreme differences in rates paid for CVP and State Water Project irrigation water.

20. We have added to the report a statement that, as more water is pumped, groundwater pumping costs may increase. We have also

[1]Water Subsidies: Basic Changes Needed to Avoid Abuse of the 960-Acre Limit (GAO/RCED-90-6, Oct. 1989).

Water Subsidies: The Westhaven Trust Reinforces the Need to Change Reclamation Law (GAO/RCED-90-198, June 1990).

footnoted some of the adverse impacts of excessive groundwater pumping.

21. The basis for the yields is explained in comment 12, and average farm size rationale is addressed in comment 15. Regarding garlic, the report clearly states that garlic is a proxy for specialty crops. While garlic itself may not be a significant crop in the CVP, specialty crops—which include garlic—are significant.

22. Our rationale for using data for Glenn-Colusa Irrigation District is explained in comment 3.

23. We agree that an "agricultural depression" occurred in the early and mid-1980s, that economic conditions had improved when the drought occurred, and that farmers applied extreme measures to maintain high levels of production during a period of reduced water supplies and higher water costs. These facts support our conclusions. The data indicate that price increases during the drought did not affect the overall farm economy as much as other factors did—such as those that caused the agricultural depression in the 1980s. The data demonstrate that farmers adjusted to water shortages and price increases over a 6- or 7-year period to maintain high levels of production. Some of these adjustments may not be sustained over long periods of time. However, the price increases analyzed in our report are not as severe as those experienced during the drought.

24. We agree that increases in irrigation efficiency will only occur when they are economically feasible, that is, when farmers' profits are higher with increased efficiency than they would be without it. Levels of efficiency achieved by farmers, therefore, depend upon the profitability of increasing efficiency. Profitability varies on the basis of production costs, such as water costs, and revenues. While some districts, such as Westlands, may currently have high levels of efficiency, irrigation efficiency throughout the Central Valley varies, and many districts are not as efficient as Westlands.

25. The report recognizes that factors such as changes in commodity prices and the opening of new markets can have a greater impact on crop choice than irrigation costs. As an example, we note that a farmer generally will not plant tomatoes without a marketing agreement with a processor.

If water costs increase, profits will decrease, and farmers will shift to crops that give them the greatest profit possible under the circumstances. We agree that there will be secondary impacts on the local economy. However, as we indicate in the report, the acreage devoted to low-value crops would likely be reduced in response to higher water rates in the Central Valley. Shifting crops, whether to high- or low-value crops, will decrease the impacts of higher water rates on farmers and local economies.

26. See comment 17.

27. See comments 1, 2, and 3.

28. In the "Matters for Congressional Consideration" section, we have added the potential adverse impacts on local economies of raising water prices as an additional factor the Congress should consider. The "Matters for Congressional Consideration" section also includes factors affecting farmers such as the extent to which farmers can absorb increased irrigation costs, the potential adverse impacts on farmers, the ability of farmers to mitigate the effects of the price increases, and the impact of future water supply reductions. We agree that these factors all must be considered under existing legislation.

Comments From the Westlands Water District

Note: GAO comments supplementing those in the report text appear at the end of this appendix.

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September 13, 1993

Mr. James Duffus III
Director, Natural Resource
Management Issues
General Accounting Office
Washington, DC 20548

Dear Mr. Duffus:

Subject: Comments on Water Subsidies: Impacts of Higher Irrigation Rates on Central Valley Project Farmers (GA/RCED-93-146)

These comments are submitted on behalf of Westlands Water District, its landowners, and water users. Westlands also joins in and supports the comments submitted by the Central Valley Project Water Association.

See comment 1.

There is one fundamental and fatal flaw in this report which materially affects and distorts the entire analytic approach and the conclusions reached therein. That flaw is the assumption that in Westlands Water District in 1990, the hypothetical farm used as the basis for the report could have obtained 3 acre-feet of Central Valley Project (CVP) water at a delivered cost of $35 per acre-foot. Simply put, this was utterly impossible in 1990. Westlands received a 50 percent CVP contract supply in 1990, which means that Priority Area I was allocated 1.3 acre-feet per acre and Priority Area II was allocated 0.7 (seven tenths) acre-feet per acre. A farmer in Westlands who wanted or needed 3 acre-feet in 1990 had to purchase supplemental transferred water from outside the District, generally at a cost of approximately $65 per acre-foot, or he had to pump groundwater (of generally less-than-desirable quality) at a cost usually significantly higher than CVP contract water, or he had to lease additional acreage in order to provide a water supply for his farmed acreage. In all of these scenarios, the true water cost (not including associated labor) of 3 acre-feet per acre would probably approach $200 per acre, a much higher number than the costs stated in the report. Since the report significantly underestimates the costs of water, the finding, that the impact of further increasing water costs will not significantly impair farm profitability, understates the true impact of increased water costs.

There are numerous other significant flaws in the assumptions or in the analysis of this report, which will be discussed in the following specific comments:

SPECIFIC COMMENTS

1. Since the Executive Summary merely states in abbreviated fashion the assumptions, analysis, and conclusions of the report, we have no comments on that section.

Now on p. 12.
See comment 2.

2. **Statement - Page 11:** "During normal years, the CVP provides about 6 million acre-feet irrigation water each year to approximately 3.8 million acres of crop land."

Comment: In the Sacramento Valley, the CVP has contract obligations to deliver about 3 million acre-feet of water rights and settlement water to Sacramento River water rights holders and Tehama-Colusa contractors. In the San Joaquin Valley, the CVP has export obligations of approximately 840,000 acre-feet for the San Joaquin Exchange Contractors and about 2 million acre-feet for the San Luis Unit, Delta-Mendota contractors, and the San Felipe Unit.

Thus, not including the Friant Unit, the Bureau has contractual obligations for water on the order of 6 million acre-feet per year. However, for the past four years, substantially less than this amount has been delivered. This is in part due to the drought conditions of the past few years, but more significantly, in 1992 and 1993 deliveries to the San Luis Unit (as well as the Delta-Mendota and San Felipe contractors) have been substantially reduced as a result of pumping limitations in the Delta. These pumping limitations are the result of the listing under the Endangered Species Act of the winter-run salmon and the Delta smelt, and the result of the implementation of the Miller-Bradley legislation (P.L. 102-575). In 1990, the export contractors received 50 percent of their contract supplies; in 1991 and 1992, 25 percent; and in 1993, 50 percent.

The impacts of the ESA and P.L. 102-575 restrictions exist independent of water supply conditions in the watersheds and reservoirs. Thus, it is no longer accurate to say the CVP will deliver 6 million acre-feet in "normal" years. For the foreseeable future, assuming these limitations on exports continue, it does not appear that there will be a "normal" year when the contractors are not subject to what is in effect a "regulatory drought."

3. **Statement - Page 12:** ". . . in 1989, approximately 71 percent of [California] water was used for irrigation . . . ."

Now on pp. 12 and 13.
See comment 3.

Comment: The percentages given in this paragraph are for developed water only and do not include water in wild and scenic rivers, or that used for instream flows and other water quality purposes. Irrigation actually accounts for less than one third of all runoff.

4. **Statement - Page 12:** "Farmers receiving water from the CVP currently pay varying rates depending on (1) the type of contract . . . and (2) the distribution costs charged by the District. Generally, there are three different federal rate structures: the fixed contract rate, the full-cost rate, and the cost-of-service rate."

Now on p. 13.

See comment 4.

Comment: These statements are not true of Westlands Water District. The water rate paid by an individual water user in Westlands depends primarily on his status under the Reclamation Reform Act of 1982 (RRA) and the type of water he receives. Most (in excess of 90 percent) of the land in WWD is held by landholders who have elected to be subject to the discretionary provisions of the RRA. Consequently, only 5 to 8 percent of all CVP water delivered in WWD is sold at the District's fixed cost contract rate of $8 per acre-foot. Since 1987, most CVP water (in excess of 85 percent) delivered in Priority Area I has been paid for at the USBR's O&M rate. A smaller portion of the water (less than 10 percent) has been paid for at the full-cost rate. Since 1978, CVP water delivered to Priority Area II under the terms of the Barcellos Judgment has been paid for at either the cost-of-service rate (in excess of 90 percent) or the full-cost rate (less than 10 percent). Thus, not only has Westlands paid for its CVP water at a rate which covers the Bureau's O&M costs (except for drought

year deliveries in 1991 and 1992), Westlands has repaid a substantial amount of capital through the cost-of-service and full-cost payments made over the years.

5. **Statement - Page 13, Footnote 2:** ". . . funds used for the CVP could have earned returns elsewhere in the economy."

Now on p. 13.
See comment 5.

Comment: The implication of this statement is that the CVP does not "earn returns" for the economy of the State of California and the nation. In fact, the CVP has over the past 40 years been the foundation of a multi-billion dollar a year agricultural economy in the Central Valley, which supports thousands of families and tens of thousands of jobs and which produces billions of dollars in commodities and related production. The implication that somehow the economy of the State of California and the United States would be better off without the investment made by the United States in the CVP is ludicrous.

6. **Statement - Page 14, Footnote 4:** "As of 1992, about 76 percent of CVP contracts are operating with an annual O&M deficit."

Now on p. 14.
See comment 6.

Comment - The percentage of contractors with O&M deficits is of little informational value. The O&M deficit is an obligation of the contractors which will ultimately be paid, in some cases with interest. Furthermore, many CVP districts make voluntary payments each year to pay off any accrued O&M deficit. In many cases, the only reason an O&M deficit exists in the first place is because the Bureau underestimated its operating costs for the ensuing year when it set water rates. As deliverable water supply decreases due to export constraints, the O&M cost per acre-foot increases. Bureau O&M costs have more than doubled in the past eight years. O&M costs for 1991 and 1992, years of 25 percent contract supplies for CVP export contractors, generated large O&M deficits because the Bureau set water rates based on a 50 percent supply.

7. **Statement - Page 15: Table 1.1** - Sample 1992 Water Rates

Now on p. 14.
See comment 7.

Comment: None of these rates shown for WWD are 1992 rates. The table is probably intended to show 1990 rates. Table 1.1 shows two full-cost rates applicable to WWD. The first rate ($45.84) is presumably intended to be the discretionary provisions full-cost rate for landholding over 960 acres. The actual rate for 1990 was $45.14 per acre-foot. The second number ($63.37) is not identifiable as a rate paid by Westlands in 1990. It perhaps was intended to be the "hammer clause" full-cost rate applicable to prior law recipients who lease land in excess of 160 acres per person. The actual "hammer clause" rate for 1990 was $59.28 per acre-foot. This rate is rarely used.

Table 1.1 also shows two cost-of-service rates for Westlands in 1990. Neither of the numbers shown is the actual 1990 cost-of-service rate for WWD of $19.03 per acre-foot. The table makes no reference to the O&M rate for 1990 which was $12.26. Actual delivered CVP water costs in 1990 were: Priority Area I - $28.27 ($12.26 to USBR plus District overhead of $16.01); Priority Area II - $36.01 ($19.03 to USBR plus District overhead of $16.98). These rates do not include the capital repayment for the District's distribution system collected by benefit assessment in the approximate amount of $6 to $8 per acre per year.

Now on p. 15.

8. **Statement - Page 16: Table 1.2** - CVPIA Effect on WWD 1992 Cost of Service Rate

See comment 8.

Comment: None of the rates shown on this table were rates applicable to WWD in 1992. The correct rates are as follows: Cost-of-service rate paid to USBR - $20.13 per acre-foot; District overhead - $19.30; delivered cost of CVP water to Priority II at cost-of-service rate - $43.41. (Most CVP water delivered to Priority Area I in 1992 was at the O&M rate of $36.01 per acre-foot).

The discretionary provisions full-cost rate for 1992 payable to USBR was $45.79 per acre-foot.

Now on p. 15.

9. **Statement - Page 16:** "... the Secretary will assess a fee of up to $6 per acre-foot on irrigation water . . . ."

See comment 9.

Comment: This reference to the Restoration Fund surcharge of P.L. 102-575 is incorrect. This charge is indexed to $6 on October 30, 1992, and will significantly increase over time. CVP contractors have been advised by USBR that effective October 1, 1993, the Restoration Fund charge will be $6.20 per acre-foot.

Now on pp. 16 and 17.

10. **Statement - Page 18:** "Farmers without adequate sources of surface water often pump groundwater."

See comment 10.

Comment: This is true. It may also be said that when the cost of surface water (e.g., CVP water) exceeds the cost of groundwater, farmers will tend to pump more groundwater. This results in groundwater overdraft, more energy use, land subsidence, and reduced yields (due to generally poorer water quality). These are among the reasons why the CVP was constructed in the first place. At some point, raising the price of CVP water begins to defeat the primary purposes of the project.

Now on p. 19.

11. **Statement - Page 21:** "The budgets reflect the impact of irrigation rate increases with full CVP deliveries, but do not consider the impact of possible reductions in water supplies resulting from drought or implementation of the CVP Improvement Act."

See comment 11.

Comment: As noted earlier in these comments, this is the fatal flaw in the analysis contained in this report. The reductions in water supplies for CVP export contractors are not "possible" or hypothetical. They are real and they are substantial. Over the period 1990 through 1993, more than 5 million acre-feet of water has been withheld from the CVP exporters. Of 8 million acre-feet in contract obligations (2 million per year for 4 years), the Bureau delivered only 3 million acre-feet. To assume, as is done in this report, full CVP water supplies is to deny reality. These reductions are not entirely a function of the drought. In 1993, they are entirely the function of ESA reductions (for winter-run salmon and Delta smelt) and P.L. 102-575 reallocation of fish and wildlife water. It is unlikely that full water supply deliveries to the exporters will resume in the near future.

Now on p. 21.

12. **Statement - Page 24:** The first paragraph states that while the increased water costs modeled in this report would decrease farm profits, generally the effect on the California farm economy would not be widespread.

See comment 12.

Comment: There is no informational or analytic value in this statement. The report could as easily conclude that increased water costs for CVP farmers will not

materially affect the national Gross Domestic Product. The statement, while it may be true, does nothing to illuminate the impact of increased water costs on CVP farmers. In fact, there is substantial evidence available that increased water costs have already had an effect on farm profits and farm survival in the CVP service areas. The number of foreclosures and receiverships in Westlands in recent years has been significant. Recently, 8,000 acres of farmland in Westlands and San Luis Water Districts was sold by foreclosure auction. These farm failures are in large part a result of water shortages and substantial increases in water costs.

Furthermore, the report makes no attempt to quantify the effect to the local economy. The drought has already impacted rural communities with unemployment estimates reaching as high as 42 percent in the City of Mendota. Increasing water prices will only add to this problem as farmers' revenue (and thus ability to pay for labor and services) is further reduced. The end result will be higher unemployment, a diminished tax base, and an increase in the need for state and federally funded social services, such as health care and welfare assistance.

Now on p. 21.

13. **Statement - Page 25, Footnote 1:** Definition of "farm profits."

See comment 13.

Comment: The footnote should make it clear that the term "profit" also does not include an allowance for interest on investment. As the term is used here, it more accurately is the margin between costs and returns, from which return on investment, return to management and taxes must be deducted to arrive at a true profit. The profit, in turn, is the only source of funds for upgraded irrigation management systems.

Now on p. 22.

14. **Statement - Page 26:** ". . . we assumed that irrigation water deliveries will not be reduced as a result of the CVP Improvement Act or other factors; therefore, all conclusions are based on farmers receiving their full CVP deliveries."

See comment 14.

Comment: As noted earlier in these comments, it is totally invalid to assume that irrigation water deliveries will not be reduced as a result of the CVPIA or other factors, such as ESA based export limitations or the proposed EPA standards. This fatal flaw invalidates the findings and conclusions of the report, i.e., the impact on profitability, since a decrease in water supply reduces farm income and increases unit water costs.

Now on p. 23.

15. **Statement - Page 26:** "Farmers plant wheat as a rotational crop . . . ."

See comment 15.

Comment: Wheat does not add nutrients to the soil, except for a small amount of organic matter if the straw and stubble is incorporated into the soil. It does provide an opportunity for weed control and land leveling after harvest, and also helps control soil organisms such as verticillium and fusarium wilt. In addition, farmers may plant wheat as a means of maximizing the benefit of winter rainfall, as well as to make greater use of their wells during the off-season for cotton, tomatoes, melons, etc.

Now on p. 24.

16. **Statement - Page 28: Table 2.1** - Summary Budget of 1990 Costs and Returns per acre for Hypothetical Farms.

See comment 16.

Comment: This table presents profits for a hypothetical cropping pattern which is supposed to typify the distribution of high and low value crops in the CVP. On average, this appears to be a reasonable distribution for the Westlands' area. However, many Westlands' farm operations do not conform to this assumed distribution.

Analysis of the 1991 Westlands' crop reports show that out of a sample of 395 farms, 285 had a crop rotation with one or more high value crops such as garlic, onions, tomatoes, lettuce, almonds, etc.; 110 had only mid to low value crops such as cotton, safflower, alfalfa seed, hay, sugar beets, wheat, barley, etc.; and 27 fallowed their entire acreage. This indicates that 35 percent of the water users do not match the cropping pattern assumptions in this report. To assume that these water users can obtain contracts for high value crops or are able to grow these crops on their land is incorrect and invalidates the applicability of this report's analysis to a significant number of Westlands' farm operations.

17. **Statement - Page 28: Table 2.1** - Summary Budget of 1990 Costs and **Page 29: Footnote 3**

Now on p. 24.

See comment 17.

Comment: The production costs do not appear to include an amount for county property taxes or water district repayment assessments. Furthermore and more significantly, the costs for irrigation water are substantially understated. CVP water in the quantities assumed was not available at the assumed price of $35 per acre-foot in 1990. In Priority Area I of Westlands in 1990, the CVP allocation was 1.3 acre-feet per acre. If the water user was eligible to buy water at the O&M rate, the delivered cost was $28.27 per acre-foot. In Priority Area II, the allocation of CVP water in 1990 was .7 (seven tenths) acre-foot per acre. The cost-of-service rate was $36.01 per acre-foot. Supplemental transfer water in 1990 ranged in cost from $16 per acre-foot to as much as $120 per acre-foot. The average groundwater pumping cost in the District in 1990 was $65 per acre-foot plus $20 per acre-foot for delivery charges. Thus, the cost of 3 acre-feet of irrigation water in 1990 could and did range as high as $200 per acre, and the profit per acre figure shown on Table 2.1 is substantially overstated.

18. **Statement - Page 28: Table 2.1** - Production Acreage and **Pages 60-62: Appendix I**

Now on pp. 24 and 45-47.

See comment 18.

The rationale for using a full 960 acres of crops for the San Joaquin Valley/Westlands farm, but only 320 acres for the Sacramento Valley farm, as presented in Appendix I, is not valid. Farmers do not necessarily plant the amount of cotton, wheat, or rice that will maximize their ASCS payments; they may plant more, they may plant less. They certainly cannot change their total landholding from year to year to precisely match their optimum ASCS acreage of cotton, wheat, and rice at varying price support levels and differing idling requirements to come out with 960 acres of irrigated land. The average landholding in Westlands is approximately 865 acres and that changes very little from year to year. It would make much more sense to use the average farm size in each area, deduct the number of acres required to be idled, use the proportionate mix of crops on the remainder, then show the profit per acre or per acre-foot of water.

The water usage of 3.0 acre-feet per acre is incorrect for cotton and tomatoes in Westlands; the actual average amounts are 2.5 acre-feet for cotton and 2.3 acre-feet for tomatoes. Even the full contract entitlement of 1,150,000 acre-feet of CVP water provides only an average of 2.15 acre-feet to the 535,000 eligible acres in Westlands. The long-term average amount of groundwater pumpage is about 145,000 acre-feet. It is the sole source for about 33,000 cropped acres in the District which are not eligible to receive Project water and also supplements CVP water on other acreage. The total supply is 1,295,000 acre-feet or an average of 2.3 acre-feet for each of the 568,000 acres farmed in the District.

Now on p. 33.

19. **Statement - Page 41:** ". . . increased irrigation rates give farmers incentive to change their farm management practices and reduce water use."

See comment 19.

Comment: Farmers already have the economic incentive to make irrigation improvements. Given Westlands' inherent limited water supply, farmers can plant more acres if they can reduce irrigation losses. Reducing farm profits may in fact decrease the number of farmers who can make capital irrigation system improvements.

Now on p. 33.

20. **Statement - Page 41:** "Some farmers may increase irrigation efficiency and reduce water use through improved irrigation practices and technologies."

See comment 20.

Comment: This statement illustrates the basic misunderstanding by the authors of the concepts involved in irrigation efficiency. Increased irrigation efficiency does not necessarily mean reduced water use. In some cases where portions of the field are over and underirrigated, improving irrigation efficiency may result in no less water being applied to a field. The major incentive in these cases is to apply water more uniformly to the field in order to increase yields and at the same time reduce the amount of deep percolation.

Now on p. 34.

21. **Statement - Page 43 - Table 3.1**

See comment 21.

Comment: The "attainable efficiencies" shown on this table are not consistent with data obtained by Westlands and by other studies of irrigation efficiency. Generally, irrigation efficiency is more related to proper system design and management practices which result in good distribution uniformity, than to the specific type of irrigation system.

Now on p. 34.

22. **Statement - Page 44 - Table 3.2**

See comment 22.

Comment: The water usage per acre shown on this table is substantially higher than actual usage observed in Westlands Water District. Data from more than 400 cotton fields evaluated during the period 1987-1991 showed no significant differences in water usage on cotton for furrow and sprinkler system; our data shows actual water used in the range of 2.3 to 2.7 acre-feet per acre on cotton. The District's average use of water (2.5 acre-feet per acre) is equivalent to the usage shown in Table 3.2 for drip system. In other words, Westlands farmers' water usage is already (with primarily furrow and sprinkler systems) at a high level of efficiency.

Now on p. 42.

23. **Statement - Page 54:** "(1) the extent to which farmers can absorb increased irrigation rates . . . ."

See comment 23.

Comment: The USBR determined the water users' ability to pay for water and drainage service during 1980-1984 to be approximately $140 per acre when a full water supply was available. The water users' ability to pay for water and drainage service during 1990 has not changed significantly and may have reduced from the USBR's estimate. A study to determine the water users' ability to pay for increased rates for CVP water should include consideration of whether the proposed increases will exceed the farmers' ability to pay.

CONCLUSION

The basic assumption of this GAO report is flawed. Water was not available in the quantities and at the prices assumed for 1990. The hypothetical farm is not

representative of all Westlands' farming operation. The report, because it understates the cost of water, understates the impact on farm profitability of additional increases in CVP water rates.

Thank you for the opportunity to review this report. If you have any questions regarding our comments or would like additional data regarding water supply or farming operations in Westlands Water District, please give me a call.

Sincerely,

Michael G. Heaton
Assistant General Counsel

cc: James Hampton, GAO
Roger Patterson, USBR

GAO's Comments

1. We disagree that the discrepancy between actual water deliveries to the Westlands Water District in 1990 and the delivery levels we use in our hypothetical San Joaquin Valley farm is a fundamental and fatal flaw in the report and materially distorts the entire analytical approach and the conclusions of the report. Our intent was not to replicate the particular farming conditions present in the Westlands Water District in 1990. Rather, we designed our hypothetical farms to reflect typical farming practices in the San Joaquin and Sacramento Valleys in general, using the most recent data available. In general, San Joaquin Valley farms use water levels of 3 acre-feet of water for cotton.

The most recent year for which complete data were available at the time of our study was 1990. However, we did not use 1990 water deliveries because we did not want to model farm production costs and profits under the extreme drought conditions present in 1990. If we had used 1990 water levels, we would have modeled profits for an atypical year, and our results would have reflected the impact of rate increases under drought conditions rather than the impact of increased water rates on farm profits. The higher water rates provided by the Westlands Water District in its comments reflect the higher costs of pumped groundwater and water purchased outside the CVP necessary to supply water levels of 3 acre-feet in the Westlands Water District in 1990.

In developing farm budgets for the San Joaquin Valley farm, we relied on data from Westlands Water District for some, but not all variables. For example, data on water rates and cropping patterns are based on Westlands Water District while crop yields and water usage were based on 1990 data for Fresno County, in which Westlands is located. Westlands is the largest water district in the San Joaquin Valley; however, it also is more efficient than many districts in the valley. Modeling all conditions based on Westlands, therefore, would be unrepresentative of other locations in the valley.

To remove any suggestion that our hypothetical San Joaquin Valley farm specifically represents a Westlands Water District farm, we have clarified our description of our farm budgets in the report.

2. We have revised the report to state that the CVP has delivered 6 million acre-feet, historically, to water rights holders and contractors.

3. We changed the report to state that the water supply refers to developed water.

4. The report recognizes that, under reclamation reform act provisions, some farmers and districts pay the Bureau's O&M rate. The report also recognizes that some farmers and districts pay the fixed contract rate, the CVP's full-cost rate, and the cost-of-service rate, as specified by Westlands Water District in its comment. Table 1.1 specifically lists certain rates for Westlands Water District and two other districts and presents the range of rates paid for CVP water. The Bureau O&M rates paid by some are included within this range.

5. We do not state or infer that the economy of California or the United States would be better off without the CVP. The purpose of the footnote is to recognize that the capital costs owed on the irrigation component of the CVP do not include interest charges. Because the government does not receive interest on its investment in the irrigation component of the CVP, it incurs opportunity costs. Opportunity costs exist for money invested anywhere in the economy because the money invested could have earned returns (such as interest) elsewhere. We have clarified the footnote.

6. The percent of contractors with O&M deficits is important because most CVP contractors will pay part of their O&M deficit in their cost-of-service rate once contracts are renewed.

7. We have revised the table to show the 1992 rates.

8. We used the Bureau's 1992 Irrigation Water Rate published by the Mid-Pacific Regional Office in the fall of 1991, for the 1992 irrigation season. The rates the Bureau charged Westlands in 1992 varied from those published the previous fall. We revised the report to reflect the rates Westlands stated were actually charged.

9. We revised the report to show that the $6 charge is indexed to 1992 price levels.

10. We revised the report to recognize that as the cost of surface water exceeds the cost of groundwater, farmers will pump more groundwater. We have also footnoted some of the adverse impacts of excessive groundwater pumping.

11. We do not agree that not analyzing future reductions in water supplies is a fatal flaw in our analysis. While water supply can impact farmers' profits, we were asked to examine the impact of increased water rates, and not the impact of reduced supplies, on farmers' profit. Moreover,

future reductions in deliveries to CVP farmers under the CVP Improvement Act are unknown. Because the Bureau was only able to provide us with very rough estimates of possible short-term reductions over the next 5 years, we did not use these data in our analysis. We have added the impact of water supply reductions to the factors to be considered by the Congress.

12. The statement concerning the effect of increased water costs on the California farm economy is highly relevant and significant. The evidence we obtained on the effect of the extensive, recent drought showed that despite higher irrigation rates and water shortages, California's overall farm economy remained strong, and other economic variables, such as interest rates, the export market, and the value of the U.S. dollar, affected the farm economy more than water rates. We have clarified the report to state that impacts on California's overall farm economy are not likely to be severe.

We have revised the report to indicate that adverse impacts on individuals can hurt local economies that rely on these individuals. However, we were asked to examine the impact of higher irrigation rates on farmers' profits, not on local economies. Because we did not analyze these impacts, we cannot discuss them extensively.

13. Our definition of profit includes an allowance for interest on investment, although it is not listed as a separate item. In our budgets, we applied an interest rate to the value of all equipment, whether owned or leased. This cost represents a cost of capital for leased equipment and an interest cost for purchased equipment. Because farmers would not have to pay this cost for any owned equipment, it represents a return on farmers' equity that is subtracted from the budget to arrive at the profit. In our budgets, equipment represents the only equity—all land is leased.

We have clarified the footnote to state that the budgets reflect farm profits before reductions for taxes.

14. See comment 11.

15. We have added this information on wheat production to the report.

16. The report recognizes that each farm in the CVP is unique and that our budgets should not be construed as indicative of all farms in the Central Valley. We believe, however, that the budgets provide an indication of the

effects of increased irrigation rates on farms with similar characteristics to our simulated farms.

This belief is buttressed by Westlands' analysis of its 1991 crop reports. By stating that 35 percent of the water users in Westlands do not match the cropping pattern assumptions in the report, Westlands is agreeing that our hypothetical San Joaquin Valley farm matches the cropping patterns of 65 percent of the water users in Westlands—the largest water district in the valley.

17. Property taxes are included under the general heading of "overhead" in table 2.1 and are listed as a separate item in appendix I. As one of our assumptions, the costs associated with irrigation water delivery are included in the rental cost for land. This includes water district repayment assessments. These costs vary from water district to water district and are frequently negotiated in land leases.

See comment 1 for the discussion on discrepancies in water supply.

18. We assumed that farmers determined crop acreage to maximize ASCS payments because it seemed unlikely that farmers would choose to exceed the acreage limitation and become ineligible for payments, or conversely, to reduce acreage and not receive all payments available.

We recognize the difficulty in estimating the average farm size in the Central Valley. In their comments to us on this draft report, the Association and the Westlands Water District provided us different averages in the CVP—one was for average farm size, the other for average landholdings. The Association indicated that the average farm size was 660 acres in the west side of the San Joaquin Valley and less than 660 on the east side. The Westlands Water District indicated that the average landholding was 865 acres. However, landholdings often are not an accurate indicator of farm size. As indicated in previous GAO reports,[2] some landholdings of less than 960 acres are operated collectively as single large farms.

Our water usage for cotton and tomatoes is appropriate. In developing farm budgets for the San Joaquin Valley farm, we relied on data from

[2]Water Subsidies: Basic Changes Needed to Avoid Abuse of the 960-Acre Limit (GAO/RCED-90-6, Oct. 1989).

Water Subsidies: The Westhaven Trust Reinforces the Need to Change Reclamation Law (GAO/RCED-90-198, June 1990).

Westlands Water District for some, but not all variables. Westlands is more efficient than many districts in the valley. Modeling all conditions based on Westlands, therefore, would be unrepresentative of other locations in the valley. Data on water usage and crop yields were based on 1990 data for Fresno County, in which Westlands is located.

19. Our statement that increased irrigation rates give farmers incentive to change their farm management practices and reduce water use does not imply that farmers in Westlands Water District do not currently have incentive to reduce irrigation losses. We recognize that Westlands engages in more efficient irrigation practices than many other districts. Our statement referred to farmers in general and indicates that increased rates provide even more incentive for conservation.

We disagree that reduced profits from increased rates will decrease the number of farmers who make irrigation system improvements. Improving efficiency is a way to mitigate the reductions in profit resulting from higher water rates. Farmers will improve efficiency if, faced with higher water rates, it is profitable to do so.

20. We recognize that increased irrigation efficiency may not always reduce water use. However, higher water costs provide an incentive to conserve on water use. Higher irrigation efficiency caused by higher rates reduces water use.

21. We agree that many factors affect irrigation efficiency and differences in reported efficiencies can occur. The attainable efficiencies included in our report were provided by California State University at Fresno.

22. Our figures on water usage are not specific to Westlands but represent other areas in the San Joaquin Valley as well. As explained in comment 1, water usage was based on 5-year averages for Fresno County, and other water districts are not as efficient as Westlands.

23. We believe that we have developed a more accurate indication of current ability-to-pay than the Bureau's figures. We developed our farm budgets with the most recent data available and obtained input and review from many knowledgable sources.

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Selected Bibliography

Archibald, Sandra, et al An Economic Analysis of Water Availability in California Central Valley Agriculture Phase II. Stanford, California: Center for Economic Policy Research (Feb. 1992).

Archibald, Sandra, et al An Economic Analysis of Water Availability in California Central Valley Agriculture Phase III. Stanford, California: Center for Economic Policy Research (Aug. 1992).

Blank, Steven and Karen Jetter. "The Effects of Higher Electrical Costs on the Financial Outlook for California Agriculture," Davis, California: Agricultural Economics Department, University of California at Davis (Mar. 1992).

Burt, Charles. Surface Irrigation Handbook. Exeter, California: Waterman Industries (Mar. 1987).

Cannon, Frederick. "Overview of Financial Conditions in California Agriculture: Implications of Higher Electrical Rates" (Mar. 1992).

Caswell, Margriet, Eric Lichtenberg, and David Zilberman. "The Effects of Pricing Policies on Water Conservation and Drainage," American Journal of Agricultural Economics (Nov. 1990).

Dinar, Ariel and David Zilberman. The Economics and Management of Water and Drainage in Agriculture, Boston, Massachusetts: Kluwer Academic Publishers (1991).

Klonsky, Karen. "Budget Planner—Version 2.0," Davis, California: Regents of the University of California (1990).

Solomon, Kenneth, Dennis Nef, Greg Jorgensen, David Zolodske. "Higher Agricultural Electricity Rates—A San Joaquin Valley Perspective," Fresno, California: A Study for the California Energy Commission (Mar. 1992).

Vaux, Jr., H.J., Dale Handley, Paul Giboney. "An Assessment of Irrigation Technology Performance in the Southern San Joaquin Valley of California," Water Resources Research, Vol. 26, No. 1: Pages 35-41 (Jan. 1990).

Zilberman, David, Neal MacDougall, Richard Howitt, L. Tim Wallace. "Analysis of the Economic Impacts of The Central Valley Improvement Act" (Mar. 1992).

"Increasing Agricultural Electricity Rates: Analysis of Economic Implications and Alternatives," Sacramento, California: California Energy Commission, P400-92-030 (June 1993).

Water Conservation Plan—Westlands Water District, Fresno, California: Westlands Water District (July 1992).

"Effective Use of Water in Irrigated Agriculture," Council for Agricultural Science and Technology, Task Force Report No. 113, Ames, Iowa: (June 1988).

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