ECONOMIC EFFECTS OF LAND IDLING FOR TEMPORARY WATER TRANSFERS

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Prepared for the California Department of Water Resources

March, 2002

The research described in this report was prepared for the Department of Water Resources under Contract 4600001841

The views and opinions expressed are those of the author and do not necessarily represent those of the Department of Water Resources

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1.0 Summary

1.1 Background

Voluntary water transfers from irrigation use to municipal, industrial, environmental or other irrigation use are increasing in California. California Water Code Section 1810 requires that State or local agencies must allow use of water conveyance facilities for water transfers if, among other considerations, the transfer can occur "without unreasonably affecting the overall economy or the environment of the county from which the water is being transferred."

This report

- describes economic effects of water transfers in the county of origin;
- estimates economic effects that occur from land idling for water transfers and compares these effects to the size of overall county economies;
- discusses a number of factors that might be considered in evaluating the reasonableness of economic effects in the county of origin, and
- proposes mechanisms that could be used to reduce, mitigate or compensate for unreasonable effects.

Third-party effects of water transfers are the effects on persons other than the buyer and seller. Third party effects can occur through physical effects or economic effects. Physical third-party effects extend beyond property boundaries and can extend to the effects on legal users of water. Changes in surface or ground water flows, or airborne dust or pests are examples of third party physical effects. In general, water transfers need to be designed to avoid or mitigate for effects on legal users of water and, where feasible, to mitigate for other physical effects on the environment.

This paper deals with the third party economic effects that occur through economic trade. These economic effects are minimal or positive when the water transfer can be accomplished without changing the type, cost, and value of the irrigated crop. However, such a water transfer may provide very little water to transfer because the amount of water consumed by the crop is unaffected. Water transfers by land idling provide more water because idling eliminates the consumption of water transpired by the crop, but the value of the crop and many associated economic activities in the local area are lost.

Third party economic effectsinvolve all sectors of the county economy that directly or indirectly trade with irrigated agriculture. These effects include:

- Loss of value of output, personal income and employment in all sectors from reduced farm expenditure in backward-linked industries;
- Effects caused by other change in farmer expenditures in the county. The farmer gains water transfer revenue less water transfer costs, but crop revenue net of variable expenses is lost.
- Loss of output, personal income and employment in all sectors from reduced production in forward-linked industries, or increased cost of agricultural inputs in these industries;
- Loss of local sales tax and property tax revenues;
- Increased unemployment and welfare costs;
- Increased variability of agricultural production leading to loss of buyers or sellers, or less favorable prices.

1.2 Baseline Economies and Economic Effects

This report develops and presents quantitative economic analyses of land idling for water transfers. The "detailed analysis" uses detailed expenditure data from crop budgets, information about forward linkages and costs, and county-level economic multipliers from IMPLAN to estimate impacts. Tables 1 through 4 show results of the detailed analysis for the selected crops and counties. Baseline levels for 1997 are provided for comparison.

Table 1.
Economic Effects of Land Idling for Water Transfers: Total Value of Output from All Sectors of the Economy [1.]

		Effect on Total County Value of Output (Dollars) per Acre Idled of										
County	Total Baseline Value of Output (Million$)	Rice	Wheat	Process Tomato	Saf-flower	Field Corn	Dry Beans	Sun-flower	Grain for Hay	Barley	Wild Rice	Upland Cotton
Butte	6,319	2,777										
Colusa	1,085	1,982	600	7,798	872		1,202					1,741
Glenn	1,071	1,332	496			1,156		1,136				
Placer	11,081	1,441										
Shasta	5,827										3,621	
Solano	12,483		673	9,137	1,157	1,390				603		
Sutter	2,707	1,563	588	5,702	1,034		1,472					
Tehama	1,444								318			
Yolo	8,365	2,455	568	8,159	932	1,245		1,560	481			
Yuba	1,767	935										

1. Effects are direct, plus indirect, plus induced

Table 2.
Economic Effects of Land Idling for Water Transfers: Total Value Added from All Sectors of the Economy[1.]

		Effect on Total County Value Added (Dollars) per Acre Idled of										
County	Total Baseline Value Added (Million $)	Rice	Wheat	Process Tomato	Saf-flower	Field Corn	Dry Beans	Sun-flower	Grain for Hay	Barley	Wild Rice	Upland Cotton
Butte	3,803	1,093										
Colusa	456	628	166	3,337	265		466					614
Glenn	504	584	144			450		376				
Placer	6,506	653										
Shasta	3,495										1682	
Solano	7,524		248	4,519	465	617				227		
Sutter	1,606	647	198	2,404	399		621					
Tehama	832								136			
Yolo	5,064	931	187	3,873	351	518		540	187			
Yuba	1,218	615										

1. Value added is wages and salaries, proprietors incomes, other property-type income and indirect business taxes. Effects are direct plus indirect plus induced.

Table 3.
Economic Effects of Land Idling for Water Transfers: Total Wages and Salaries from All Sectors of the Economy[1.]

County	Total Baseline Wages & Salaries Million $	Effect on Total County Wages and Salaries (Dollars) per Acre Idled of: Rice	Wheat	Process Tomato	Saf-flower	Field Corn	Dry Beans	Sun-flower	Grain for Hay	Barley	Wild Rice	Upland Cotton
Butte	2,063	543										
Colusa	212	357	96	1,767	146		283					370
Glenn	254	323	83			267		208				
Placer	3,258	335										
Shasta	1,954										1013	
Solano	4,163		138	2,401	250	359				125		
Sutter	780	361	111	1,351	208		359					
Tehama	462								83			
Yolo	3,081	530	109	2,104	195	315		300	109			
Yuba	740	307										

1. Effects are direct plus indirect plus induced.

Table 4.
Economic Effects of Land Idling for Water Transfers: Total Employment

County	Total Baseline Employ-ment (jobs)	Effect on Total County Employment (jobs) per 1000 Acres Idled of: Rice	Wheat	Process Tomato	Saf-flower	Field Corn	Dry Beans	Sun-flower	Grain for Hay	Barley	Wild Rice	Upland Cotton
Butte	96,329	30										
Colusa	10,781	18	6	85	8		16					21
Glenn	12,308	23	6			17		12				
Placer	125,480	19										
Shasta	80,937										60	
Solano	146,509		8	110	13	19				7		
Sutter	38,201	22	7	76	12		22					
Tehama	21,694								5			
Yolo	98,433	23	6	91	10	15		13	6			
Yuba	26,878	24										

1. Effects are direct plus indirect plus induced.

The example below shows how Tables 1 through 4 can be used to estimate the impacts of a given water transfer.

Example: What is the effect on Butte County total value of output from idling 10,000 acres of rice in Butte County?				
Column #1	#2	#3	#4	#5
Acres Idled	Loss of output, dollars per acre of rice, from Table 1	Total value of output lost from acres idled in Million $ (#1 times #2, divided by 1,000,000)	Total value of output in the county from Table 1 in Million $	Value of output lost as a percent of total value of output (#3 divided by #4) times 100
10,000	$2,777	$27.77	$6,319	0.439%

Suppose that a dry-year water transfer would idle 10,000 acres of rice in Butte county. The example shows that value of output would be reduced by 27.77 million dollars, or 0.439 percent (less than 1 percent) of the county baseline level. From tables 2 and 3, value added, and wages and salaries lost would be $10.93 million and $5.43 million, respectively, and from Table 4, 300 jobs would be lost. These amounts are 0.29%, 0.26% and 0.31% of the baseline levels, respectively.

Another way to apply tables 1 through 4 is to estimate the amount of idling that would result in a specified fraction of the baseline levels. For example, how many acres of rice idling would result in a 1% loss of jobs in Butte county? The answer, as shown in the example below, is 32,110 acres.

Example: How many acres of rice idling would result in a 1% loss of jobs in Butte county?				
Column #1	#2	#3	#4	#5
Jobs lost per 1,000 acres of rice idled, from Table 4	Total employment in the county, number jobs, from Table 4	Specified fraction of jobs in the county (1% of #2)	1,000s of acres idled to result in the specified fraction of jobs lost (#3 divided by #1)	Acres idled to result in the specified fraction of jobs lost (#4 times 1,000)
30	96,329	963	32.11	32,110

In comparing across counties (moving down a column in Tables 1 through 4), there is some variation in the total impact per acre of crop idled. This variation is caused by differences in

- production practices, yields, prices and costs
- location of forward processing facilities, and
- economic multipliers

Differences in production practices, yields, prices and costs create some differences between counties. However, these differences are generally small compared to the other two factors. Some counties do not have tomato processing or rice milling facilities, so the economic effects of reduced production of processing tomatoes and rice in these counties is less. The more urban counties have significantly larger economic multipliers than the smaller counties, so the impact per dollar of direct change in crop production is more.

As in any economic analysis, there are many uncertainties and outstanding issues that bear on the impact estimates. Many assumptions, discussed in the text below, were required to derive results. The detailed analysis generally resolved any uncertainties in a way that would increase the magnitude of the negative economic effects measured. Even with this allowance, local economic conditions and other factors could combine to result in a larger economic effect for a particular water transfer. In general, this should not be likely.

1.3 Factors to Consider in Judging Reasonableness

Water Code Section 1810 requires that water conveyance facilities be made available for water transfers if, among other considerations, the transfer can occur “without unreasonably affecting the overall economy of the county from which the water is being transferred.” There is no economic definition of “reasonable” that would allow for unambiguous quantification of this standard. However, there are factors that affect how costly, painful or difficult a given amount of land idling might be. Some factors that might be considered in evaluating if a given effect is reasonable or not include:

- Local economic conditions
- Agricultural economic conditions
- Baseline level of land idling
- Normal variation in acreage
- Normal variation in value of output
- Frequency of land idling
- Characteristics of crop idling
- Diversity of crops idled
- Unique conditions

California Water Code Section 1810 requires that State or local agencies must only consider the “overall economy.” However, impacts on specific sectors within the county might be considered in judging what is reasonable. Appendix 1 provides detailed data on agricultural economics for each county from the Regional Economic Information System (REIS). These data could be used as a basis for information on agricultural revenues and costs for the study counties.

1.4 Reduction and Compensation Strategies

If economic effects of a proposed water transfer were judged to be unreasonable, strategies to reduce the economic impacts might be considered, or a plan might be developed to compensate the adversely affected persons. Potential strategies to reduce adverse effects include

- Obtain water in ways that do not result in land idling
- Target idling to crops that reduce spending less per unit water acquired
- Target idling to areas that have the least impact on the county economy
- More diverse land fallow
- Avoid idling in locations where more-than-average idling is already occurring

Potential compensation strategies include

- Unemployment compensation
- Welfare
- Small business programs
- Healthcare systems
- Targeted compensation (identify those most harmed and direct payment to them)

2.0 Background

2.1 Historical Background and Review of Studies

Agricultural communities are familiar with the economic effects of variable crop acreage. The mix and amounts of acreage change with market conditions, weather, government programs, technology and many other factors. The economic condition of agricultural communities usually follows the condition of its farmers. More crops mean more crop income, and many businesses provide inputs, services, and value added to the local farm economy in ways that increase income and employment.

Beginning in the early 1900's, the city of Los Angeles bought and retired thousands of acres of irrigated farmland in the Owens Valley. The resulting environmental and economic consequences to the region were substantial. The Owens Valley water transfer has influenced perceptions and policies about water transfers in California ever since.

Prior to the 1980s, water transfers were common in California, especially during drought, but most transfers were trades among water users within small regions such as water districts, so there was little net effect on the local economy. In 1982, California adopted a statewide policy of encouraging voluntary water transfers between agencies (Rosengrant, 1995). Throughout the 1980s, there was a general increase in the number of water transfers, but most transfers were small, short-distance, and did not involve land fallow. Until 1991, there were few instances of large inter-regional water transfers by land idling in California. Large transfers were limited by legal problems, lack of conveyance, local opposition, and limited demand.

The drought of 1988 to 1992 threatened to cause severe water shortages in California's urban areas. In February 1991, the Department of Water Resources (DWR) announced that the State Water Project (SWP) would be able to deliver only 10 percent of urban water requests and no agricultural water (DWR, 1992). The Bureau of Reclamation predicted that only 25 percent of CVP contracts could be delivered. Many counties had declared drought emergencies, and water storage fell to record low levels.

Executive Order W-3-91 empowered DWR to organize and implement the drought water bank (DWB) to purchase water for sale to meet critical water needs. Price was set at $125 per AF. The DWB acquired 820,805 acre-feet (AF) of which 420,064 or about half were obtained by no-irrigation contracts. These contracts required either land idling or dry farming from the date of the contract to October 15. Idling of corn acreage (59,276 acres) and non-irrigation of wheat (43,584 acres) accounted for 62 percent of the 166,094 acres enrolled in no-irrigation contracts. Eleven counties had some acreage enrolled in the DWB. San Joaquin, Yolo and Sacramento Counties accounted for 73 percent of the no-irrigation acreage with the remainder spread among the other eight counties.

As the DWB was implemented, some county leaders voiced concerns over impacts to the selling regions' environment and economies. In Yolo County, the Board of Supervisors obtained only limited cooperation from farmers in their attempts to implement monitoring and a water sales tax (Marchand, 1993). The County developed a damage claim that they felt was conservative, but the claim was not paid by the State, because no mechanism was in place to pay the claim.

DWR contracted with University of California researchers in 1991 to conduct an analysis of the DWB (Howitt, 1993). The analysis included a survey of 188 farmers in Yolo and Solano counties, input-output (IO) analysis, and a survey of 108 affiliated industries. The analysis found that

- Farm jobs were reduced by 4.7 percent;
- Farm revenues, county income and agriculturally related jobs were reduced by 3.5 and 5 percent in Solano and Yolo counties, respectively;
- With water sales, farm profits were increased for most farmers;

The survey of agricultural industries found that most believed they were not affected by the DWB. Of those believing they were affected, most believed their sales and profits were decreased. Average sales and profits were reported to be decreased by about 4 and 6.5 percent, respectively. Payrolls, capital outlays and expansion plans were cut back, and borrowing increased. Community leaders were also surveyed. Results indicate that most of these persons felt that impacts of the DWB on the future economy, local economy, farm workers and social services were very negative.

DWR commissioned Rand to conduct a second study of economic impacts in the water selling regions (Dixon, Moore and Schechter, 1993). The study was based largely on survey data from the farmers and businesses involved in the DWB. The stated goal of the study was "to measure, as accurately as our budget allowed, the changes in farm operations caused by the Bank and their repercussions in the local economy." The analysis considered the possibility that some land enrolled in the DWB would have been fallowed anyway, and that participating farmers may have farmed their other land more intensively.

Statistical methods were used to estimate the affect of the DWB on operating costs and crop sales. Results are shown in Table 5 below.

Table 5.
Statistical Estimate of Reduction in Operating Costs Due to Water Bank, UC Crop Budget Cost per Acre, Reduction in Crop Sales per Acre in Bank, and Normal Crop Income per Acre, 1991 Dollars

Crop	Operating Cost Reduction per AF Sold	Operating Cost Reduction per Acre in Bank	UC Crop Budget Cost/Acre	Crop Sales Reduction per Acre in Bank	Normal Crop Income per Acre
Rice	$79	$269	$401	$398	$600
Alfalfa	$52	$171	$418	$515	$595
Sugar Beets	$48	$134	$594	$804	$770
Corn	$32	$70	$355	$304	$355
Wheat	$35	$63	$265	$194	$308

Source: Dixon, Moore and Schechter, 1993, page 24

These results suggested that no-irrigation contracts reduce costs by less than the full amount of expenditure per acre as estimated by UCCE crop budgets. This was to be expected because of fixed costs – some costs continue even if no crop is planted or irrigated. Also, crop sales of some crops were reduced by less than the normal crop income per acre. This occurred because some crop sales were possible even without irrigation.

The analysis also estimated changes in operating cost between 1990 and 1991 by component. On average, the no-irrigation sample spent $49 less per acre in 1991. Most of the reduction was for labor ($16), chemicals ($11), and contractors ($10) with small shares in haulers, seed, fuel and rentals. These impacts are not due to the DWB alone; the reported results merely compare two years and do not isolate the effect of the DWB.

Overall, the analysis suggests that crop sales were reduced by $58 million by the sale of 453,000 AF through no-irrigation contracts. Operating expenses were reduced by $17.1 million. This expenditure loss was partly offset by an increase in investment expenditure of $2.5 million for a net expenditure reduction of $14.6 million, about 2 percent of estimated crop operating costs without the DWB

DWB payments totaled $56.6 million. The study infers that, with reduced crop revenues of $58 million and cost savings of $17.1 million, net revenue from participation in the DWB was $15.7 million (56.6+17.1-58.0). The study estimates that $11.7 of this net revenue went to farmers, $3.4 million to landlords, and $0.6 million to water agencies.

A mail and telephone survey of agricultural firms was conducted. Results suggest that "the impact of the Bank on agricultural businesses is of the same order of magnitude as the impact on farm inputs purchases and crop sales."

Several comparisons of DWB impacts to other sources of variation were conducted. The study found that "the estimated percentage drop in business of agricultural firms due to the Bank was not large" compared to variation in agricultural personal income or employment during the 1980's. Also, the decline in income and employment in 1991 did not approach the maximum declines of the 1980s. Finally, the study was unable to detect any relationship between DWB impacts and overall county economies.

In 1992, the Bay Area Economic Forum and Metropolitan Water District of Southern California (MWDSC) published "Water Marketing in California: Resolving Third-Party Impact Issues (Mitchell, 1992). This publication argues several related points: that a small percentage of farm water would be affected, that water transfers would affect mainly field crops which are usually associated with relatively small employment and value per acre, and that the impacts would be small compared to normal fluctuations, and that other factors such as technological change and USDA commodity programs have, historically, created much larger employment losses. The analysis suggests that "impacts are well within the range of ordinary economic consequences that arise from changing circumstances in a market economy." Strategies to minimize or mitigate negative effects of water transfers include broad-based transfers, conjunctive use, compensation for displaced workers, and compensation for local governments.

An analysis for the California Farm Water Coalition refutes this study (NEA, 1993). Concerns in selling regions include "a loss of control over water supplies, significant loss of land value, sharp increases in demands for community services, the loss of rural community stability, and reduced protection of the environment." Still, "California agriculture has practiced and continues to support transfers, generally, with appropriate protections to prevent Owens Valley type problems." However, "there must be better recognition of the full extent of possible third-party impacts . . . California's developed water supply has not kept pace with urban, environmental and industrial demands. . . Addressing third-party impacts and the questions related to them demands full participation in water allocation decisions by urban, agricultural and environmental interests."

Existing federal and State laws can provide some protection from adverse effects of water transfers in selling regions. The Central Valley Project Improvement Act (CVPIA) Section 3405(a) allows that

> All individuals or districts who receive Central Valley Project water . . . are authorized to transfer all or a portion of the water subject to such contract to any other California water user or water agency . . .Transfers involving more than 20 percent of the Central Valley Project water subject to long-term contract . . . shall also be subject to review and approval by such district or agency . . .”

California Water Code, Section 1810 reads as follows:

> Notwithstanding any other provision of law, neither the state, nor any regional or local public agency may deny a bona fide transferor of water the use of a water conveyance facility which has unused capacity, for the period of time for which that capacity is available, if fair compensation is paid for that use, subject to the following . . .
>
> (d) This use of a water conveyance facility is to be made . . . without unreasonably affecting the overall economy or the environment of the county from which the water is being transferred.

- The literature on water transfer economics has considered some of the factors that must be considered in judging reasonableness under Section 1810. Expenditures for crop production are reduced by temporary idling, but expenditure is reduced by an amount less than the total, long-run expenditure per acre.

On the other hand, reduced farm expenditure is not the only source of adverse regional effect of land idling. Especially, an economic analysis to consider whether a water transfer can occur “without unreasonably affecting the overall economy” must consider forward linkages. Forward linkages are the economic effects associated with trade after the crop leaves the farm. Transportation, storage, marketing and processing are examples.

2.2 Economic Background

This report focuses on economic information pertinent to Section 1810(d). The law requires consideration of the overall economy of the county from which the water is transferred, not the smaller, local transfer area or a larger, multi-county region. Therefore, county-level analysis is appropriate for analysis.

Backward economic linkages involve farm expenditures for the production requirements of farming. Reduced crop production causes expenditures for farm inputs such as labor, materials, custom operators, and fuel to decline. These expenditure reductions are called first round effects. When farm laborers, farm stores, custom operators, and others lose business, they reduce their spending (these are second round effects), and the people they buy from reduce their spending (third round effects), and so on. The sum of all effects is called the multiplier effect. The multiplier effect is limited by leakages out of the economy. Leakages are exports of money, mostly payments made to non-residents for imported goods, materials and production factors. Leakages are not returned to the regional economy, so they do not result in multiplier effects.

Economic multipliers, and economic impacts from backward linkages, are often estimated with input-output (I-O) models. I-O analysis estimates total impacts on economic output, income, and employment for a given region (in this case, a county) based on a change in final demands. Final demands are direct changes in economic expenditure that are independent of the regional economy. Crop sales for export or increased federal expenditure are examples. An increase in final demand requires an increase in expenditures for intermediate goods needed to meet that demand. These expenditures, in turn, create demands on other regional industries, and so on.

This analysis includes I-O analyses of economic impacts from reduced production of crops. Two separate analyses are included. In one analysis, value of production of crops is the input to the I-O model. This is called the simple approach.

I-O models are actually very simple models relative to the complexity of regional industries and economies, for at least three reasons. A simple application of I-O presumes that all inputs change with output according to their pre-existing average expenditure shares. The pattern of expenditure changes caused by the initial impact – land idling in this case – is the same as the pre-existing average. Economic theory and experience with the DWB suggest that farm expenditure does not decrease by an amount equal to the loss of crop sales, because the water transfer is temporary. Some long-run expenditures are not reduced by participation in the dry-year no-irrigation contract because

- The farmer expects to continue farming in the future, so he maintains his complement of machinery and other capital for future use.

- Some labor expense is maintained because experienced labor is scarce, and skilled persons may not be available for hire in the future.

- Some production expenses such as ground preparation and planting expenses are made prior to the decision to participate in the dry-year bank. Therefore, these sunk costs occur either with or without the transfer.

- Some production expenses continue because a crop can still be produced without irrigation.

The second reason why simple I-O may not be very accurate is that I-O only includes the backward linkages. Forward linkages – economic effects from transportation, marketing and processing of farm products – are not counted when the I-O model input is value of farm output.

Third, the readily available I-O models use expenditure patterns based on national averages. IMPLAN, an I-O database and modeling tool, uses county-level final demand and employment data with a national average technology matrix. This technology matrix may not be representative of California conditions. A survey of local industries or other information on local expenditure patterns is required to consider unique local conditions.

This report includes a simple approach, based on a naïve interpretation of I-O, and a more detailed analysis to correct for the three limitations discussed above. Expenditure data from University of California Cooperative Extension (UCCE) crop budgets are used to correct for two of the limitations of I-O. These expenditure data, not the value of crop production, are input to the I-O model. Unfortunately, there are no survey-based I-O models available for the study region. Therefore, IMPLAN is used for the I-O analysis.

First, fixed costs and sunk costs are isolated and excluded from the analysis. Information about which expenditures are reduced by a temporary water transfer has been developed from DWB experience, economic theory, and expert advice. Second, the UCCE data should more accurately represent the expenditure patterns for idled crops than the national average technical coefficients in IMPLAN. The use of UCCE crop budgets means that the "first round" expenditure effects should be more accurate. The inaccuracy created by national average coefficients in second round and subsequent rounds of regional expenditure remains.

The detailed analysis includes forward economic linkages. These linkages are included by considering the expenditure patterns of forward linked industries for transportation, storage, tomato processing, and rice milling. Transportation and storage costs have been developed from industry sources and from market reports that provide prices at the farm gate and at central markets. Processing and milling cost studies have been obtained and analyzed, and forward linkage expenditures are included.

The simple approach uses the change in crop sales as I-O model input. In the detailed analysis, the initial input is the change in regional production expenditures in crop production plus the reduced expenditure caused by any reduced forward processing, plus certain changes in net revenues.

I-O analysis implicitly includes other simplifications. There is no substitution among inputs ─ ratios of inputs used in production are fixed. The method assumes constant returns to scale ─ the amount of production increases by the same amount per unit of input regardless of the initial amount of output. I-O also assumes fixed prices ─ prices do not change as quantity of demand or supply changes. These simplifications have not been considered by this analysis.

3.0 Baseline Economies of Affected Counties

California Water Code Section 1810 requires that effects on the "overall economy" of each county be considered. This section describes common economic measures for regional economies and provides baseline data from IMPLAN and from the Regional Economic Information System.

3.1 Economic Baseline Measures

3.1.1 Value of Production

Value of production is the total value of output produced by industries located in the region. Value of production is usually measured from the market value of goods sold. 1997 data from IMPLAN are used in the analysis.

3.1.2 Employee compensation

Employee compensation is wages and salaries and value of benefits. 1997 data from IMPLAN are used in the analysis.

3.1.3 Value Added

Value added is employee compensation, proprietor's income, other property-type income, and indirect business taxes. Proprietor's incomes are net incomes of businesses operated by proprietors in the region. Other property-type income includes rents, interest and dividends. 1997 data from IMPLAN are used in the analysis.

3.1.4 Employment

Employment is the number of jobs at industries in the region. Jobs are full-time equivalents. For direct agricultural employment, a job is 2000 hours. 1997 data from IMPLAN are used in the analysis.

3.2 Economic Baseline Measures for Sacramento Valley Counties

Table 6. shows baseline levels of economic activity by county. These data are from the IMPLAN data set. IMPLAN accounting conventions differ slightly from some other common economic data measurement standards.

Table 6.
Baseline Levels of Economic Activity by County, 1997 Dollars

County	Total Value of Output	Total Regional Value Added	Total Wages and Salaries	Value of Output in Agricultural Industries	Total Employment
	(Million $)	(Million $)	(Million $)	(Million $)	(Jobs)
Butte	6,319	3,803	2,063	419	96,329
Colusa	1,085	456	212	381	10,781
Glenn	1,071	504	254	276	12,308
Placer	11,081	6,506	3,258	123	125,480
Shasta	5,827	3,495	1,954	127	80,937
Solano	12,483	7,524	4,163	253	146,509
Sutter	2,707	1,606	780	469	38,201
Tehama	1,444	832	462	162	21,694
Yolo	8,365	5,064	3,081	640	98,433
Yuba	1,767	1,218	740	195	26,878
Source: IMPLAN data for 1997. See text for definitions					

3.3 Farm Income and Expenditure Estimates from the Regional Economic Information System

California Water Code Section 1810 requires that effects on the "overall economy" be considered, but local communities are often concerned with the effects of transfers on particular segments of their agricultural economies, and these concerns might be considered in evaluating the reasonableness of a water transfer. Appendix 1 provides baseline farm income and expenditure estimates for Sacramento Valley counties from the U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Information System.

4.0 Methods

4.1 The Simple Approach and the Detailed Analysis

The analysis estimates the amount of impact on county output, employment, wage and salary income, and value added from water transfers by ceasing irrigation and idling land on a temporary (annual) basis. For every crop under a no-irrigation contract, it is assumed that the entire yield (production per acre) and sales revenue is lost to the region. That is, the farmer does not harvest a crop. The analysis uses county-level 1997 IMPLAN data and models to develop the impact estimates, except that for direct agricultural employment impacts, data from the UCCE budgets are used. For direct output losses, County Agricultural Commissioner (CAC) data are used.

If the crop is a program commodity (rice, cotton, wheat, barley, corn) a government payment is obtained both with and without the water transfer. This represents the current structure of market transition payments under the Federal Agriculture Improvement and Reform Act of 1996. New farm legislation in 2002 could change this assumption.

Two approaches are taken. The simple approach shows the total effect of idling irrigated land where the I-O input is the dollar value of crop production that is lost. Loss per acre is crop sales revenue based on the CAC data.

For the detailed analysis, I-O input data are developed from detailed information about crop expenditures, net revenues and forward processing. With the transfer, most variable crop expenditures, including land rent and water cost, are not required. The reduced variable crop expenses also become reduced expenditures in the regional economy. On the other hand, there are some expenditures required to idle land that are included.

Forward linked industries lose revenue. The lost value is the difference between the value of the raw product and the value when it leaves the county. This lost value can be input to the I-O model if there is an appropriate industry available. For example, IMPLAN includes rice milling, and this sector is used in the detailed analysis. For processing tomatoes, IMPLAN has a canned fruit and vegetable sector, but more detailed expenditure data are available for tomato processing in California (Durham et. Al, 1995). Net revenues and expenditures are estimated from this source outside of the I-O model and the expenditures become inputs to each county I-O model.

Agricultural storage and transportation businesses lose income, and their expenditure in the regional economy is reduced. Some storage and transportation expenditures are included in the UCCE budgets. Additional transportation expenditure losses are counted for grains, processing tomatoes and dry beans, and additional storage expenditures are counted for grains.

The change in regional expenditures caused by a water transfer involves more than farm expenditures and forward processing. In particular, farmers also experience changes in their net revenues and personal income from the water transfer. These net revenues are assumed to be respent in the economy as household income to the extent that persons receiving the net revenues live in the county.

It is assumed that the farmer acts as the water seller and that the farmer is also the landowner. This assumption is supported by survey results from the DWB (Dixon et al., 1993). For their sample of no-irrigation contracts, farmers received 93 percent of water bank payments. Landlords received only 6 percent, and water agencies or counties received only 1 percent.

As part of this analysis, agricultural authorities in the Sacramento Valley were queried about the residence of farmers (Rich, 2001). This information suggests that nearly all farmers live within or near the county that their owned or leased farmland is located. Therefore, it was assumed that 90 percent of net farm income becomes household income.

In truth, landowners often rent land for farming, and a potential issue regards whether impacts may be different in this situation. The landowner who leases his water forgoes the land rent, but the tenant does not have to pay it, so there is no net effect involving land rent. Differences only arise if landowners spend their income from water transfers differently than farmers. This may happen if the landlord is not a resident of the county. It is possible that, in some situations, the tenant farmer may lease the water. If the tenant is the water seller, he pays land rent with or without the transfer. Therefore, land rent can again be ignored. Overall, the assumption about the situation of the seller should not have a large effect on results. However, transfers involving land leased by non-resident landlords where the landlord is also the water seller may result in more adverse economic effects than estimated here,

With the transfer, it is assumed that the buyer pays the cost of water directly to the water provider. It is assumed that the water buyer also reimburses the water district or provider for any additional costs caused by the transfer. Therefore, it is assumed that the district is made whole, and no analysis of water district revenues or expenses is included. Also, water transfer revenue to the farmer is net of the cost of water.

With the transfer, there are expenses to maintain the fallow land that are counted. These expenses subtract from the water transfer revenue that the farmer has available to spend in the county.

Table 7 compares income and expenses with and without transfers and shows how net revenue increases for the farmer/landowner are calculated. These are handled as an increase in household income in the I-O modeling.

Table 7.
Net Economic Effect of a Water Transfer on Regional Net Revenues

	Without Water Transfer		With Water Transfer		Net Revenue Gain from Water Transfer
Perspective	Revenues	Expenses	Revenue	Expenses	
Farmer/Land owner	Crop Revenue	Variable crop expenses	Water transfer revenue	Water transfer expenses	Water transfer revenue, net of water transfer expenses, minus loss of crop revenue, net of variable crop expenses and water cost
	Governmnt Payment	Fixed crop expenses	Governmnt payment	Fixed crop expenses	
		Water cost			
Irrigation District	Water Cost		Buyer pays water cost		0
Farm Input Industries	Variable crop expenses by farmers	Variable costs of providing inputs	0	0	Loss of revenue net of variable costs in input industries
Forward-linked industries	Market value added in forward processing	Variable expenses of forward processing	0	0	Loss of revenue net of variable costs in forward-linked industries
All Regional Industries		Fixed expenses in regional industries		Fixed expenses in regional industries	

Input data for the detailed analysis are:

1) Net revenue from the water transfer

It is assumed that the landowner/farmer receives $50 per AF for any water sold. Ninety percent of water transfer income, net of the variable cash expenditures of idling land (3 below), becomes household expenditure.

2) Variable crop expenditures that are lost because of the water transfer

The detailed analysis relies on the UCCE crop budgets, and information on Standard Industrial Classifications to develop estimates of farm expenditure by economic sector. Multiple UCCE crop budgets were used for most crops to capture variation in common farming techniques. For example, wheat budgets were available for wheat as a double crop and wheat in rotation with other crops. Each crop budget was weighted according to 1) how recently is was developed, 2) the variety of crop in the budget relative to the share of that variety in the county, 3) the location of the crop production described in the budget relative to the county in the I-O analysis.

Some of expenditures lost because of land idling for water transfers are:

- Machine and hand labor costs
- Petroleum, electricity and repair costs
- Materials, custom operations, and bank financing costs

Some expenditures that continue even with the land idling are:

- Certain fixed cash costs, non-cash fixed costs, and land rent or interest
- Costs already expended when the farmer decides to participate
- Water costs

Since these expenditures are assumed to be unaffected, no analysis is needed.

3) Variable cash expenditures when land is idled

Certain machinery costs, petroleum (fuel), material and custom costs are required when land is idled. These expenditures are handled as an offset to the variable expenditure reductions from 2), and they reduce the net income from the water transfer in 1) available to spend.

4) Net returns from crop production lost because of the water transfer

The farming income lost by the water transfer is crop revenue minus the amount of expenditure from 2) that is avoided by idling the land. Again, 90 percent of this residual is treated as household income. The crop revenue includes the effect of any support prices on price received, but it does not include fixed payments per acre such as market transition payments that are received with or without the transfer.

5) Additional expenditures lost because transportation, processing, milling and storage expenditures are reduced with the reduced crop production.

These losses are generally not included in crop budgets, so a variety of additional data sources are used as detailed for each crop in Section 4.5 below. Generally, the sources are

- detailed budgets of the forward-linked industry showing cost of raw product, disaggregated expenses, and value of output;
- industry sources have provided estimates of storage and transportation costs
- data on market prices at the farm and distant points can be used to estimate transportation costs

4.2 Selection of Crops for Analysis

The locations and crops selected for analysis were picked based on historical participation in no-irrigation transfer markets, expectations regarding crops and locations allowed to participate in the dry-year transfer program, potential amount of acreage, and availability of data.

The scope of the analysis includes irrigated field crops and vegetables on the Sacramento Valley floor outside of the inner Delta. Other areas and crops are excluded because of concerns involving ability to participate in future dry-year markets. All tree and vine crops, alfalfa, and irrigated pasture are excluded. These crops would be unlikely to experience idling in significant acreage, or the amount of real water supply made available by idling is very uncertain. Some locations are excluded because of concerns regarding the ability to monitor irrigation conditions or obtain real water supply. Farmland in the inner Delta is excluded. Lands in the San Joaquin Valley have been excluded because they were beyond the scope of the requested analysis.

The potential scope still includes acreage in ten counties and many crops. It would not be possible to evaluate all potential combinations of counties and crops, and many crops are grown on such small acreage that results would not be useful. Therefore, 1999 CAC crop data were used to screen crops for the analysis. For each county, eligible crops were sorted by acreage in descending order. Crops were then excluded if there was not a UCCE crop budget available for that crop. Then, a maximum of five crops was selected to a minimum of 5,000 acres. If a county had no eligible crop acreage over 5,000 acres, a minimum of one crop was selected for analysis. In Solano County, there were about 5,800 acres of sugar beets in 1999, but less than 1,000 acres were reported in 2,000. Therefore, sugar beets in Solano County were excluded.

Table 8 shows the counties and types of crops included in the analysis with data on 1999 acreage, yield, production, price and value.

4.3 Crop Revenues and Yields

Crop revenues are input for the simple approach, and crop revenues net of variable costs are input for the detailed analysis. Crop revenue and yield data for the period of 1995 to 1999 were taken from CAC data to develop weighted averages for the 1995 to 1999 period. These data are assumed to represent normalized averages for 1997. The 1997 estimates were chosen because the IMPLAN model used in the analysis is based on 1997 data.

Table 8.
List of Counties and Crops for Input-Output Analysis and 1999 Acreage, Yield, Production, Price and Value

County	Crop Name	Harvested Acres	Tons Yield	Tons Produced	Price $/Ton	Million $ Value
Butte	Rice	96,500	3.69	356,083	$290	$103.27
Colusa	Rice	140,920	3.75	528,450	$293	$154.84
Colusa	Processing Tomatoes	30,500	35.70	1,088,850	$60	$65.88
Colusa	Wheat	19,740	2.40	47,376	$95	$4.50
Colusa	Safflower	12,400	1.00	12,400	$290	$3.60
Colusa	Upland Cotton	6,100	0.64	3,889	$1,440	$5.60
Colusa	Dry Beans	5,900	0.90	5,310	$600	$3.19
Glenn	Rice	82,980	3.75	311,175	$290	$90.24
Glenn	Field Corn	15,685	5.50	86,268	$85	$7.33
Glenn	Wheat	15,104	2.75	41,536	$89	$3.70
Glenn	Sunflower Seed	10,053	0.52	5,251	$926	$4.86
Placer	Rice	15,793	3.10	48,959	$293	$14.34
Shasta	Wild Rice	2,833	0.70	1,969	$920	$1.81
Solano	Wheat	36,270	2.59	93,792	$90	$8.44
Solano	Processing Tomatoes	18,341	34.58	634,231	$58	$36.79
Solano	Field Corn	15,600	5.04	78,624	$90	$7.08
Solano	Safflower	9,977	1.25	12,471	$300	$3.74
Solano	Barley	5,778	2.20	12,687	$95	$1.21
Sutter	Rice	100,087	3.75	375,326	$292	$109.60
Sutter	Processing Tomatoes	18,763	34.71	651,264	$58	$38.03
Sutter	Safflower	15,977	1.28	20,451	$300	$6.14
Sutter	Wheat	7,921	2.36	18,694	$90	$1.67
Sutter	Dry Beans	7,143	0.82	5,865	$550	$3.23
Tehama	Grain For Hay	4,600	2.00	9,200	$60	$0.55
Yolo	Processing Tomatoes	67,114	33.93	2,277,178	$58	$132.67
Yolo	Wheat	33,832	2.41	81,535	$90	$7.36
Yolo	Safflower	29,545	1.15	33,977	$292	$9.92
Yolo	Rice	24,483	3.71	90,832	$268	$24.34
Yolo	Field Corn	13,513	5.12	69,187	$86	$5.94
Yolo	Sunflower For Seed	10,381				$7.63
Yolo	Grain For Hay	7,340	2.90	21,286	$57	$1.22
Yuba	Rice	36,000	3.45	124,200	$240	$29.81

Source: CAC, 2000

4.4 IMPLAN Application

To apply IMPLAN, a model was developed for each county included in the analysis. IMPLAN can provide estimates of direct, indirect, and induced impact coefficients per direct dollar of value of output change. The impact measures are value of output, value added, wages and salaries, and employment. The coefficients were copied into an EXCEL spreadsheet where total effects are calculated and summed over the directly affected sectors.

The simple approach is complicated by the fact that IMPLAN does not include crop sectors that correspond exactly to the crop types considered in this analysis. The pertinent crop types in IMPLAN are

- Cotton
- Food grains
- Feed grains
- Hay and pasture
- Vegetables
- Miscellaneous crops, and
- Oil bearing crops

The data in IMPLAN reflect a mix of individual crop types in the county. For example, cotton may include Pima and upland, food grains may include rice, wheat, and corn, hay and pasture include alfalfa as well as grain for hay. Also, the economic multipliers from IMPLAN reflect national average expenditure patterns for those crop types.

For the detailed analysis, the IMPLAN sectors directly affected by water transfers are

- Agricultural services
- Rice milling
- Motor freight transport
- Electricity services
- Gas services
- Water supply
- Wholesale
- Auto dealers and service stations
- Banking
- Low income households, and
- Medium income households

The detailed approach does not count the value of lost output as a direct effect. Therefore, this value from the CAC data is added into the total value of output effect. The detailed analysis also does not generate an estimate of direct agricultural labor and wages and salaries lost by land idling. Estimates were developed from the UCCE crop budgets. Direct labor losses were added into the total employment effect, and direct wage and salary losses were added into the wage and salaries and value added totals.

4.5 Regional Expenditures in the Detailed Analysis

The following sections describe assumptions and qualifications about how regional expenditures in the detailed analysis are developed for use with the IMPLAN multipliers. Forward processing, transportation and storage effects are discussed.

Rice

The landowner/farmer receives $50 per AF for 3.3 AF of water per acre idled, but expenses of idling land offset some of this income. All rice production is lost, and the farmer gives up the value of crop sales less variable costs avoided. The government payment for rice land enrolled in the commodity program is obtained in any case.

Table 9 shows input data to the county I-0 models for rice for the detailed analysis. Data is provided as dollars of lost direct expenditure per acre idled. For rice, variable farm expenditures lost are $467 (45+422) per acre, much more that the $269 per acre estimated for land enrolled in DWR's 1991 Water Bank (Table 5).[1] This suggests that the detailed analysis may overstate impacts to the county. The other effects in Butte County include increased expenditure of $102 of water transfer net revenue, crop revenue net of avoided costs of $80, and losses in forward linked industries of $628 per acre.

Data on value added in rice milling were obtained from the 1997 Economic Census (USCB, 1997). No data was found specific for California. On average, 60 percent of the value of milled rice output is the cost of rough rice. Therefore, for every $1,000 of rough rice there is an additional value added of $666 in milling. IMPLAN includes a rice milling sector. Without California-industry specific data, the existing IMPLAN sector was judged to be best-available.

The UCCE crop budgets included the cost of transporting rice from the field to the drier, and the cost of drying, but hauling cost from the drier to the warehouse was not included (Williams et al., 2001). The detailed analysis includes an expenditure of $0.50 per hundredweight (cwt) to cover expenditures for transportation from the drier to the mill and from the mill to port.

IMPLAN results show that there is no rice milling in Sutter, Yuba, Placer or Glenn Counties, and this was confirmed by discussion with local experts. Therefore, there are no rice milling effects in these counties.

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[1] Some of this difference may be accounted for by inflation between 1991 and 1997. The CPI increased about 18 percent between 1991 and 1997.

Table 9.
IMPLAN Model Input for Rice
Direct Dollar Expenditure Reduction Per Acre, 1997 $

County	Water Transfer Net Revenue	Laborer Income	Other Farming Expenditure	Crop Revenue Minus Avoided Costs	Total On-Farm Effect	Forward Linkages	Total
Butte	-102	45	422	80	445	628	1,073
Colusa	-101	43	419	58	420	573	993
Glenn	-104	44	425	88	453	39	491
Placer	-91	45	410	-11	353	36	389
Sutter	-101	44	415	61	419	38	458
Yolo	-101	44	421	65	428	619	1,048
Yuba	-101	46	410	79	433	38	471

Wheat and Barley

The landowner/farmer receives $50 per AF for 0.5 AF of water per acre enrolled, but expenses of idling land offset some of this income. It is assumed that the buyer also pays the cost of water to the water provider.

Table 10 shows input data to the IMPLAN models for wheat and barley.

Variable expenditures lost for wheat are $76 to $91 per acre, about the same as the $63 per acre estimated for land enrolled in DWR's 1991 Water Bank (Table 5) after accounting for inflation.

Grain crops are planted relatively early in the growing season. Most Sacramento Valley farmers prepare their fields for planting in the fall and plant them soon after. Therefore, wheat growers incur an unusually large proportion of their cultural costs before the dry year water purchase program begins. If it turns out that there is enough rainfall during the fall, winter and spring to grow a crop then no irrigation may be required. Therefore, DWR might get very little effective water from non-irrigation of wheat, and the quantity of wheat produced may be unaffected.

The analysis includes lost expenditures for transportation and storage. Transportation expenditures are $0.50 per cwt, and storage expenditures assumed to be $0.05 per cwt per month for 7.5 months. It is assumed that all of this expenditure occurs in the county from which the water is transferred. Storage and transportation expenditure is based on information from local trucking companies (Adams Grain, 2002) and The California Grain and Feed Report (2001). It is assumed that an average of 100 miles of transportation requires expenditure in the county of origin.

Table 10.
IMPLAN Model Input for Wheat and Barley
Direct Dollar Expenditure Reduction Per Acre, 1997 $

County	Water Transfer Net Revenue	Laborer Income	Other Farming Expenditure	Crop Revenue Minus Avoided Costs	Total On-Farm Effect	Forward Linkages	Total
Colusa	23	12	65	60	160	43	203
Glenn	20	11	68	11	110	35	145
Solano barley	18	4	87	-2	107	36	143
Solano	19	12	69	30	130	40	170
Sutter	20	12	64	24	121	43	164
Yolo	19	12	67	29	128	38	166

Processing Tomatoes

The landowner/farmer receives $50 per AF for 1.8 AF of water per acre enrolled, but expenses of idling land offset some of this income. The tomato production is lost to the region, and the farmer gives up the value of crop sales less variable costs.

Growers of processing tomatoes normally sign a contract with a tomato processor before planting their crop. The use of contracts raises some issues about the economic and hydrologic effects of water transfers from land that would have grown tomatoes. Most Sacramento Valley processing tomato growers would not choose to participate in DWR's land idling program unless it was made more lucrative. The main reason for this is the valuable, multi-year contracts that virtually all tomato growers sign with tomato processors. The large majority of tomato growers would not jeopardize those contracts for the sake of a modest one-year land idling payment. Possibly, land offered for enrollment in DWR's program would not have produced tomatoes anyway.

However, a farmer might participate if he has more acreage available for growing tomatoes than he needs to meet his contract. He would idle acreage for DWR but shift the production of tomatoes to different acreage to maintain the production required by his contract. In this case, the water savings from land fallow for the water market is actually offset by increased water use somewhere else. Perhaps, the tomatoes grown somewhere else would displace some other, non-tomato crop. Therefore, DWR's program would have no negative economic impact on the tomato industry, and any regional economic or hydrologic effects would be caused by the other displaced crop, not tomatoes.

This analysis assumes that DWR's program would include safeguards to ensure that tomato idling and water savings would not be offset by increased plantings and water use elsewhere. Therefore, the amount of lost production is also a regional loss, and additional losses occur in forward processing.

Data on tomato processing were obtained from university and industry sources. The amount and location of processing tomato capacity in the Sacramento Valley have changed substantially in recent years. Currently, there are four plants operating or planning operations in the region. The plants assumed to be operating are shown in Table 11 below.

Table 11. Tomato Processing Plants in the Sacramento Valley			
Plant Name	**Location**	**Type**	**Weekly Capacity (000 tons)**
Morning Star	Williams, Colusa Co.	Paste	101.1
Colusa County Canning Co.	Williams, Colusa Co.	Paste	25.4
Pacific Coast Producers	Woodland, Yolo Co.	Diversified	46.7
Dixon Canning Company	Dixon, Solano Co	Paste	33.0
Hanover	Colusa	Paste	8.7
Source: Durham et al, 1995, and Evans 2001			

Pacific Coast Producers currently operates a diversified plant in Oroville. The analysis assumes that tomato processing in this plant will cease and operations moved to the plant formerly owned by Contadina Foods, Inc. in Woodland. Also, it is assumed that the diversified plant operated by Harter Packing Company in Yuba City will be leaving the region. For Sutter County, there are no tomato processing effects counted in the IMPLAN analysis.

IMPLAN does not include a separate tomato processing industry. Data on expenditure patterns are from Durham et al (1995). From Table 11, about 80 percent of capacity is in paste plants and 20 percent in diversified plants. Durham et al. also provide labor expenditure shares in small, medium and large plants. About 5, 35 and 60 percent of production is in each of these categories, respectively. It is estimated that value added in processing is about equal to the value of raw product. Processing expenditure shares used in the IMPLAN analysis are electricity, 3.5%; gas, 8.5%; wholesale, 54.2%; water, 0.2%; and labor, 33.6%.

The analysis also includes a cost of $12.00 per ton of raw tomatoes to cover transportation to the processing plant. It is assumed that all of this expenditure occurs in the county from which the water is transferred.

Table 12 shows input data to the I-0 models for processing tomatoes.

Table 12.
IMPLAN Model Input for Processing Tomatoes
Direct Dollar Expenditure Reduction Per Acre, 1997 $

County	Water Transfer Net Revenue	Laborer Income	Other Farming Expenditure	Crop Revenue Minus Avoided Costs	Total On-Farm Effect	Forward Linkages	Total
Colusa	83	296	638	1,188	2,205	2,379	4,584
Solano	74	283	632	974	1,963	2,099	4,062
Sutter	75	293	634	1,029	2,031	385	2,416
Yolo	76	286	632	1,019	2,014	2,157	4,170

Safflower

The landowner/farmer receives $50 per AF for 0.7 AF of water per acre enrolled, but expenses of idling land offset some of this income. It is assumed that the buyer also pays the cost of water to the water provider. The safflower production is lost to the region, and the farmer gives up the value of crop sales less variable costs.

Irrigated safflower in the Sacramento Valley is usually planted in April. Safflower can often be planted much earlier with the hope that it will be able to survive on existing soil water and rainfall. Up to two-thirds of the Sacramento Valley's safflower is grown without irrigation in most years, and much is grown under contract. With contracts, the concerns regarding water savings and economic effects that were discussed for processing tomatoes apply.

The analysis includes lost expenditures for transportation and storage. Transportation expenditures are $0.50 per cwt, and storage expenditures are $0.076 per cwt per month for 8.75 months (Adams Grain, 2002). It is assumed that all of this expenditure occurs in the county from which the water is transferred.

Table 13 shows input to the IMPLAN models for safflower.

Table 13.
IMPLAN Model Input for Safflower
Direct Dollar Expenditure Reduction Per Acre, 1997 $

County	Water Transfer Net Revenue	Laborer Income	Other Farming Expenditure	Crop Revenue Minus Avoided Costs	Total On-Farm Effect	Forward Linkages	Total
Colusa	-2	33	101	244	376	8	385
Solano	-3	33	101	256	388	28	416
Sutter	-2	33	101	254	386	27	413
Yolo	-2	33	101	227	360	24	383

Cotton

The landowner/farmer receives $50 per AF for 2.3 AF of water per acre enrolled, but expenses of idling land offset some of this income. It is assumed that the buyer also pays the cost of water to the water provider. The cotton production is lost to the region, and the farmer gives up the value of crop sales less variable costs.

Sacramento Valley cotton growers generally prepare their cotton beds in the fall. If a cotton grower decides to participate in DWR's land idling program, they would still incur those fall costs, plus spring or summer costs to keep the weeds down. Cultural costs for an acre of Valley cotton land enrolled in DWR's land idling program could be as little as $60.

No forward linkage effects are included. Farm costs and revenues carry the cotton to the point where it leaves the cotton gin. This is believed to be enough expenditure to fairly represent the within-county direct effects.

Table 14 shows input to the IMPLAN models for cotton.

Table 14.
IMPLAN Model Input for Cotton
Direct Dollar Expenditure Reduction Per Acre, 1997 $

County	Water Transfer Net Revenue	Laborer Income	Other Farming Expenditure	Crop Revenue Minus Avoided Costs	Total On-Farm Effect	Forward Linkages	Total
Colusa	-55	77	483	57	562	0	562

Dry Beans

The landowner/farmer receives $50 per AF for 1.5 AF of water per acre enrolled, but expenses of idling land offset some of this income. It is assumed that the buyer also pays the cost of water to the water provider. Some UCCE dry bean crop budgets include warehousing, sorting, grading and bagging, but county crop prices from some county crop reports are a mix of farm gate and warehouse prices. Therefore, half of the warehouse cost was added back into the crop revenue.

Table 15 shows input to the IMPLAN models for dry beans.

Table 15.
IMPLAN Model Input for Dry Beans
Direct Dollar Expenditure Reduction Per Acre, 1997 $

County	Water Transfer Net Revenue	Laborer Income	Other Farming Expenditure	Crop Revenue Minus Avoided Costs	Total On-Farm Effect	Forward Linkages	Total
Colusa	-25	72	312	78	438	9	447
Sutter	-24	74	317	84	450	10	460

The analysis includes lost expenditures for transportation. Transportation expenditures are $0.50 per cwt. It is assumed that all of this expenditure occurs in the county from which the water is transferred.

Field Corn

The landowner/farmer receives $50 per AF for 1.8 AF of water per acre enrolled, but expenses of idling land offset some of this income. It is assumed that the buyer also pays the cost of water to the water provider. Variable expenditures lost are over $300 per acre, much more that the $70 per acre estimated for land enrolled in DWR's 1991 Water Bank (Table 5).

The analysis includes lost expenditures for transportation and storage. Transportation expenditures are assumed to be $0.50 per cwt, and storage expenditures are assumed to be $0.05 per cwt per month for 7.5 months. It is assumed that all of this expenditure occurs in the county from which the water is transferred.

Table 16 shows input to the IMPLAN models for field corn.

Table 16.
IMPLAN Model Input for Field Corn
Direct Dollar Expenditure Reduction Per 1000 $ Direct Output Reduction by County, 1997 $

County	Water Transfer Net Revenue	Laborer Income	Other Farming Expenditure	Crop Revenue Minus Avoided Costs	Total On-Farm Effect	Forward Linkages	Total
Glenn	-36	77	248	28	317	89	406
Solano	-35	81	235	36	316	83	399
Yolo	-36	79	239	47	329	84	414

Sunflower

The landowner/farmer receives $50 per AF for 1.4 AF of water per acre enrolled, but expenses of idling land offset some of this income. It is assumed that the buyer also pays the cost of water to the water provider.

The analysis includes lost expenditures for transportation and storage. Transportation expenditures are assumed to be $0.50 per cwt, and storage expenditures are assumed to be $0.05 per cwt per month for 7.5 months (Adams Grain, 2002). It is assumed that all of this expenditure occurs in the county from which the water is transferred.

Table 17 shows input to the IMPLAN models for sunflower.

Table 17.
IMPLAN Model Input for Sunflower
Direct Dollar Expenditure Reduction Per 1000 $ Direct Output Reduction by County, 1997 $

County	Water Transfer Net Revenue	Laborer Income	Other Farming Expenditure	Crop Revenue Minus Avoided Costs	Total On-Farm Effect	Forward Linkages	Total
Glenn	-13	36	259	131	413	5	418
Yolo	-16	36	266	260	546	7	553

Grain Hay

The landowner/farmer receives $50 per AF for 0.5 AF of water per acre enrolled, but expenses of idling land offset some of this income. It is assumed that the buyer also pays the cost of water to the water provider.

There is a transportation expenditure of $15 per ton. This expenditure is based on the difference between observed hay prices in the Sacramento Valley and prices observed at dairies in the Modesto-Turlock area (USDA, 2001). It is assumed that all of this expenditure occurs in the county from which the water is transferred.

Table 18 shows input to the IMPLAN models for grain hay.

Table 18.
IMPLAN Model Input for Grain Hay
Direct Dollar Expenditure Reduction Per 1000 $ Direct Output Reduction by County, 1997 $

County	Water Transfer Net Revenue	Laborer Income	Other Farming Expenditure	Crop Revenue Minus Avoided Costs	Total On-Farm Effect	Forward Linkages	Total
Tehama	5	2	92	-50	50	28	78
Yolo	8	2	110	-14	106	39	145

Wild Rice

In Shasta County, the landowner/farmer receives $50 per AF for 2.0 AF per acre of wild rice but expenses of idling land offset some of this income. Table 19 shows input to the IMPLAN models for wild rice.

Table 19.
IMPLAN Model Input for Wild Rice
Direct Dollar Expenditure Reduction Per 1000 $ Direct Output Reduction by County, 1997 $

County	Water Transfer Net Revenue	Laborer Income	Other Farming Expenditure	Crop Revenue Minus Avoided Costs	Total On-Farm Effect	Forward Linkages	Total
Shasta	-74	16	938	-23	857	657	1,514

The detailed analysis includes expenditure for forward processing based on rice milling costs, and an expenditure of $0.50 per hundredweight (cwt) to cover expenditures for transportation.

5.0 Comparison of Results from the Simple Approach and Detailed Analysis

The input data in Tables 9 through 19 and the results in Tables 1 through 4 were developed by the detailed analysis. This section compares the detailed analysis results to results from the simple approach. With the adjustments in the detailed analysis for water transfer net revenue, farming net revenues, fixed costs and forward linkages, there is no reason to expect that results would be comparable.

Table 20 compares results of the simple approach and the detailed analysis for some selected county-crop combinations. In general, the detailed analysis shows larger impacts per acre than the simple, naïve approach. For rice, differences between results in the two approaches depend on whether milling occurs in that county. Without milling (i.e., not Yolo county), some of the results from the two approaches are comparable. Impacts from the detailed analysis are generally larger, but total value added is smaller. In Yolo county, all impacts per acre are larger. For corn, the detailed analysis shows larger value of output, wage and salary, and employment impacts, but value added impacts are about the same. The pattern of differences for wheat are similar. For processing tomatoes, the detailed analysis shows larger impacts for all of the measures, even in counties without tomato processing.

Table 20.
Selected Comparison of Results from Simple and Detailed Analysis
Dollar Impacts per Acre, and Jobs per 1,000 Acres

Rice, Yuba County	Total Output	Wages & Salaries	Value Added	Jobs
Detailed analysis	$935	$307	$615	24.3
Simple Approach	$1,092	$163	$774	22.1
Rice, Yolo County				
Detailed analysis	$2,455	$530	$931	22.8
Simple Approach	$1,244	$186	$608	16.6
Rice, Sutter County				
Detailed analysis	$1,563	$361	$647	21.5
Simple Approach	$1,170	$172	$691	18.4
Rice, Placer County				
Detailed analysis	$1,441	$335	$653	18.9
Simple Approach	$1,113	$210	$893	21.2
Corn, Yolo County				
Detailed analysis	$1,245	$315	$518	15.3
Simple Approach	$983	$141	$476	10.7
Corn, Solano County				
Detailed analysis	$1,390	$359	$617	18.5
Simple Approach	$1,027	$164	$643	13.2
Corn, Glenn County				
Detailed analysis	$1,156	$267	$450	17.0
Simple Approach	$754	$76	$394	8.6
Wheat, Glenn County				
Detailed analysis	$496	$83	$144	5.9
Simple Approach	$395	$41	$203	5.6
Wheat, Yolo County				
Detailed analysis	$568	$109	$187	5.8
Simple Approach	$554	$83	$271	7.4
Tomato, Yolo County				
Detailed analysis	$8,159	$2,104	$3,873	90.7
Simple Approach	$3,258	$683	$1,688	33.4
Tomato, Sutter Co.				
Detailed analysis	$5,702	$1,351	$2,404	75.8
Simple Approach	$2,861	$631	$1,846	31.6
Tomato, Solano Co.				
Detailed analysis	$9,137	$2,401	$4,519	109.6
Simple Approach	$2,864	$707	$2,000	29.8

For the simple approach, rice and wheat are food grains, corn is a feed grain, safflower Is an oil crop, and processing tomatoes are a vegetable (these are the affected IMPLAN sectors). All results include direct, indirect and induced effects.

6.0 Impacts on Local Governments

Local governments – counties, towns and special districts – could face a variety of adverse economic effects from temporary water transfers. These impacts are, generally, income-reducing or cost-increasing. Income reducing effects are revenue losses from lost taxes, fees, and charges. Cost increases are caused by increases in need for public expenditures; for example, for unemployment, welfare, or retraining. Increased public costs could occur if land idling has physical effects. For example, weeds on idle land could increase public weed control costs.

The analysis above assumed that water districts would be compensated by the buyer for whatever costs are caused by the water transfer. These costs may be lost net revenues or increased expenses. Lost revenues should be net of any cost savings because the district does not need to deliver water to the farmer. Increased expenses may be required in the form of paperwork and other administration.

Property taxes could be affected if property values are affected. Theoretically, it is not possible to say whether voluntary water transfers would increase or decrease property tax revenues in a county, because some property values in the county should increase in value. For owners of irrigated land, water transfers represent a potential source of profit. Some persons may view irrigated land as an investment property where water transfers are a source of income. The purchase of properties by these persons increases property prices. On the other hand, some properties; farm stores, for example, may face reduced income, profits, and property values.

Sales taxes are roughly 7 percent of retail sales, and 1 percent is returned directly to the county. Information from the I-O analysis can be used to estimate sales tax losses due to temporary water transfers. IMPLAN data suggest that low and medium income households spend 15.3 and 15.6 percent, respectively, of their income on retail sales. I-O analysis impacts on value added - wages, salaries, proprietor's incomes, and rents and dividends, are assumed to represent income for county households. Value added may overstate impacts on household income because some value added payments go to non-residents. With these assumptions, Table 21 below can be derived.

Table 21.
Impact of a One Acre Reduction of Each Crop on Sales Tax Revenue Returned to the County, 1997 Dollars

	Rice	Wheat	Process Tomato	Saf-flower	Field Corn	Dry Beans	Sun-flower	Grain for Hay	Barley	Wild Rice	Upland Cotton
Butte	$1.75										
Colusa	$1.00	$0.27	$5.34	$0.42		$0.75					$0.98
Glenn	$0.93	$0.23			$0.72		$0.60				
Placer	$1.04										
Shasta										$2.69	
Solano		$0.40	$7.23	$0.74	$0.99				$0.36		
Sutter	$1.04	$0.32	$3.85	$0.64		$0.99					
Tehama								$0.22			
Yolo	$1.49	$0.30	$6.20	$0.56	$0.83		$0.86	$0.30			
Yuba	$0.98										

Water transfers may increase costs for local governments in the form of unemployment costs and other social services. More information about relationships among unemployment and costs of social services would be required to quantify impacts.

7.0 Factors that Influence Reasonableness of Economic Effects from Land Idling

Section 1810 requires that State or local agencies allow the use of water conveyance facilities for water transfers if, among other considerations, the transfer can occur "without unreasonably affecting the overall economy of the county from which the water is being transferred." The law requires some consideration of what may be reasonable. There is no legal or economic guidance that can define an exact level of economic effect that might qualify. However, conditions that might make a given level of economic effects more or less reasonable can be considered.

7.1 Local Economies

Local economies vary considerably in their size and structure. A level of effect that might be easily absorbed by one economy might be devastating to others. Economic characteristics that make an effect less unreasonable may include:

- Size of the local economy
- A strong economy (low unemployment, perhaps)
- Opportunities for re-employment of labor, including opportunities in adjacent areas
- Plans for new industry and economic opportunity
- High per-capita incomes

A lack of these characteristics would make a given amount of idling more detrimental or less reasonable for a local economy.

7.2 Conditions in the Local Agricultural Economy

Section 1810 only requires consideration of the overall economy, but "reasonableness" might consider effects on the most affected parts of the economy. Appendix A includes detailed data on baseline agricultural conditions in each of the counties. REIS information that could be used as a basis of comparison for the direct effects of water transfers includes:

- Cash receipts from marketings
- Cash receipts: livestock and products
- Cash receipts: crops
- Government payments
- Total production expenses
- Feed purchased
- Livestock purchased
- Seed purchased
- Agricultural chemicals purchased
- Petroleum products purchased
- Hired farm labor expenses
- All other production expenses
- Realized net income
- Total net farm proprietors' income

- Farm wages and perquisites
- Other farm labor income
- Total farm labor and proprietors' income

The UCCE crop budgets and the CAC data provide information on the per-acre effects of land idling. With this information and the REIS data, relative impact measures could be derived. The CAC data provide information on the amount of acreage of each crop in the county.

7.3 Baseline Level of Land Idling

Total economic impacts depend on the total amount of land idling, not just idling for water transfers. Land may be idled because of drought or if crop prices are poor. Land idling could become a condition for payments under federal farm programs, or other State or federal programs may be idling land. The level of idling expected without transfers might be considered in judging if an additional amount of idling is reasonable.

7.4 Variation in Effects: Acreage and Gross Revenue

Variability in production can create economic costs in several ways. Production, storage and transportation capacities must be available to handle the larger-than-average production levels, local economic interests must be able to ride out periods of low economic returns, and future variability results in additional planning costs when future variations are not predictable far in advance. If variation is normal, then the regional economy is able to cope with it. When a region does not experience large normal variation in acreage, production and revenue, there will be costs to introduced variability. Therefore, land idling is more reasonable, all else equal, when a region normally experiences large variation in acreage and gross revenue of a crop, and the variation caused by water transfers is within the normal variation.

Value of output in a region depends on the amount of output and its' unit value. For crops, value of output is acreage times yield times price. Sometimes, value of output will be more variable than acreage. For example, low crop prices may associated with low yields and less acreage. In this case, value of output declines relatively more than acreage, and the variation in value of output is larger than variation in acreage alone. Idling in a period of low prices may be less reasonable than idling during high prices. On the other hand, water transfers may be more welcome as an economic alternative when prices are low. For other crops, reduced acreage and production in a region increases price. This often occurs for bulky crops that are sold locally. For example, idling of hay acreage can increase local hay prices. Other hay growers in the region benefit from land idling, but farmers who feed livestock pay higher costs for feed.

For this report, an analysis of variability of county acreage and gross revenue during the 1995 through 1999 period was developed. The number of observations is five years times the number of counties included for that crop.

Barley acreage and total gross revenue are very variable. For each of these characteristics, 5 of the 10 yearly values differ from the period average by at least 40 percent. This extreme variability is what one would expect when looking at only one county. The number of acres is not large, and the crop is both a "program crop" (one for which growers usually receive federal crop support payments) and a crop with a significant proportion of dryland acres.

Grain corn acreage and total gross revenue are also very variable. For acreage, 8 of the 15 yearly values differ from the period average by at least 20 percent, and 3 of these values differ from the average by at least 30 percent. Total gross revenue shows even more variability: 12 of the 15 yearly values differ from the period average by at least 10 percent, and 7 of these values differ from the average by at least 30 percent. The fact that corn is a program crop may contribute to its variability.

Dry bean acreage and gross revenue appear to have substantial variability, in the moderate range when compared to the other ten crops. Cotton is a highly variable crop. For acreage, 4 of 5 yearly values differ from the period average by at least 20 percent, and 2 of these values differ from the average by at least 40 percent. For gross revenue, all 5 values differ from the average by at least 10 percent, 4 of the 5 values differ from the average by at least 20 percent, and 2 of these values differ from the average by at least 40 percent.

Grain hay acreage is fairly stable in Tehama county. Only 1 of the 5 yearly values differs from the average value by at least 10 percent, and none differs by at least 20 percent. However, gross revenue is a lot more variable: 2 of the 5 values differ from the average by at least 30 percent. A significant proportion of the grain hay in the valley is grown without irrigation most years, which contributes to its revenue variability.

Rice acreage in the valley was surprisingly stable during the 1995-1999 period. Only 2 of the 35 values differ from the period average by at least 10 percent, and none differ by at least 30 percent. Rice gross revenue is more variable: 12 of the 35 values differ from the county average by at least 10 percent, 6 of these values differ from the average by at least 20 percent, and 3 of these values differ from the average by at least 30 percent. Still, this is less variation in gross revenue than for other crops.

In Shasta county, wild rice acreage and total gross revenue are variable.. For acreage, 2 of the 5 values differ from the average by at least 20 percent, and 1 of these differs from the average by at least 40 percent. For gross revenue, 3 of the 5 values differ from the average by at least 10 percent, and 1 of these values differs from the average by at least 30 percent.

Safflower is also a rather variable crop, although safflower acreage and gross revenue do not show the extreme levels of fluctuations that characterize many crops. The high proportion of moderate fluctuation in safflower acreage and gross revenue is probably due in part to the fact that a substantial portion of the valley's safflower acreage is not irrigated most years.

Sunflower seed and processing tomatoes are also variable, although tomato acreage and gross revenue do not show the extreme levels of fluctuations that characterize some other crops. Wheat was the most variable crop, showing large fluctuations in acres and gross revenue for the 1995-99 period in the five valley counties for which wheat data were gathered.

In summary, acreage and gross revenue of almost all of the crops examined are very variable. One notable exception is rice. Rice acreage is relatively stable, probably because much rice land has limited suitability for other crops. Since rice acreage is relatively stable, it may be that rice production factors are not as easily converted to other useful purposes as for other crops, and idling of rice may have more adverse effects than other crops. More analysis of rice production and marketing patterns would be required to test this theory.

7.5 Frequency of Land Idling

The frequency of land idling in a region should be considered in evaluating reasonableness. More frequent fallow means larger effects, on average. Also, more frequent fallow could increase the amount of effect on local economies. Buyers and sellers, faced with variable and uncertain income, are more likely to make permanent business decisions that permanently affect the local economy.

7.6 Diversity of Crop Types

All else being equal, a more diverse mix of crop idling should be considered more reasonable. This is because some types of effects are associated with specific crops. By spreading the types of crops being idled, the effects are also spread among more persons.

7.7 Unique Conditions

The dry-year lease program should be willing to consider a variety of unique situations that may arise. Examples include eminent business decisions, temporary shortages, conditions of local government finances, and the opinions and attitudes of residents.

8.0 Reduction and Compensation Strategies

The dry-year idling program could consider a number of strategies that could reduce or compensate for adverse economic effects. All of these strategies would also make a water transfer more reasonable.

8.1 Reducing Adverse Third-Party Economic Effects

Third party effects can be reduced by reducing land idling or by acquiring water that has the least possible third-party effects.

8.1.1 Obtain water in ways that do not result in land idling

Water may be obtained in ways that do not fallow land. In general, these methods have less adverse effect per unit water than land idling, but hydrologic impacts may be greater, or they may not produce as much money per dollar spent.

8.1.2 Target idling to crops that reduce spending less per unit water

Adverse economic effects could be minimized by idling land that has the least adverse effect per unit water acquired. Table 22 shows value of output reduction per unit water acquired. Value of output data are from Table 1.

Table 22 shows that total county value of output lost per AF of water acquired varies substantially between crops. In Colusa County, for example, rice, dry beans, wheat and cotton idling cause about $400 of lost value of production per AF of water acquired. Safflower cause about $650 of value of output losses, but processing tomatoes cause about $3,150 of losses per AF acquired.

Table 22.
Reduction in Total County Value of Output per Acre-Foot of Water Acquired by Land Fallow

	Rice	Wheat	Tomato	Saf-flower	Corn	Dry bean	Sun-flower	Grain hay	Barley	Wild rice	Cotton
Acre-feet per Acre	3.3	0.5	1.8	0.7	1.8	1.5	1.4	0.5	0.5	2.0	2.3

Reduction in Total Value of Output per Acre-Foot of Water Acquired by Land Fallow, Dollars

Butte	842										
Colusa	601	1,201	4,332	1,245		802					757
Glenn	404	991			642		812				
Placer	437										
Shasta										1,810	
Solano		1,346	5,076	1,653	772				1,207		
Sutter	474	1,176	3,168	1,477		981					
Tehama								636			
Yolo	744	1,136	4,533	1,331	692		1,114	962			
Yuba	283										

8.1.3 Location of Land Idling

The location of land idling can influence the amount of direct effect in the county. Some land may be located in close proximity to trading centers in other counties. Therefore, most expenditure occurs outside of the county in which the land is located. From the perspective of "the economy of the county from which the water is being transferred" the fact that more of the trade occurs outside of the county should be considered. For example, farming in east or south Yolo county is more likely to rely on purchases from Sacramento or Solano counties than farming in north or west Yolo county. If this were true, the farming economy in east or south Yolo county would experience more leakage, and idling of land in this region would have less economic impact, all else equal.

8.2 Compensation for Adverse Third Party Economic Effects

If adverse third party economic effects are expected, compensation of the affected persons may be considered, and a water transfer package that includes compensation would be more reasonable than a package that does not.

8.2.1 Compensation Should be Based on Economic Cost

Economic impacts are not necessarily the same thing as economic costs. Economic impacts typically measure the market value of a good, or employment, and these measures are not the same as economic costs. Compensation should be based on economic costs. Economic costs, or benefits forgone, are net concepts. Typically, compensation does not offer to pay the total value of sales lost. Rather, compensation is the value of sales, less the cost to the seller of providing the goods. More generally, the goal of compensation is to return the compensated person to the pre-impact state of well-being. Therefore, the cost of compensation may well be less than the amount of impact.

8.2.2 Existing Mechanisms

Many mechanisms exist whereby funds or other resources could be channeled to the affected persons. Since these mechanisms already exist, the incremental cost of establishing the mechanism is avoided and the incremental cost of administering the compensation may be small. Current programs that exist for providing assistance include:

- Unemployment Compensation

- Welfare
- Small Business Programs
- Healthcare Systems

8.2.3 New Mechanisms

New programs could be developed to provide compensation for people adversely affected by water transfers. The advantages of this approach would be control, and the ability to target resources in a tailored, original approach. Possibly, DWR could administer a program whereby affected persons could submit claims, or local organizations could submit claims on behalf of affected persons. Legislation would probably be required to establish such a program.

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Appendix 1. Regional Economic Information System Data