Chapter 18
Economic Analyses

18.1 Introduction

As described in more detail in Chapter 1, *Introduction,* the purpose of this SED is to document the State Water Resources Control Board's (State Water Board) analysis of the needs for and effects of potential changes to the Lower San Joaquin River (LSJR) flow and southern Delta water quality objectives and program of implementation included in the 2006 Bay-Delta Plan. This Substitute Environmental Document (SED), although not an environmental impact report (EIR), fulfills the requirements of the California Environmental Quality Act (CEQA) to analyze the environmental effects of a proposed regulatory activity and its alternatives. The State Water Board must also comply with Section 13141 and Section 13241 of the Porter-Cologne Act when developing and adopting new water quality objectives.

Under CEQA, project-related social or economic effects are not, as a general rule, required to be analyzed in CEQA documents; however, a lead agency may decide to include an assessment of economic or social effects in an EIR (or, by extension, an SED), particularly if these effects are perceived as being important or substantial. As discussed in Section 15131 of the *Guidelines for Implementation of the California Environmental Quality Act* (CEQA Guidelines), economic or social information may be included in an EIR in whatever form a lead agency desires. The guidelines also indicate that social and economic issues may be discussed in an EIR when they are linked to physical change [CEQA Guidelines, § 15131(a)]. The intermediate economic or social changes that cause the physical change, however, need not be analyzed in any detail greater than necessary to trace the chain of cause and effect. The focus of the analysis should be on the physical changes. If, for example, a construction project would severely limit access to a business area, and the resultant loss of taxes would reduce an agency's ability to maintain infrastructure and public services, then the fiscal (economic) impacts should be discussed. California courts have held that potential economic and social consequences of a program or project causing urban decay or blight (e.g., effects on downtown businesses from developing a suburban shopping center) should be discussed in an EIR (e.g., *Bakersfield Citizens for Local Control v. City of Bakersfield*).

Under the California Water Code, the need for economic analysis associated with State Water Board actions is required by two sections. Water Code Section 13141 states:

> . . . prior to implementation of any agricultural water quality control program, an estimate of the total cost of such a program, together with an identification of potential sources of financing, shall be indicated in any regional water quality control plan.

Water Code Section 13241 states that "economic considerations" should be considered in establishing water quality objectives. In practice, compliance with these statutory provisions typically involves quantifying the costs to affected parties (e.g., farmers and water districts), and assessing potential impacts on affected local and regional economies of related changes in economic activity. Evaluation of other potential economic effects, such as water quality benefits, typically is conducted more qualitatively.

The economic analysis presented in this SED will help inform the State Water Board's consideration of potential changes to the 2006 Bay-Delta Plan related to LSJR flows and southern Delta water quality objectives. Any project-level changes to water rights or other measures that may be needed to implement any approved changes to the 2006 Bay-Delta Plan will be considered in a subsequent proceeding and would require project-level analysis as appropriate. Therefore, the economic analysis presented in this chapter, which summarizes results from topic-specific analyses presented elsewhere in this SED and its appendices, is limited by the programmatic nature of this document.

18.2 Summary of Results

The economic analyses in this chapter present a comparison of potential economic impacts of the Lower San Joaquin River (LSJR) alternatives and the southern Delta water quality (SDWQ) alternatives. The economic analyses summarize results from topic-specific analyses presented elsewhere in this SED its appendices, and are limited by the programmatic nature of these analyses.

Under the LSJR alternatives, changes in flows would result both in potential costs (e.g., reduction in agricultural production and/or hydropower production) and potential benefits (e.g., fisheries and river recreation opportunities) in the three eastside tributary watersheds (the Stanislaus, Tuolumne, and Merced Rivers) and the San Joaquin River (SJR) Basin. Each of the LSJR alternatives requires a specific percentage of unimpaired flow for the three eastside tributaries. The anticipated economic effects of the LSJR alternatives are summarized in Table S-1.

Table 18-1. Summary of Average Annual Effects of the LSJR Alternatives, Relative to Baseline, in the LSJR Watershed

	LSJR Alternative 2		LSJR Alternative 3		LSJR Alternative 4	
Impact Category	Change	% Change	Change	% Change	Change	% Change
Agricultural Production						
Irrigated acreage	+12,280	+1.0	-66,500	-7.0	-155,720	-16.0
Crop revenues ($M)	+$9	+0.3	-$40	-1.5	-$124	-4.5
Hydropower Production						
Generation (GWh)	+6	+0	-38	-2	-68	-4
Hydropower revenue ($M)	-$0.852	+0.9	-$2.45	-3.0	-$5.06	-4
Recreation						
Use (visitor days)	0	0.0	-44,600	–	-119,600	–
User net benefits ($M)	$0	0.0	-0.56	–	-1.5	–
Visitor spending ($M)	$0	0.0	-0.67	–	-1.8	–
Recreational Fisheries	Effects not quantified but anticipated to be minor.		Effects not quantified but anticipated to be adverse for the Stanislaus River due to lower flows, particularly during the February–June period, and related effects on fisheries.		Effects not quantified but anticipated to be minor.	

Impact Category	LSJR Alternative 2		LSJR Alternative 3		LSJR Alternative 4	
	Change	% Change	Change	% Change	Change	% Change
Regional Economic Effects						
Agriculture-related effects						
Total sector output ($M)	+$15	+0.3	-$69	-1.5	-$210	-4.5
Total sector jobs	+102	+0.3	-465	-1.5	-1,432	-4.5
Hydropower-related effects	Regional effects not quantified but anticipated to be minor.		Regional effects not quantified but anticipated to be minor.		Regional effects not quantified but anticipated to be minor.	
Recreation-related effects	No effects.		Regional effects not quantified but anticipated to be minor.		Regional effects not quantified; anticipated to be greater than LSJR Alternative 3 but still minor.	
Recreational fisheries-related effects	Regional effects not quantified but anticipated to be minor.		Regional effects not quantified but anticipated to be adverse for the Stanislaus River.		Regional effects not quantified but anticipated to be minor.	

M = millions
GWh = gigawatt hour

The SDWQ alternatives would establish revised salinity objectives to protect the beneficial use of agriculture in the southern Delta. Revising the objective could involve costs of dischargers complying with a National Pollution Discharge Elimination System Permit (NPDES) discharge permit, waste discharge requirements, or complying with a total maximum daily load (TMDL) that is established for protecting agricultural beneficial uses, all of which would be established through subsequent actions of the Central Valley Regional Water Quality Control Board (Central Valley Water Board). Potential compliance costs would be expected mostly from increased wastewater treatment costs at various wastewater treatment districts, although costs also could be incurred by agricultural operators for return flow salinity controls. Potential ratepayer effects and regional economic impacts resulting from higher treatment costs would also be possible. Because the actual methods of compliance that would ultimately be used are necessarily site- and discharge- specific, only general costs of compliance for agencies could be developed, as described below.

- **Reduce salinity discharges by developing new, higher-quality water supplies.** The cost for a permanent water purchase by a water purveyor in the southern Delta study area would be $1,716 per acre-foot (AF), or $310 per AF for a long term transfer, not including capital costs, administrative, engineering, or legal costs related to securing the water supply (Tables H-1 and H-2 in Appendix H, *Evaluation of Methods of Compliance*). These costs could range from $235 to $337 million to develop between 33,600 and 44,000 AF per year (AFY) of new surface water resources (Table H-11 in Appendix H. (Note that these are examples of unit costs for developing new water supplies and do not represent potential total costs if all water purveyors in the southern Delta portion of the plan area decide to develop new, higher-quality water supplies.) Higher quality water would be used by water purveyors to reduce reliance on groundwater, which is typically more saline than surface water supplies.

- **Implement salinity pretreatment programs.** A wastewater treatment agency could implement a program that involves, for example, replacing 2,000 salt-regenerating water softeners over 5 years. Under such a program, the wastewater treatment agency could reasonably be expected to pay between $900,000 and $9,000,000 over the life of the program ($185,000 to $1,800,000 per year) (Tables H-13 and H-14). In the case when a commercial, industrial, or institutional discharger decides to install a desalination device, costs vary based on what is being discharged, the volume, and the desired water quality entering the wastewater collection system. Costs can range considerably; relatively small systems can cost as little as $1,000 to install and $200 per year to operate, whereas larger systems can cost millions of dollars to install and tens of thousands of dollars to operate.
- **Develop desalination processes at the wastewater treatment plant.** Assuming a 10 million gallon per day discharger, a wastewater treatment agency could be expected to pay between $5 million and $22 million to construct a reverse osmosis system at the wastewater treatment plant (WWTP).
- **Implement agricultural return flow salinity controls.** Control options include real-time management (e.g., changing the timing of the release of agricultural discharge to receiving waters) or containing agricultural discharge in evaporation ponds. Assuming 11 real-time management systems to effectively cover the major water users in the plan area, estimated construction costs could total $4.7 million, with an operations and maintenance budget of $1.1 million per year (excluding costs to construct and operate temporary detention ponds). Assuming a maximum of 50 thousand acre-feet (TAF) storage is needed for zero surface water discharge, constructing evaporation ponds could cost an estimated $17 million, with $2.5 million per year to operate. Hauling concentrated salts to a landfill could cost $200 per ton, and $25 per ton for landfill operations and maintenance.
- **Provide additional low lift pumping stations at existing south Delta temporary barriers.** Assuming a two-pumping site alternative with 1,000 cubic feet per second (cfs) pumping capacity, with combined pumping at Middle and Old River barriers, estimated construction costs could range from $55.5 to $540.7 million, with annual operating costs ranging from $4.5 to $62.7 million

Under the SDWQ alternatives, costs for complying with salinity objectives could result in rate increases for ratepayers in wastewater treatment districts that do not currently meet salinity objectives set by the alternatives. Assessing how sewer utility rates could be affected by complying with salinity objectives under the SDWQ alternatives is complicated because of several unknowns that make it infeasible to estimate rate effects as part of this SED's program-level assessment. However, the following wastewater treatment agencies could face increased compliance costs, potentially resulting in higher costs to ratepayers to offset compliance-related expenditures for development and operation of programs and/or facilities.

- **SDWQ Alternative 1: No Project:** City of Tracy, City of Stockton, City of Manteca
- **SDWQ Alternative 2: 1.0 dS/m Salinity:** City of Tracy, City of Stockton
- **SDWQ Alternative 3: 1.4 dS/m Salinity:** none

From the perspective of the regional economy of the southern Delta area, rate increases could shift a portion of the spending by residential, commercial, and industrial ratepayers on consumer goods and services, business employee wages, and business supplies and services to monthly sewer utility bills. This shift, although somewhat speculative, would not be anticipated to affect a large percentage of overall consumer and business spending in the region but could result in relatively small losses of sales, employment, and income in several sectors of the regional economy. To some extent, these adverse regional economic effects would be offset by increased spending and employment by wastewater treatment agencies as they spend to construct and operate facilities, and establish and operate programs to achieve salinity objectives established by their NPDES permits.

18.3 Lower San Joaquin River and Tributaries

This section describes modeling results and interpretation of these results for the LSJR alternatives. Because changes in flows would result both in potential costs (e.g., reduction in agricultural production due to reduced diversions) and potential benefits (e.g., improved fisheries and creation of river recreation opportunities), the analyses focus on presenting the pertinent effects as opposed to classifying effects as either costs or benefits.

18.3.1 Changes in Hydrologic Conditions

Each of the LSJR alternatives considered in this chapter is defined by a specified percentage of the unimpaired flow requirement for the Stanislaus, Tuolumne, and Merced Rivers. Specific requirements of the LSJR alternatives are presented in Chapter 3, *Alternatives Description*, Section 3.3, *Lower San Joaquin River (LSJR) Alternatives*.

As discussed in greater detail in Appendix G, *Agricultural Economic Effects of Lower San Joaquin River Flow Alternatives*, allowable monthly diversions under the LSJR alternatives were estimated using the State Water Board's Water Supply Effects (WSE) model. The WSE model is a monthly water balance spreadsheet model that estimates allowable surface water diversions and reservoir operations needed to achieve the target flow requirements of the LSJR alternatives on the three eastside tributaries. For the purposes of this analysis, these monthly values were added together for a given year and presented as annual allowable diversions in TAF increments. The diversion estimates, presented as changes from baseline, were then used to drive the analysis of agricultural production effects, hydropower generation effects, recreation and fishery effects, and regional economic effects presented later in this chapter. Estimates of the surface water diversions allowable under baseline were obtained directly from the "Current (2009) Conditions" CALSIM II model run from the California Department of Water Resources' (DWR) *State Water Project Delivery Reliability Report*, *2009* (2010).

Table 18-2 summarizes the average difference in allowable diversions above or below baseline, and the average percent difference from baseline, for each of the three eastside tributaries and the entire LSJR watershed across 82 years (1922–2003) of modeling simulation. Water supplies and related conditions in the watersheds are highly variable over time. For a particular LSJR alternative, the diversions estimated for a given year may be above or below that same year's estimate for the baseline. In general, as the percent of unimpaired flow increases, the average difference in diversions for a particular alternative relative to baseline increases (i.e., greater diversion reductions would be needed to accommodate the increase in unimpaired flow).

Table 18-2. Average Difference in Diversions Above or Below Baseline, with Average Percent Difference from Baseline, for Each of the Three Eastside Tributaries and the Entire LSJR Watershed Across 82 Years of WSE Model Simulation

LSJR Alternative	Stanislaus (TAF)	Tuolumne (TAF)	Merced (TAF)	LSJR Watershed (TAF)
LSJR Alternative 2	+76	-5	-10	+64
LSJR Alternative 3	-6	-172	-87	-264
LSJR Alternative 4	-119	-328	-163	-610
	(%)	(%)	(%)	(%)
LSJR Alternative 2	+14	<-1	-2	+3
LSJR Alternative 3	-1	-19	-16	-13
LSJR Alternative 4	-21	-37	-31	-31

TAF = thousand acre-feet

As shown in Table 18-2, potential diversion reductions on the Stanislaus River are generally less than those potentially needed on the Tuolumne and Merced Rivers. This is due to the generally higher level of existing flows on the Stanislaus River. As a result, under LSJR Alternative 2, average diversions on the Stanislaus River are predicted to be higher than under baseline, potentially offsetting reductions on the Tuolumne and Merced Rivers and yielding a net increase of about 3 percent in diversions across the watersheds. Conversely, under LSJR Alternatives 3 and 4, diversions on all three rivers would be reduced, resulting in predicted total average diversion reductions of 13 percent and 31 percent, respectively.

18.3.2 Effects on Agricultural Production

Introduction

The analysis in this section focuses on the potential economic effects on agricultural production from estimated changes in allowable surface water diversions needed to meet the requirements of the LSJR alternatives. Agricultural production in the tributary watersheds is dependent on irrigation water supply from various sources, including surface water diversions, groundwater pumping, and deliveries from the state and federal water projects [State Water Project (SWP) and the Central Valley Project (CVP)]. The LSJR alternatives have the potential to affect the amount of allowable surface water diversions, and, hence, the amount of agricultural production dependent on those diversions.

As described in detail in Appendix G, *Agricultural Economic Effects of Lower San Joaquin River Flow Alternatives*, the analysis in this section includes two major steps. First, the effects on allowable surface water diversions for each of the LSJR alternatives are estimated relative to baseline using the WSE model. For the purposes of the analysis, baseline conditions are those representing what existed in the tributary watersheds in 2009. Second, the Statewide Agricultural Production (SWAP) model is used to estimate the direct effect of these changes on agricultural production and related revenues.

The allowable surface water diversions and associated agricultural production generated by SWAP for each of the LSJR alternatives are compared to those estimated for baseline. The net difference is the agricultural production attributed to implementing that alternative. The analyses incorporate several conservative assumptions as detailed in Appendix G, including, notably, no increased use of groundwater to augment water supply. In general, as flow requirements on each of the rivers increase, the surface water diversions would need to decrease, with a corresponding effect on agricultural production.

The potential cost to farmers to pump groundwater to offset the loss of surface water supplies is discussed in detail in Appendix H, *Evaluation of Methods of Compliance*. As discussed in Appendix H, groundwater pumping may be viable for water diverters that experience a reduction in surface water diversions. Operations and maintenance costs to operate new groundwater wells, or to increase operation of existing wells, are highly variable. Factors affecting costs include pump efficiency, depth of well, cost of electricity, volumetric flow, cost of materials for maintenance (lubrication, replacement parts, etc.), proximity to water distribution system, and staff needed to maintain equipment and facilities. Based on electricity costs and other assumptions developed in Appendix H, electricity costs for groundwater pumping in the plan area could be expected to range between $57.36 and $76.48 per AF. Additional operating costs, including labor, maintenance, and replacement costs, are highly also variable and are based on the specific characteristics of a groundwater well and pumping components. As discussed in Appendix H, energy costs may represent 50–75 percent of a water utility's budget. Applying this factor to electricity costs produces a total operations and maintenance budget for groundwater pumping ranging from $101.97 to $152.96 per AF. For cases in which groundwater pumping is viable, this estimated per AF groundwater pumping cost would vary to some unknown extent from the surface water costs assumed in SWAP; however, it is likely that these groundwater costs would be substantially lower than the costs for surface water supplies assumed in SWAP. [Note: As part of the California Water Plan Update 1994, DWR analyzed agricultural groundwater production costs. This analysis described the average costs at specific locations within a region, including capital, operations, maintenance, and replacement costs. These costs are presented in Table H-5 in Appendix H.]

Baseline Agricultural Production and Revenue Conditions

As discussed in Appendix G, *Agricultural Economic Effects of Lower San Joaquin River Flow Alternatives*, the SWAP model was calibrated to DWR's estimates of land use and applied water data for water year 2005. This represented the most recent "normal" water year in terms of both water availability and crop prices. Annual surface water diversion changes estimated by the WSE model (summarized in Section 18.3.1, *Changes in Hydrologic Conditions*, and described in detail in Appendix G) were input to SWAP to estimate the associated agricultural production (crop acreages) and revenues (total production value) under simulated baseline, as well as under LSJR Alternatives 2, 3, and 4. Baseline results for crop acreages are shown in Table 18-3. Under baseline, total production value, which is gross crop revenues directly generated by farming operations across regions 11, 12, and 13 in the Central Valley Production Model (CVPM), was estimated by SWAP to be approximately $2.76 billion (in 2008 dollars) (Table 18-4). CVPM regions 11, 12, and 13 include parts of San Joaquin, Stanislaus, Merced, and Madera Counties, and are representative of the crop production and acreage in the three eastside tributary watersheds and along the LSJR.

Table 18-3. Average Annual Acreage of Irrigated Crops for Baseline and Average Difference (in Acres and Percent) Between LSJR Alternatives and Baseline, by Crop Group

	Baseline	LSJR Alternative 2		LSJR Alternative 3		LSJR Alternative 4	
Crop Group	Acreage	Change	% Change	Change	% Change	Change	% Change
Alfalfa	94,180	+660	+1	-3,100	-3	-10,760	-11
Almonds/Pistachios	295,630	+180	<+1	-610	<-1	-2,680	-1
Corn	137,020	+870	+1	-13,020	-10	-33,740	-25
Cotton	30,660	+200	+1	-440	-1	-850	-3
Cucurbits	2,700	0	0	-10	<-1	-150	-6
Dry Bean	1,890	+10	+1	-40	-2	-180	-10
Grain	21,220	+90	<+1	-320	-2	-1,340	-6
Onion and Garlic	820	0	0	-10	<-1	-60	-7
Orchards	65,420	+130	<+1	-370	-1	-900	-1
Other Field Crops	57,510	+6,240	+11	-21,550	-37	-42,030	-73
Other Truck Crops	30,410	+10	<+1	-30	<-1	-1,570	-5
Pasture	76,570	+3,720	+5	-25,290	-33	-54,760	-72
Rice	4,520	+100	+2	-1,450	-32	-3,380	-75
Safflower	430	0	0	-10	-2	-40	-9
Subtropical	5,850	0	0	0	0	-30	-1
Sugarbeet	2,480	+10	<+1	0	0	-10	<-1
Tomato (fresh)	6,770	0	0	-10	<-1	-30	<-1
Tomato (Processing)	12,330	+20	<+1	-70	-1	-230	-2
Vine	112,390	+40	<+1	-170	<-1	-2,980	-3
TOTAL	958,800	+12,280	+1	-66,500	-7	-155,720	-16

Effects of the LSJR Alternatives on Agricultural Production and Revenue

Table 18-3 presents the estimated average annual change in irrigated acreage of each crop type for the LSJR alternatives compared to baseline over the 82-year simulation period. Under LSJR Alternative 2, the average amount of irrigated acreage would increase slightly (1 percent) due to increased diversions on the Stanislaus River. (As described in Section 18.3.1, *Summary of Changes in Hydrologic Conditions*, average diversions on the Stanislaus River are predicted to be higher under LSJR Alternative 2 than under baseline, thereby offsetting reductions on the Tuolumne and Merced Rivers.) Under LSJR Alternatives 3 and 4[1], irrigated acreage would fall by an estimated 7 percent and 16 percent, respectively, as diversions are reduced on all three rivers.

[1] The SWAP analysis of agricultural effects incorporates several conservative assumptions as detailed in Appendix G, *Agricultural Economic Effects of Lower San Joaquin River Flow Alternatives,* including, notably, no increased use of groundwater to augment water supply. As previously noted, operating costs for groundwater pumping are estimated to range from $101.97 to $152.96 per AF. The increased use of groundwater for irrigation purposes could dampen the acreage reductions estimated by SWAP under LSJR Alternatives 3 and 4; however, relative to existing costs, production costs would likely increase, resulting in lower profits for farmers and potential changes in cropping patterns.

The effects of these diversion changes on irrigated agriculture were estimated by the SWAP model, which simulates the decisions of farmers at a regional level based on principles of economic optimization. The model assumes that farmers maximize profit (revenue minus costs) subject to resource, technical, and market constraints. The model selects crops, water supplies, and irrigation technology that maximize profit subject to the constraints. As shown in Table 18-3, as water becomes less available across the LSJR alternatives, the model predicts that the crops most affected are rice, pasture, and field crops, followed by corn. These are affected more because they are relatively high water use, annual crops, and/or crops with lower value per acre. The low-value crop groups that cover large areas are substantially reduced as the LSJR alternatives increase from 20 percent to 60 percent of unimpaired flow.

As shown in Figures G-5 through G-9 of Appendix G, *Agricultural Economic Effects of Lower San Joaquin River Flow Alternatives*, pasture and field crops (field crops not shown in the figures) may be nearly eliminated from production in some years of extreme drought, particularly under LSJR Alternatives 3 and 4, while the high-value crops, such as vines, remain unaffected under all alternatives other than LSJR Alternative 4. Higher-value crops, such as tomatoes, are less affected by increased diversion reductions than lower-value crops because farmers are expected to fallow lower-value crops first. Perennial crops such as vines, almonds, pistachios, and sub-tropical crop groups are predicted to experience decreases in production only during prolonged extreme droughts, such as occurred in the early 1990s. On the other hand, cotton, an annual crop, is reduced in nearly all years, although not as drastically as rice, a lower-value and higher water-use crop than cotton. Safflower, shown in Figure G-9, is also a low-value crop, but given its low acreage and low water use, is relatively unaffected.

Similar to changes in crop acreages, average annual total gross crop revenues generated across CVPM regions 11, 12, and 13 are predicted to slightly increase under LSJR Alternative 2, as diversions increase on the Stanislaus River, but to fall as irrigation water becomes less available under the LSJR Alternatives 3 and 4, compared to baseline. As shown in Table 18-4, total average annual crop revenues in CVPM regions 11, 12, and 13 would increase by an estimated $9 million, or 0.3 percent, under LSJR Alternative 2, compared to baseline revenues. Under LSJR Alternatives 3 and 4, crop production revenues are estimated to decline by $40 million (1.5 percent) and $124 million (4.5 percent), respectively, compared to baseline revenues.

Table 18-4. Estimated Average Annual Baseline Crop Production Revenue and Changes Associated with LSJR Alternatives 2–4

		Change from Baseline by LSJR Alternative ($Millions)		
	Baseline	LSJR Alternative 2	LSJR Alternative 3	LSJR Alternative 4
Total Crop Production Revenue (2008 dollars) ($ Millions)	2,760	+9	-40	-124
% of Revenue	100	+0.3	-1.5	-4.5

Water supplies and related conditions are highly variable over time. Thus, effects on crop revenues under the LSJR alternatives may be better understood by evaluating trends characterized by an exceedance plot showing the magnitude and variability of estimated revenues across the 82 years of model simulation (1922–2003) for each of the LSJR alternatives and baseline. The exceedance plot in Figure G-10 graphically shows the expected change in total gross crop revenues under the LSJR alternatives, exceeding or falling below baseline crop revenues over time.

In summary, total agricultural production and gross crop revenues in the CVPM regions 11, 12, and 13 are expected to be higher under LSJR Alternative 2 than under baseline during most years (due to increased diversions on the Stanislaus River that would offset decreased diversions on the Tuolumne and Merced Rivers). For LSJR Alternatives 3 and 4, irrigated acreage and crop revenue are anticipated to decline because of lower diversions on all three eastside tributaries. On average, under LSJR Alternative 2, the annual amount of acreage irrigated across regions 11, 12, and 13 would increase by about 1 percent, and gross crop revenues are predicted to increase by 0.3 percent, compared to baseline levels. Under LSJR Alternatives 3 and 4, reduced diversions would result in an estimated average annual decrease in irrigated acreage of about 7 percent under LSJR Alternative 3, and of 16 percent under LSJR Alternative 4. Average annual crop revenues in regions 11, 12, and 13 are predicted to fall by 1.4 percent under LSJR Alternative 3 and by 4.5 percent under LSJR Alternative 4.

18.3.3 Effects on Hydropower Generation

Introduction

The analysis in this section, as explained in greater detail in Appendix J, *Hydropower and Electric Grid Analysis of Lower San Joaquin River Flow Alternatives*, provides estimates of the potential effects of the LSJR alternatives on hydropower generation on the three eastside tributaries. The LSJR alternatives propose to alter the February–June flow on the Stanislaus, Tuolumne, and Merced Rivers, which would be expected to affect reservoir operations, surface water diversions, and the associated timing and amount of hydropower generation from reservoirs on the tributaries. Results from the WSE model are used in this analysis to estimate the effects of the LSJR alternatives on reservoir releases and storage (elevations head) and allowable diversions to off-stream generation facilities, then calculates the associated change in monthly and annual amounts of energy produced. The results of the analysis in Appendix J provide input for calculations of estimated changes in hydropower generation revenues under the LSJR alternatives.

To calculate the direct effects of the LSJR alternatives on revenue for the hydropower plants within the plan area, the monthly price of power was multiplied by the estimated monthly change in power generated over the 82-year simulation period. The price of power used in the analysis represents the value at the 80th percentile of average hourly power prices available from the Independent System Operators (ISO) for each month during 2006 (in other words, the value at which 80 percent of the hourly prices were lower), and adjusting to 2008 dollars using *Engineering News-Record* (*ENR*) Building Cost Indices[2]. Prices for 2006 were used in the calculations because they most closely matched the median of all years in the range of available data from 1998 to 2008. Figure 18-1 shows the monthly average ISO prices from 1998 to 2008 and the median of all years, and shows that the 2006 prices closely followed the median. The 2006 80th percentile prices and ENR indices are presented by month in Table18-5. Note that use of monthly power prices at the 80 percentile of hourly prices is considered a conservative approach to estimating hydropower revenue impacts because, as presented, power prices have historically been lower than this value. As a result, the estimated revenue impacts of the LSJR alternatives likely overstate actual effects.

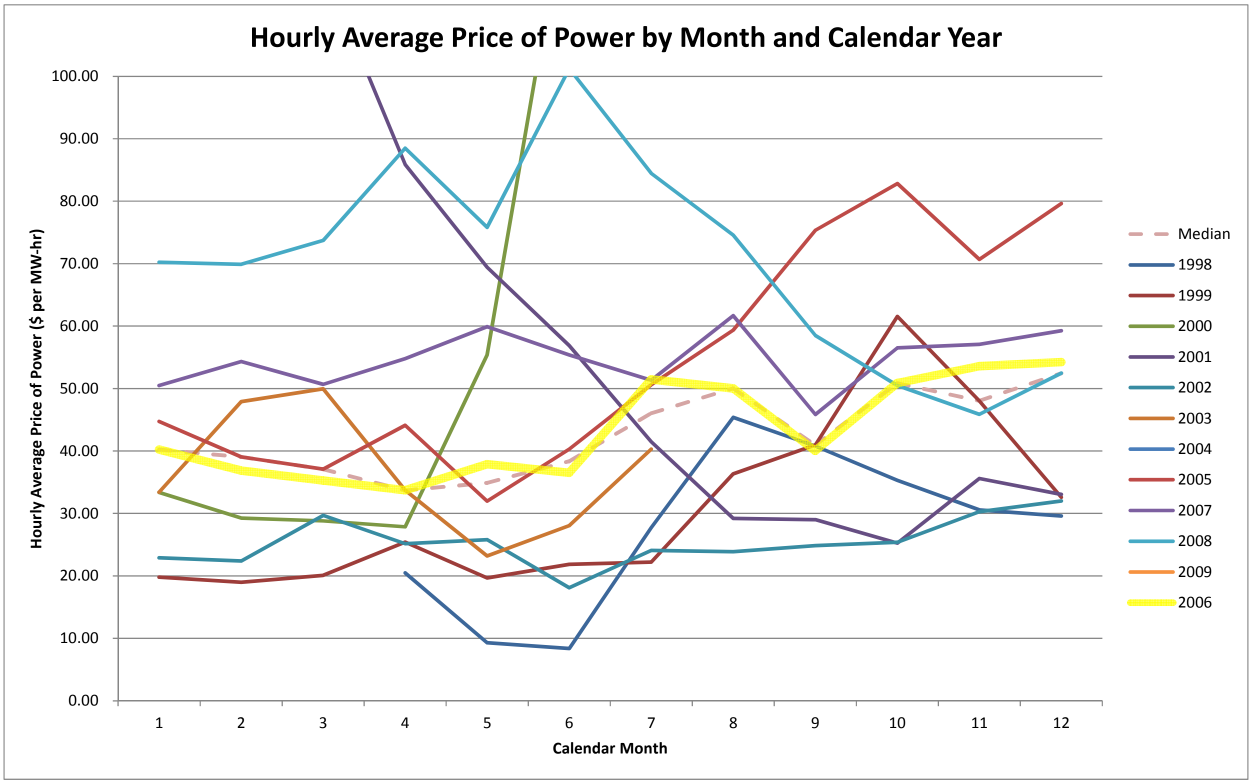

Figure 18-1. Monthly Average Price and Median Monthly Average Price of Power 1998– 2008

[2] The *ENR* Building Cost Index, which has been issued since 1915, is widely used throughout the U.S. construction industry as a benchmark for measuring inflation.

Table 18-5. Selected 80th Percentile of Hourly Prices from 2006 and Factors used to Escalate to 2008 Dollars

Calendar Month	2006 ISO Power Price		ISO Power Price Adjusted by Building Cost Index Factor
	$/MWh ($2006)	Building Cost Index Adjustment Factor	$/MWh ($2008)
1	56.46	1.0900	61.54
2	47.86	1.0886	52.11
3	43.81	1.0927	47.87
4	47.48	1.0934	51.92
5	51.83	1.0938	56.69
6	54.31	1.0949	59.46
7	61.49	1.0912	67.10
8	61.22	1.0896	66.70
9	51.25	1.0891	55.82
10	58.63	1.0456	61.30
11	63.76	1.0404	66.34
12	64.31	1.0435	67.11

Note: The 2006 ISO power price is the 80th percentile of hourly prices within each month during the 2006 calendar year. The 2006 prices were adjusted to 2008 dollars using the *Engineering News-Record* Building Cost Index.

MWh = megawatt hours

Baseline Hydropower Generation and Revenue Conditions

For each of the LSJR alternatives, the analysis presented in Appendix J, *Hydropower and Electric Grid Analysis of Lower San Joaquin River Flow Alternatives*, estimated the amount of hydropower that would be generated from the various facilities on the three eastside tributaries for comparison with the amount generated under baseline. Baseline numbers are those from the "Current (2009) Conditions" CALSIM II model run from DWR's *State Water Project Delivery Reliability Report, 2009* (2010).

As shown in Table 18-6, average annual baseline hydropower generation was estimated to total 1,607 gigawatt hours (GWh), distributed as follows among hydropower facilities: facilities on the Stanislaus River, 36 percent; facilities on the Tuolumne River, 39 percent; and facilities on the Merced River, 25 percent. Baseline revenues associated with this baseline hydropower generation are estimated to be about $94.8 million (Table 18-7).

Table 18-6. Average Annual Baseline Hydropower Generation and Difference from Baseline by Tributary

Alternative	Stanislaus (GWh)	Tuolumne (GWh)	Merced (GWh)	All Tributaries (GWh)
Baseline	577	628	403	1,607
LSJR Alternative 2	+7	-1	0	+6
LSJR Alternative 3	-20	-11	-7	-38
LSJR Alternative 4	-33	-19	-16	-68

Note: Numbers are rounded.
GWh = gigawatt hours

Table 18-7. Average Annual Baseline Hydropower Revenue and Difference from Baseline by Tributary

Alternative	Stanislaus ($)	Tuolumne ($)	Merced ($)	All Tributaries ($)
Baseline	34,018,000	36,863,000	23,958,000	94,839,000
LSJR Alternative 2	693,000	59,000[1]	100,000	852,000
LSJR Alternative 3	-1,092,000	-803,000	-551,000	-2,447,000
LSJR Alternative 4	-2,193,000	-1,623,000	-1,238,000	-5,055,000

Note: Revenues shown in 2008 dollars.

[1] An increase is revenue is explained by the shift in power generation over the year from a lower price to a higher price. Although the overall generation is lower, the change in price leads to higher revenue (e.g., shifting an equal generation January–April to June–October would result in increased revenue due to higher prices charged for energy).

Effects of the LSJR Alternatives on Hydropower

Table 18-6 also summarizes the change in average annual hydropower generation on each of the tributaries due to the LSJR alternatives. Generally, as the percent of unimpaired flow increases, the amount of power generated annually is reduced. As shown in table 18-6, total hydropower generation would increase by 6 GWh under LSJR Alternative 2; decline by 38 GWh under LSJR Alternative 3; and decline by 68 GWh under LSJR Alternative 4. These changes are represented by percent in Table 18-8, with reduction in total hydropower generation ranging from no change to 5 percent of baseline.

Table 18-8. Average Annual Hydropower Generation as Percent Change from Baseline by Tributary

Alternative	Stanislaus	Tuolumne	Merced	All Tributaries
Baseline	0	0	0	0
LSJR Alternative 2	+1	0	0	0
LSJR Alternative 3	-4	-2	-2	-2
LSJR Alternative 4	-6	-3	-4	-4
Note: Numbers are rounded.				

An evaluation of the monthly pattern of the average change (over the 82 years of simulation) in hydropower generation is presented in Appendix J.

Under the LSJR alternatives, total average annual revenues generated by hydropower generation on the three rivers are estimated to increase by $852,000 under LSJR Alternative 2; decline by $2.45 million under LSJR Alternative 3; and decline by $5.01 million under LSJR Alternative 4, compared to revenues under baseline (Table 18-7). The revenue reductions, compared to baseline revenues, would be relatively small under LSJR Alternative 2 (0 percent), but would rise to 3 percent under LSJR Alternative 3 and to 4 percent under LSJR Alternative 4 (Table 18-9).

Table 18-9. Average Annual Hydropower Revenue as a Percent Difference from Baseline by Tributary

Alternative	Stanislaus (%)	Tuolumne (%)	Merced (%)	All Tributaries (%)
LSJR Alternative 2	+2	0[1]	0	0.9
LSJR Alternative 3	-3	-2	-2	-3
LSJR Alternative 4	-6	-4	-5	-4

Note: Numbers are rounded.

[1] An increase is revenue is explained by the shift in power generation over the year from a lower price to a higher price. Although the overall generation is slightly lower, the change in price leads to higher revenue. (e.g. shifting an equal generation from January–April to June–October would result in increased revenue due to higher prices charged for energy).

18.3.4 Effects on Fisheries and Recreation

This section addresses potential economic effects related to predicted changes in aquatic and recreational resource conditions. Because certain physical impacts on these resources, such as changes in fish populations, cannot be reliably predicted, related economic effects are correspondingly difficult to evaluate with certainty. As a result, the analysis of aquatics- and recreation-related economic effects is necessarily more qualitative.

Fisheries

Background

Fishing is a common recreational activity on the rivers and reservoirs of the plan area. As discussed in greater detail in Chapter 7, *Aquatic Resources*, the mainstem LSJR and three eastside tributaries support several warmwater game fish populations, such as smallmouth and largemouth bass, sunfish, and catfish, and a variety of native fishes, such as hardhead, Sacramento pikeminnow, Sacramento sucker, sculpin, and lamprey. The mainstem LSJR and the major LSJR tributaries also provide habitat for coldwater species, such as trout and Chinook salmon. Historically, the Upper SJR supported abundant populations of spring- and fall-run Chinook salmon and steelhead. Today, however, only small populations of fall- and late fall–run Chinook salmon and steelhead are found in the mainstem LSJR and the major LSJR tributaries.

Among the game fish available in the mainstem LSJR and tributaries, the following species are the most commonly caught by recreational anglers.

- LSJR: catfish and smallmouth bass
- Stanislaus River: catfish, crappie, largemouth bass, and smallmouth bass
- Tuolumne River: Chinook salmon
- Merced River: catfish and smallmouth bass

The tributary reservoirs are home to a variety of fish species, including rainbow trout, brown trout, largemouth bass, smallmouth bass, black bass, sunfishes, kokanee, blue gill, catfish, carp, and crappie. Recreational anglers typically fish from the shore or boats for the following species on tributary reservoirs.

- New Don Pedro Reservoir: bass, trout, salmon, crappie, bluegill, catfish, and king salmon
- New Melones Reservoir: bass, rainbow trout, brown trout, blue gill, catfish, carp, and crappie
- Lake McClure Reservoir: bass, trout, blue gill, catfish, sunfishes, and crappie

Historical (1990s and early 2000s) estimates of fishing activity at the major recreation areas within tributary watersheds are identified in Table 18-10. As shown, fishing-only recreation on the tributary rivers totaled an estimated 5,200 angler days annually along the lower Stanislaus River; 34,900 angler days annually along the lower Tuolumne River; and an estimated 57,500 angler days annually on the Merced River. (Reservoir fishing is combined with boating and other activities within the affected watersheds.)

Table 18-10. Estimated Use of Affected Recreation Areas

Watershed/Recreation Area	Counties	Estimated Recreation Days (Year)	Type of Activities
Stanislaus	San Joaquin, Calaveras, Tuolumne, Stanislaus		
New Melones Reservoir		498,000 (1992)[1]	All activities
Tulloch Reservoir		800,000 (unk)[2]	All activities
		122,000 (1992)	
Stanislaus River		5,200 (average of 1999/2000)[3]	All activities Fishing only
Tuolumne	Tuolumne, Stanislaus		
Don Pedro Reservoir		407,000 (average of 1999-2008)[4]	All activities
Tuolumne River		150,000 (1992)[5]	Water-related and wildlife viewing
		34,900 (2000)[6]	Fishing only
Merced	Mariposa, Merced		
Lake McClure		1,400,000 (2010)[7]	All activities
Merced River		73,000 (unk)[8]	Water-related activities
Lower San Joaquin River	San Joaquin, Stanislaus, Merced	157,000 (unk)[9] 57,500 (2000)[10]	Boating and fishing Fishing only

Unk = unknown

[1] As cited in SJRG 1999; use is measured in 12-hour recreation visitor days (RVDs).

[2] As cited in USBR 2011.

[3] Derived based on information from CDFG 2001a and 2001b; includes reach of the river from Goodwin Dam (Tulloch Reservoir) downstream to the McHenry Avenue bridge near Meyers.

[4] As cited in TID & Merced ID 2011.

[5] As cited in SJRG 1999; use is measured in 6-hour RVDs.

[6] Derived based on information from Gallo 2002. Note that estimates in Table 20 of the report were adjusted to account for all visitors; as stated in the referenced report, county residents account for an estimated 51 percent of all recreation days.

[7] As cited in Merced ID 2011.

[8] As cited in SJRG 1999; use is measured in 6-hour RVDs.

[9] As cited in SJRG 1999; use is measured in 6-hour RVDs.

[10] Derived based on information from Gallo 2002. Note that estimates in Table 20 were adjusted to account for all visitors; as stated in the referenced report, county residents account for an estimated 51 percent of all recreation days.

Effects of the LSJR Alternatives

The effects of the LSJR alternatives on aquatic resources, including discussions of the potential beneficial and negative impacts of each alternative, are discussed in detail in Chapter 7, *Aquatic Resources*, and are summarized in Table 7-1. Releases from major reservoirs on the LSJR tributaries are made in response to multiple operational objectives, including flood management, downstream diversions, instream fisheries flows, instream water quality flows, and releases to meet water quality and flow objectives at Vernalis. Under the LSJR Alternatives, increased flows would largely be confined within existing channels, would not increase flood flows, would be within the range of historical flows, and would have timing similar to historical flows. As a result, increased flows from the LSJR alternatives are not anticipated to cause substantial adverse impacts on fish species in the tributary watersheds and LSJR, with the exception of specific effects on the Stanislaus River under LSJR Alternative 2.

Under LSJR Alternative 2, the Stanislaus River would experience flows that, in general, are lower than flows under baseline, particularly during the February–June period. The lower flows may substantially decrease the quantity and quality of spawning, rearing, and migration habitat; increase exposure of fish to pollutants; increase predation risks; and substantially change fish transport flows. Changes in flow, water temperature, and water quality also may increase fish disease risk. Additionally, changes in reservoir storage and release temperatures could substantially increase exposure of fish in the river to stressful water temperatures. These effects could adversely affect the recreational fishery in the Stanislaus River, leading to reduced fishing opportunities and associated reductions in fishing-related economic activity near the river and region. As discussed in Chapter 7, *Aquatic Resources*, effects on aquatic species at watershed reservoirs (Lake McClure, Don Pedro, and New Melones) are not anticipated to be substantial, indicating that effects on fishing opportunities would be minor.

Under LSJR Alternatives 3 and 4, flow alterations would not be sufficient to substantially affect aquatic resources in the tributary rivers or watershed reservoirs. As a result, adverse effects on fish species in the tributary rivers and reservoirs, and consequently on recreational fisheries, are anticipated to be minor. As a result, effects on angler benefits and spending on goods and services related to visits to rivers and reservoirs also would be minor.

Recreation

Background

As described in Chapter 10, *Recreational Resources and Visual Quality*, project-related changes in flows and reservoir levels potentially affect recreational opportunities and the quality of these opportunities. Recreational activities may be affected by the LSJR alternatives through changes in water management that affect reservoir levels and downstream releases. Changes in reservoir levels would affect recreational activities primarily by reducing access to boat ramps, marinas, and boat-in campgrounds; reducing water surface area for boaters; and exposing large areas of shoreline, negatively affecting aesthetic quality and access for picnickers, swimmers, and shoreside fishing areas. Changes in downstream flows could affect both water-dependent and water-enhanced recreation in the tributary streams and potentially along the LSJR. These potential changes in recreational opportunities and quality could, in turn, affect the value that recreationists place on the activities, which could lead to changes in the frequency of use of the recreational resources.

Existing recreational use levels provide a baseline for assessing potential economic effects from changes in flows and reservoir levels. Table 18-10 provides information on recreational use of the major recreational resources to be affected by the LSJR alternatives. The counties in which the rivers and reservoirs are located also are identified in Table 18-10. Although the use estimates in some cases are dated, they provide context for approximating the relative importance of recreational activity at these areas to the surrounding regions.

As described in Gallo (2002), economic benefits from recreation accrue through two pathways. First, participation in recreational activities contributes value to those participating in the activities, as measured in their willingness to pay over and above trip expenditures. The extent of value depends to a large extent on the quality of the recreation environment. For example, wildlife watching is more rewarding where there is more viewable wildlife, creating greater value in that environment. Benefits to residents of the region resulting from an improvement in the quality of the local environment are typically measured by the increase in their willingness to pay for these improvements. Local residents of the region who recreate at affected rivers and reservoirs receive, on average, an estimated $25 per visitor day in benefits from recreation, as measured by their net willingness to pay for these recreation opportunities (Hanemann 2005). Based on an estimated 1.15 million reservoir days (consisting of 50 percent of total reservoir days at New Melones Lake, Don Pedro Lake, and Lake McClure, as reported in Table 18-10) and 173,000 river days (consisting of 50 percent of total river days along the Stanislaus River, Tuolumne River and Merced River, as reported in Table 18-10) annually by residents of the regions, it is estimated that residents of the region who recreate at area reservoirs and rivers receive about $33 million in baseline recreation benefits.

A second economic pathway to assess the economic benefits of recreation is the effect that nonresidents of a region who participate in recreational activities within the region have on regional economic activity. Nonresidents are particularly important in this regard because their economic activity may not otherwise occur within the region. More frequent trips by visitors mean additional spending in the region. These types of economic effects are referred to as regional economic impacts, and a region can be defined in terms of a small geographic area (e.g., a county or city) or a large multi-county area. While these effects do not directly affect residents, increased visitor spending does support local economic activity. Although not considered here, persons who do not engage in recreational activities on the tributary rivers and lakes may benefit from the existence of enhanced biodiversity and other factors contributing to amenity values (i.e., non-user value).

Based on estimates of spending related to recreation on the upper San Joaquin River (Hanemann 2005), nonresidents of the region are estimated to spend, on average, about $30 per visitor day to recreate at area reservoirs and rivers (2007 dollars). Based on an estimated 1.15 million reservoir days and 173,000 river days (excluding the LSJR) spent annually by nonresidents of the region (50 percent of total recreation days [i.e.,visitor days] reported in Table 18-10), baseline spending by nonresidents contributes an estimated $40 million annually in recreation-related spending to the regional economy.

Effects of the LSJR Alternatives

As described in Chapter 10, *Recreational Resources and Visual Quality*, the impacts of the LSJR alternatives are most substantial on river recreation (i.e., the seasonal monthly average frequency of flows within a range that supports a type of recreation would decrease more than 10 percent). No significant impacts on recreation would be expected under LSJR Alternative 2. Under LSJR Alternative 3, changes in flows in the Merced and Tuolumne Rivers would substantially reduce the frequency of low-range flows (less than 500 cfs), which mainly support swimming, wading, and floating. Under LSJR Alternative 4, changes in flows in the Tuolumne River would substantially reduce the frequency of mid-range flows (500–1,500 cfs), which mainly support motorized boating, kayaking, rafting, and canoeing, and would substantially reduce low-range flows in both the Merced and Tuolumne Rivers (Tables 10-4 and 10-5). Changes in seasonal average flows on the Stanislaus River would not be substantial under any of the LSJR alternatives; some recreational flow ranges would increase compared to baseline (Table 10-6).

Potential impacts on recreational opportunities at the three reservoirs (New Melones Reservoir, Don Pedro Reservoir, and Lake McClure) are predicted to change, although the effects are variable across the reservoirs and summer months at each of the reservoirs. Overall, recreational opportunities and use at all three reservoirs would be expected to increase or generally remain the same under LSJR Alternative 2 and decrease under LSJR Alternative 4. Under LSJR Alternative 3, recreational opportunities and use would be expected to increase at Lake McClure but likely decrease at New Melones Reservoir and Don Pedro Reservoir. Because the magnitude of change in water levels at all three reservoirs is not considered extensive relative to the recreation thresholds described in Chapter 10, Section 10.4.1, the impacts on recreational opportunities and use, and visual quality, are not considered substantial at the reservoirs. As a result, changes in recreation benefits and visitor spending attributable to recreational use of the three reservoirs would not be substantial under the LSJR alternatives.

The extent that economic values associated with recreation on the Merced and Tuolumne Rivers would be affected is uncertain, primarily because reliable data on use by activity and the relationship between changes in flows and use are not known. However, for purposes of developing a worse-case, planning-level scenario affecting potential displacement of recreational activities, the recreational use information in Table 18-10 is used to assess order-of-magnitude effects on recreation benefits and spending. Effects on use from population changes or other factors that may have affected historical use levels are not considered.

As identified in Table 18-10, the Merced and Tuolumne Rivers support about 223,000 water-related visitor days annually—73,000 days on the Merced River and 150,000 days on the Tuolumne River. Based on recreation activity information reported for the Lower San Joaquin River (Hanemann 2005) and on activity distribution information reported in recreation surveys of visitors to the Pitt River in northern California (Whittaker and Shelby 2003), it is assumed low-flow activities, such as swimming, account for an estimated 20 percent of all use, and boating-related activities, including kayaking and rafting, account for an estimated 50 percent of all activities. Based on information about the county of origin for anglers of the Lower San Joaquin River (Gallo 2002), it is also assumed that changes in flow conditions would displace 50 percent of these activities to other recreation areas outside the regions.

Under LSJR Alternative 3, potential use-related impacts could approximate up to 44,600 visitor days of low-flow activities, of which an estimated 50 percent would be residents and 50 percent would be nonresidents of the region. Based on an average recreation benefit to residents of $25 per visitor day, the annual impact on resident recreation benefits, as measured by the reduction in resident's willingness to pay for recreation opportunities, could approximate $557,000. Flow-related effects on recreation spending by nonresidents of the region could reduce regional spending by about $669,000, based on average spending of $30 per visitor day.

Under LSJR Alternative 4, the change in flows could reduce boating-related activities supported by mid-range flows on the Tuolumne River in addition to the impact on low-range flow activities on the Merced and Tuolumne Rivers previously described for LSJR Alternative 3 (a reduction of 44,600 visitor days). It is estimated that 75,000 boating-related visitor days by resident and nonresidents occur annually on the Tuolumne River. Based on an average recreation benefit to residents of $25 per visitor day and that residents account for 50 percent of the total 119,600 visitor days (44,600 low-range flow visitor days and 75,000 boater-related visitor days), the annual impact on recreation benefits to residents could approximate $1.5 million. Flow-related effects on recreation spending by nonresidents of the region could reduce regional spending by an estimated $1.8 million annually, based on average spending of $30 per visitor day.

18.3.5 Regional Economic Effects

This section addresses potential regional economic impacts associated with flow-related impacts on agricultural production, hydropower generation, fisheries, and recreational resources. The analysis focuses on predicted changes in agricultural output, although potential regional economic impacts from changes in hydropower generation, fisheries, and recreational resources also are considered qualitatively. The changes in hydroelectric power generation would affect residents statewide in terms of electricity rates; however, modeling results suggest that the changes in energy generation would be virtually imperceptible at the statewide level.

Regional Economic Effects of Changes in Agricultural Production

Under the LSJR alternatives, reductions in water deliveries to agricultural users would affect several sectors of the economy, not just agriculture. When farm production falls as a result of reduced water availability, farmers would hire fewer seasonal workers and may lay off some year-round workers. Without jobs, household spending by these workers is likely to fall, affecting retailers and other businesses in the area. In addition, farmers would reduce purchases of equipment, materials, and services from local businesses, reducing jobs and income for these suppliers. The total regional economic effect is the sum of the direct effects to agriculture and the associated indirect and induced effects.

As discussed in detail in Appendix G, *Agricultural Economic Effects of Lower San Joaquin River Flow Alternatives*, the IMPLAN input-output economic model was used to analyze agriculture-related effects on the regional economy to estimate the indirect and induced economic activity associated with direct changes in agriculture-related revenue predicted by the SWAP model. IMPLAN is the most widely used economic input-output model for assessing regional economic impacts of regulatory and policy actions. An IMPLAN-based model that includes the Madera, Merced, and Stanislaus Counties was constructed for the regional economic analysis, which is considered a good representation of the agricultural area in the LSJR watershed. Refer to Appendix G for additional details concerning IMPLAN model development.[3]

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[3] The regional economic effects estimated by the IMPLAN model may be overestimated to some extent. As discussed previously in this chapter, the SWAP analysis of agricultural effects, which drives the assessment of related regional economic effects, incorporates several conservative assumptions, as detailed in Appendix G, including no increased use of groundwater to augment water supply.

It should be noted that potential effects on economic activity extend beyond the three-county study region used to analyze predicted changes in agricultural production. Effects of these changes would affect residents and businesses throughout the state and beyond. In general, even when a project is concentrated in a particular region and sector, economic activity (sales and purchases) typically extends beyond that area, both directly and indirectly. For example, agricultural inputs such as seed, fertilizer, insurance services, and fuel and transportation often originate outside the region where they are used. After accounting for direct sales and purchases, the indirect and induced transactions that result from income changes and secondary effects broaden the boundaries of the originally-affected area. However, potential statewide effects of flow-related changes on affected resources are not considered in this analysis because effects outside of the three-county area would be relatively small in the context of the statewide economy, with some effects even leaking beyond the state boundary, further diluting the impact outside of the plan area.

Under baseline, average annual industrial output generated by agricultural production plus all other sectors of the regional economy secondarily affected by agricultural production (e.g., suppliers, consumer retail, and service sectors) is estimated to total $4.7 billion (in 2008 dollars) (Table 18-11). In addition to revenue, the IMPLAN model was used to estimate the number of jobs supported by crop production and related (indirect and induced) sectors of the economy. Under baseline, jobs annually supported by agricultural production (directly and indirectly) are estimated to total about 31,790 (Table 18-12).

Table 18-11. Estimated Average Annual Baseline Economic Output for the Crop Production and Related Sectors and Changes Associated with the LSJR Alternatives

Economic Effects (2008 Dollars)	Baseline	Change from Baseline by LSJR Alternative		
		LSJR Alternative 2	LSJR Alternative 3	LSJR Alternative 4
Total Sector Output ($ Millions)	4,701	+15	-69	-210
% of Sector	100	+0.3	-1.5	-4.5
Direct ($ Millions)	2,760	+9	-40	-124
Indirect and Induced ($ Millions)	1,941	+6	-28	-87

Table 18-12. Estimated Average Annual Number of Crop Production and Related Sector Jobs for Baseline Conditions and Changes Associated with LSJR Alternatives

Economic Effects	Baseline	Change from Baseline by LSJR Alternative		
		LSJR Alternative 2	LSJR Alternative 3	LSJR Alternative 4
Total Regional Effect on Employment (# jobs)	31,787	+102	-465	-1,432
% of Sector	100	+0.3	-1.5	-4.5
Direct Jobs	13,080	+42	-191	-586
Indirect and Induced Jobs	18,707	+60	-273	-838

Regional output and employment increase for LSJR Alternative 2 but increasingly decrease as the percentage of unimpaired flow increases for LSJR Alternatives 3 and 4. As previously noted, increased average annual flow diversions on the Stanislaus River under LSJR Alternative 2 are expected to offset the reduced diversions on the Tuolumne and Merced Rivers compared to baseline diversions; under LSJR Alternatives 3 and 4, diversions on all three rivers decrease.

For LSJR Alternative 2, industrial output is predicted to increase compared to baseline, with a change in total regional output of approximately $15 million, or 0.3 percent (Table 18-11). Alternatively, industrial output is predicted to fall under LSJR Alternatives 3 and 4, decreasing by $69 million (1.5 percent) and $210 million (4.5 percent), respectively.

The total regional effects on jobs associated with the LSJR alternatives are similar, in relative terms, to the effect on economic output. The effect on the total number of jobs of the various percentages of unimpaired flow requirements associated with IMPLAN crop production and related sectors is shown in Table 18-12. Average annual jobs within the region are predicted to increase by 102 jobs (0.3 percent) under LSJR Alternative 2 compared to baseline. Conversely, jobs are predicted to decrease by 465 jobs (1.5 percent) and 1,432 jobs (4.5 percent) under LSJR Alternatives 3 and 4, respectively.

It should be noted that the regional economic impact results are not disaggregated to individual tributary watersheds because of a lack of boundary correspondence between the affected watersheds and the counties used to construct the IMPLAN model. However, as discussed in Appendix G, the LSJR alternatives would be expected to reduce overall surface water diversions more on the Tuolumne and Merced Rivers than on the Stanislaus River. Although the direct economic effects associated with these changes in diversions would be expected to be distributed similarly across the three tributary watersheds, the distribution of total regional effects (direct, indirect, and induced) would be affected by the presence of urban centers where many of the businesses that would benefit from farm- and employee-related spending are located.

Regional Economic Effects of Changes in Hydropower Generation

Potential impacts on regional economic conditions caused by changes in hydropower generation can be viewed by tracing the underlying relationship between changes in hydropower production and regional economic impacts. From the perspective of the statewide electricity grid, power lost as a result of implementing one of the LSJR alternatives would need to be replaced to meet statewide electricity demand, especially during peak summer months. Presumably, purchasing replacement power from other sources would be more costly to electricity utilities than the cost of the power currently being produced by the hydropower facilities on the three tributaries. Electricity utility providers would offset the cost of purchasing replacement power by raising utility rates for residential, commercial, and industrial users. For these users, increased spending on higher electricity bills could cause reduced spending on other goods and services, in turn causing losses in employment and income in many sectors of the state's economy. The extent of these effects would depend upon the size of the hydropower losses relative to California's overall supply of electricity.

As discussed previously in this chapter, hydropower generation under the LSJR alternatives is estimated to increase by 6 GWh under LSJR Alternative 2, and decrease by 38 GWh under LSJR Alternative 3, and by 68 GWh under LSJR Alternative 4 (Table 18-6). According to the California Energy Commission (2012), California's electricity generating system annually produces more than 296,000 GWh, accounting for 69 percent of the electricity the state uses. Compared to annual statewide electricity production, the hydropower changes potentially caused by one of the LSJR alternatives would range from an increase of 0.002 percent under LSJR Alternative to a reduction of 0.023 percent under LSJR Alternative 4. Thus, while the loss of hydroelectric power generation would affect residents statewide in terms of electricity rates, the changes would be very small, and their subsequent effects on regional economic conditions would be virtually imperceptible at the regional and statewide levels.

Regional Economic Effects of Fisheries, and Recreation

Potential impacts on regional economic conditions caused by changes in fisheries and recreation in the three tributary watersheds and the LSJR can be viewed by tracing the underlying relationship between recreational activities, including fishing, and regional economic impacts. Conceptually, local and regional economic activity generated by use of recreational resources can be traced from the availability of recreational resources to the generation of employment and income within a region. Management of recreational resources, including reservoir levels and flows, affects the amount and type of visitation attracted to recreation areas. Changes in the availability of recreation facilities and facility management result in changes in visitation, which, in turn, alter the location and level of spending by visitors to these facilities. For example, a highly developed recreation area, such as a reservoir including a resort with restaurants, boat slips, and boat launching facilities, may attract large numbers of visitors from outside the region who spend money on accommodations, restaurant meals, boat rentals, and fuel in the vicinity of the recreation area. Alternatively, an undeveloped campground may attract relatively few visitors from outside the local area, resulting in spending that largely consists of food and gasoline purchases made at home or en route to the site.

As discussed previously, effects on recreation in the region would occur under LSJR Alternatives 3 and 4 and be related to visitation to the Merced and Tuolumne Rivers. As a consequence, potential reductions in recreation-related economic activity would likely be most concentrated in Merced and Stanislaus Counties. LSJR Alternative 3 could be expected to have a minor impact on economic activity related to reduced recreation at these rivers (a function of reduced low-flow activities), whereas LSJR Alternative 4 would have a larger impact on regional spending and economic activity because of the additional adverse effects on boat-related activities. The overall effect on the recreational economy (economic activity associated with $1.8 million or less in annual recreation-related spending) in this region, however, would be expected to be minimal under both alternatives.

18.4 Southern Delta

Consistent with requirements in Water Code Section 13241, this section of the chapter presents results from an analysis of potential costs of compliance with salinity water quality objectives in the southern Delta. Potential ratepayer effects and regional economic impacts resulting from higher treatment costs also are considered.

In addition to compliance costs, potential effects on crop yield (dry beans) were investigated. Results from this investigation indicate there would not be substantial impacts; Chapter 11, *Agricultural Resources,* provides the complete analysis, so it is not discussed further here.

18.4.1 Costs of Methods of Compliance

This section includes a summary of information presented in Appendix H, *Evaluation of Methods of Compliance,* on the costs for WWTPs of complying with plan objectives for salinity in the southern Delta. Because the actual methods of compliance ultimately used are necessarily site- and discharge-specific, only general costs of compliance are presented in this section and in Appendix H. A precise evaluation of the actual economic impacts is neither required in this plan-level analysis nor is it feasible without specific data about projects that would be selected by project proponents as they move toward compliance.

As discussed more fully in Appendix H and in Chapter 13, *Service Providers,* compliance costs in the southern Delta would be attributable to complying with NPDES salinity objectives that could be developed and applied to WWTP dischargers as a result of the SDWQ alternatives. The following three methods of compliance are the methods most likely to be implemented by WWTPs to comply with potential NPDES salinity objectives. This list is not intended to be limiting, but rather is a sampling of methods from each step in the domestic water use cycle.

- **Develop new surface water supplies.** By reducing reliance on highly-saline groundwater for potable water demand, salinity discharged to the southern Delta would decrease.
- **Implement salinity pretreatment programs.** Target salinity loading in the sewer collection systems by removing water softeners and reducing salinity discharged to the sewer collection system from commercial, industrial, or institutional (CII) dischargers.
- **Desalination at the WWTP.** Remove salts at the WWTP to improve treated water quality and meet waste discharge permit limits.

Additionally, as a result of the SDWQ alternatives, it is possible that the Central Valley Regional Water Board would implement a TMDL for salinity in the southern Delta. While there is no current indication that a TMDL would be established, if one were to be established, agricultural users may need to reduce agricultural discharges to the southern Delta. In that case, agricultural dischargers may implement agricultural return flow salinity controls, such as changing the timing of the release of current discharges into the southern Delta, or storing the agricultural discharge in evaporation ponds. The SDWQ alternatives would require additional studies and monitoring of the southern Delta circulation and water levels. It is possible that additional studies and monitoring would indicate the need for modifications of the temporary barriers. If the State Water Board makes this determination, it might lead to DWR installing low lift pumping stations at the temporary barriers as a method of compliance.

New Surface Water Supplies

One method to reduce salinity discharges from Publicly Operated Treatment Works (POTWs) is to use more high-quality (lower salinity) surface water to meet water demands. To use more surface water, assuming there is sufficient water availability, a water purveyor may need to enlarge existing structures (water intake, treatment facility, pipelines, pumps), or build new structures.

The analysis presented in Appendix H, *Evaluation of Methods of Compliance,* focuses on the water purveyor's (e.g., irrigation or water supply district's) costs of developing new surface water supplies. For this proposed method of compliance, it is assumed that a water purveyor will have to purchase or transfer water rights from a senior water right holder. Terms for a water transfer are subject to many factors, but a useful indicator of the price of water is CALFED's Environmental

Water Account (EWA) Spot Price. Table 18-13 is a list of significant permanent CVP and SWP water contract sales from 2002 through 2004. Table 18-14 presents significant long-term transfers from 1997 through 2005.

Based on the significant purchases in the southern Delta, a reasonable cost of $1,716 per AF is assumed for a permanent water purchase, or $310 per AF for a long-term transfer. These cost estimates are based solely on the projected cost of surface water and do not include capital costs (e.g., conveyance of water from source to point of use), administrative, engineering, or legal costs related to securing the water supply and building the infrastructure. As discussed in Appendix H and depicted in Table H-11, it would generally cost between $337 and $235 million to plan, design, manage, and construct the required facilities to develop between 44,000 and 33,600 AFY of new surface water resources. These calculations are based on costs for the Davis-Woodland Water Supply Project, which will provide water from the Sacramento River, and the City of Stockton's Delta Water Supply Project, which will develop new water resources in the Delta. (Note these are examples of unit costs for developing new water supplies and do not represent potential total costs if all water purveyors in the southern Delta portion of the plan area decide to develop new, higher-quality water supplies.) To potentially offset or reduce total project costs, the regional water boards (e.g., Central Valley Water Board) and the California Department of Public Health offer grants and low-interest financing.

Table 18-13. Significant, Permanent Environmental Water Account Contract Sales 2002–2004

Year	Buyer	Seller	Type	Quantity (AF)	Price ($/AF)	2010 Nominal Price ($/AF)
2004	Westlands WD	Widren WD	CVP	2,990	1,500	1,741
2004	Westlands WD	Centinella WD	CVP	2,500	1,400	1,625
2003	West Kern WD	Berrenda Mesa WD	SWP	6,000	1,000	1,161
2003	Lemoore Naval Military Base	Tulare Lake Basin WSD	SWP	5,000	2,150	2,496
2003	Coachella Valley WD	Tulare Lake Basin WSD	SWP	$9,900	2,150	2,496
2002	City of Tracy	Banta Carbona ID	CVP	2,500	1,000	1,161
2002	City of Tracy	West Side ID	CVP	5,000	1,000	1,161
2002	Zone 7	Tulare Lake Basin WSD	SWP	400	1,600	1,858
2002	Zone 7	Belridge WSD	SWP	2,219	1,500	1,741
					Average	1,716

WD = Water District
ID = Irrigation District
WSD = Water Storage District
CVP = Central Valley Project
SWP = State Water Project
AF = acre-foot

Table 18-14. Significant Long-Term Transfers 1997–2005

Year	Buyer	Seller	Water Source	Length	Quantity (AFY)	Reported Price ($/AF)	2010 Nominal Price ($/AF)
2003	City of Lodi	Woodridge ID	NOD	40 years	6,000	200	238
2003	Cities of Tracy, Lathrop, Manteca, and Escalon	South San Joaquin ID	SOD	30 years	43,090	191	228
2003	Newhall Land & Farming Co.	Nickel Family	SOD	30 years	1,600	475	566
2000	Contra Costa WD	East Contra Costa ID	NOD	Permanent	8,200	25	32
2000	Northridge WD	Placer County Water Agency	NOD	15 years	12,000	435	565
1997	Metropolitan WD	Arvin Edison WSD	SOD	25 years	50,000	165	233
						Average	310

NOD = North of the Delta

SOD = South of Delta

Salinity Pretreatment Programs

A salinity pretreatment program targets salinity loading in the sewer collection system from domestic (residential sources), industrial, and commercial sources. It would provide salinity source control at different locations within a service district reduce the overall salt loading into the sewer system.

Removing water softeners and reducing salinity discharged to the sewer collection system would be expected to reduce salinity in the southern Delta. Many wastewater treatment agencies offer water softener removal rebate programs. Currently the Inland Empire Utilities Agency (IEUA) and the Los Angeles County Sanitation Districts (LACSD) offer between $206 and $2,000 to homeowners to remove water softeners. Rules for each agency's programs differ, but in general, once a homeowner certifies (and the wastewater treatment agency later verifies) that the water softener is removed, the wastewater treatment agency will reimburse the homeowner for the cost of removal, up to $2,000. Tables H-13 and H-14 in Appendix H, *Evaluation of Methods of Compliance,* display the costs of these two programs. Based on this information, if a wastewater treatment agency anticipates replacing 2,000 water softeners over 5 years, the agency can reasonably expect to pay between approximately $928,000 and $9,000,000 over a period of 5 years ($186,000–$1,800,000 per year).

Salts also can enter the wastewater collection system as a byproduct of CII activities. To address salinity loading by CII dischargers, many wastewater treatment agencies prohibit CII users from discharging to the wastewater collection system or strictly regulate the quality of wastewater entering the wastewater collection system. A variety of pollution control methods can be used to improve the water quality of CII dischargers, including best management practices (BMPs) or desalination devices, depending on the activities conducted by the CII discharger. These methods are typically applied at the industrial or commercial business that generates the wastewater.

CII pretreatment processes vary with discharger type and sources of elevated saline discharge. In some cases, an activity can be modified to reduce the amount of salts discharged to the wastewater collection system. Some general examples of methods a wastewater treatment agency's pretreatment program could implement to reduce salinity are to conserve water, pretreat water, install a desalination device, reduce water runoff, or use process water for landscape irrigation.

The costs of some BMPs (e.g., disposing of solids in landfills instead of the wastewater collection system) have nominal costs (i.e., a slightly higher garbage removal bill). Other BMPs may save the CII money; such is the case when a discharger reuses process water for landscape irrigation and reduces its monthly water bill.

In the case when a CII discharger decides to install a desalination device, costs vary based on what is being discharged, volume of the discharge, and water quality entering the wastewater collection system. Some light commercial reverse osmosis (RO) filtration systems cost as little as $1,000 to install and $200 per year to operate. These systems would purify the domestic water supply for the specific discharger, but the brine must be disposed of and not discharged back to the wastewater collection system. Other systems cost millions of dollars to install and tens of thousands of dollars to operate per year, per user. In some areas, the wastewater treatment agency will bear the cost of procuring and installing a CII pretreatment device; in other areas, the costs will be split between the CII discharger and the wastewater treatment agency.

Desalination

Some wastewater treatment agencies may opt to remove salts at the WWTP before discharging treated effluent to the southern Delta. Conventional wastewater treatment processes do not significantly remove salts from the wastewater treatment stream. To remove salts, a discharger must desalinate treated wastewater effluent. There are three methods to desalinate water: Thermal separation, electro-dialysis, and RO. RO is analyzed in Appendix H, *Evaluation of Methods of Compliance,* because it is the most common desalination technology in California, and its cost is comparable to or less expensive than other desalination methods, such as ion exchange or distillation.

The cost to install a desalination system at a wastewater treatment plant is highly variable. Important factors to consider include, but are not limited to: the quality and quantity of water entering the desalination system, the desired water quality leaving the desalination system, energy costs, the chosen method of desalination, and brine disposal method. Some WWTPs only treat a portion of the influent wastewater to achieve water quality objectives and reduce costs.

The *California Water Plan Update 2009* (DWR 2009) discusses the cost of desalination. These costs are summarized in Table 18-15.

Table 18-15. California Water Plan Update 2009 Unit Cost of Desalination

	Total Water Cost ($ per acre-foot)	
Type of Desalting	Low	High
Groundwater	$500	$900
Wastewater	$500	$2,000
Seawater	$1,000	$2,500

Using this approximation, a 10 million-gallon per day discharger can expect to pay between $5 and $22 million to construct an RO system at the WWTP. Extrapolating this trend is non-linear. The associated administrative, engineering, and legal costs do not generally decrease for smaller projects. Larger RO facilities cost more, but the typical unit price of water produced decreases due to the scale of construction costs compared to administrative, engineering, and legal costs. To potentially offset or reduce total project costs, the regional water boards and the California Department of Public Health offer grants and low interest financing.

Agricultural Return Flow Salinity Control

Agricultural water users may comply with proposed salinity standards by using agricultural return flow salinity controls such as real-time management (i.e., changing the timing of the release of agricultural discharge to receiving waters); or containing agricultural discharge in evaporation ponds. Agricultural water users may implement these methods of compliance for the southern Delta to protect agricultural uses. These methods, implemented as either as standalone actions or implemented together, may reduce salinity entering the southern Delta.

Real-Time Management

Agricultural dischargers could monitor receiving water's assimilative capacity on a real-time basis and time discharges to coincide with periods of high flow (i.e., more assimilative capacity). This method of complying with proposed salinity standards would require dischargers to establish a network of monitoring stations and a discharge schedule. When there is no assimilative capacity, irrigators would either recycle water that would otherwise be discharged, or would discharge to a detention pond until discharges to the receiving water are permitted. This method of compliance could be integrated with other BMPs (such as water recycling or use of evaporation ponds) to reduce salinity entering the plan area.

Based on a cost assessment detailed in Appendix H, *Evaluation of Methods of Compliance*, costs were estimated for developing a real-time management system, including construction and operations. These costs are summarized in Table 18-16.

Table 18-16. Costs and Components of a Real-Time Management System

Construction	
Computer and Software	$5,000
Control Gates (10)	$100,000
Floats, Weirs, and EC Monitoring Equipment	$50,000
Installation of Monitoring Components	$75,000
Conveyance to River	$100,000
Subtotal	$330,000
Contingency (30%)	$99,000
Total Construction Cost	$429,000
Operations and Maintenance	
Operations and Maintenance (Including Coordinating Discharges)	$100,000 per year

It is assumed that 11 real-time management systems would need to be constructed to effectively cover the major water users in the plan area (Appendix H). The total estimated construction cost for 11 systems is $4,719,000, with an operations and maintenance budget of $1.1million per year in addition to the costs to construct and operate temporary detention ponds. The cost to construct and operate temporary detention ponds is the same as the cost to construct and operate evaporation ponds.

Evaporation Ponds

Use of evaporation ponds may reduce salt loading in the plan area. Before water is discharged to receiving waters, it would rest in evaporation ponds to allow a portion of the discharged water to evaporate and leave behind suspended and dissolved solids. These solid salts are then collected and hauled to a landfill for disposal instead of being discharged to receiving waters.

Based on a cost assessment discussed in Appendix H, *Evaluation of Methods of Compliance*, constructing an evaporation pond would cost about $340 per AF of water. These costs include construction, land acquisition, purchase of compensatory land, and a 30 percent contingency (Appendix H). To operate an evaporation pond system would generally cost $50 per AF, including maintenance, pumping power, and monitoring. Assuming a maximum of 50 TAF storage is needed for zero surface water discharge in the plan area, it is estimated to cost a total of $17 million to construct the evaporation ponds and $2.5 million per year to operate. Actual costs are assumed to be less because there is no proposal to completely eliminate surface water discharges in the plan area.

It is estimated that concentrated salts could be stored in an evaporation pond for up to 50 years before salt would have to be hauled to a landfill. Hauling salts to a landfill could cost $200 per ton, and $25 per ton for operations and maintenance (Appendix H).

Low Lift Pumping Stations

The SDWQ alternatives require modeling and field studies to better understand circulation conditions in the southern Delta. These studies might indicate that modifications to the existing southern Delta temporary barriers project are needed, including providing additional lift stations at the barriers.

DWR, in its *Low Head Pumping Conceptual Plan* (2011), describes potential modifications to the operations of these barriers. As discussed in more detail in Appendix H, *Evaluation of Methods of Compliance*, cost evaluations undertaken for the plan were based on a number of layouts and scenarios for either permanent or temporary pumps at the southern Delta temporary barriers. Estimated costs for the various layouts and scenarios evaluated in the plan are summarized in Tables H-20 through H-23. The layout providing the greatest benefits is a two-pumping site alternative with 1,000 cfs pumping capacity, with combined pumping at Middle and Old River barriers. The estimated cost of construction for this layout is between $55.5 and $540.7 million (Table H-21), with annual costs estimated to range from $4.5 to $62.7 million (Table H-23).

18.4.2 Ratepayer and Regional Economic Effects

As discussed more fully in Chapter 13, *Service Providers*, existing WWTPs are point source dischargers of salt into the southern Delta, influencing the southern Delta salinity. The following six WWTPs[4], all of which are required to comply with effluent limitations established by the NPDES permits, discharge into the southern Delta.

- City of Tracy WWTP: 16 million gallons per day (mgd) permitted discharge.
- Manteca Wastewater Quality Control Facility: 17.5 mgd permitted discharge.
- Stockton Regional Wastewater Control Facility: 55 mgd permitted discharge.
- Deuel WWTP (Deuel Vocational Institution: 0.6 mgd permitted discharge.
- Mountain House Community Service District (CSD) WWTP: 5.4 mgd permitted discharge.
- Discovery Bay Community Services District WWTP: 2.1 mgd permitted discharge.

These WWTPs, their NPDES wastewater discharge permit order numbers, and their receiving water bodies are listed in Table 13-4 in Chapter 13.

Costs for complying with NPDES permit discharge limitations could result in rate increases for utility ratepayers. Assessing how sewer utility rates could be affected by compliance with salinity objectives is complicated by several unknowns. First, to determine potential rate impacts, the specific actions to be taken by wastewater treatment agencies to meet salinity objectives must be determined by each discharger. As discussed previously, each decision could include some or all of the following: 1) developing new surface water supplies, 2) developing and enforcing a salinity pretreatment program, and/or 3) developing desalination processes at WWTPs. These decisions, which have different cost implications, would be made by individual wastewater treatment agencies based on numerous considerations including the needs of their service districts, availability of

[4] As discussed in Chapter 13, *Service Providers*, while Discovery Bay Community Services District (CSD) is very close to the southern Delta, it is not expected to result in any modifications or new construction to its facility. This is because of the large dilution in Old River and the good quality water in Old River coming down from the Sacramento River (Marshall pers. comm. 2012a). Therefore, the Central Valley Water Board has determined the discharge from Discovery Bay CSD does not have reasonable potential to cause or contribute to an exceedance of the Bay-Delta water quality objectives in Old River (Marshall pers. comm. 2012a). Thus, they can comply with the water quality objectives and do not need effluent limits based on the Bay-Delta water quality objectives (Marshall pers. comm. 2012a). Accordingly, Discovery Bay CSD is not further included in the analysis.

surface water and land, and operation of their wastewater facilities. Water Boards are precluded from specifying manner of compliance under Water Code Section 13360, so each agency must choose for itself the appropriate mix of actions to meet its discharge requirements. Second, once individual wastewater treatment agencies have decided on the proper combination of salinity control measures, costs to undertake the specific actions by each agency would become apparent. All of the potential actions that could be undertaken by wastewater treatment agencies have differing costs, based on design and scale, and would achieve differing results in meeting the SDWQ alternatives. Without knowing how agencies would develop projects to include a mix of the actions they each need to address salinity objectives under each SDWQ alternative, estimating costs is not possible. Third, once total costs for the actions have been estimated, costs would need to be recovered by increasing utility rates for customers, a process which is determined by each individual agency, although the process would likely be similar for each agency.

According to the City of Manteca's *Draft Sewer Rate Study* (2008), sewer rates are set for ratepayers based on a systematic analysis of the sewer contribution made by various land uses and the costs required to collect and treat sewer influent. Collection and treatment costs are allocated to the various customer categories based on their relative contribution to the sewer system influent. The allocation of collection and treatment costs between customer categories is based on a combination of estimated usage and actual sewer influent. Sewer expenditures generally include the following categories.

- Collection operating and maintenance costs
- Treatment operating and maintenance costs
- Debt service (existing and projected)
- Capital replacement
- Depreciation
- Operating reserves/contingency

Once the collection and treatment costs are allocated to the various customer categories, rates are determined by dividing the allocated costs by the number of users in each category. Customer categories generally include residential, commercial, and industrial users.

Four of the five southern Delta dischargers that could be affected by the SDWQ salinity alternatives are communities that, to varying extents, serve a mix of residential, commercial, and industrial users, with service area populations ranging from the relatively small residential community of Mountain House (population 10,000) to the relatively large urban service area of the Stockton Regional Wastewater Control Facility (population 280,000). (Note that Deuel Vocational Institution would not be affected by the SDWQ salinity alternatives.) For each wastewater treatment agency, potential rate increases attributable to compliance with salinity objectives would be spread among user groups depending on each group's contribution to sewer system influent. Generally, rates for each user group could be expected to rise by a percentage similar to the percentage increase in wastewater treatment agency budgets to achieve salinity objectives under each of the SDWQ alternatives.

Ratepayer Effects

SDWQ Alternative 1: No Project

The following list, based on the impact analysis presented in Chapter 15, *LSJR Alternative 1 and SDWQ Alternative 1 (No Project)*, identifies wastewater treatment agencies that could face increased compliance costs, potentially resulting in higher costs to ratepayers to offset compliance-related expenditures for development and operation of programs and/or facilities. Based on the assessment of utility impacts presented in Chapter 13, the following dischargers would not be expected to meet the salinity objectives under the No Project Alternative conditions.[5]

- City of Tracy
- City of Stockton
- City of Manteca

Some wastewater treatment modifications are already being proposed by dischargers as a result of existing effluent limitations, southern Delta water quality issues, and in anticipation of complying with SDWQ Alternative 1 (existing water quality objectives for salinity as identified in the 2006 Bay-Delta Plan). Of the dischargers potentially affected by compliance costs, two have made efforts or are working toward reducing salinity concentrations in their source water supplies, four are implementing pretreatment programs to reduce water softener use among water users, and three are either proposing to construct or are already operating an RO treatment system (Chapter 13, Table 13-8). Based on the existing data for the electrical conductivity (EC) of discharged treated effluent, the circulation in the southern Delta, and the history of WWTP violations, SDWQ Alternative 1 is expected to result in the construction of new water or wastewater treatment facilities or expansion of existing facilities by three dischargers; the construction of these facilities could result in increased costs to ratepayers.

SDWQ Alternative 2: 1.0 dS/m Salinity

As discussed in Chapter 13, *Service Providers*, the following dischargers would not be expected to meet the salinity objectives under SDWQ Alternative 2.

- City of Tracy
- City of Stockton

For these two dischargers, SDWQ Alternative 2 is anticipated to require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could result in increased costs to ratepayers.

SDWQ Alternative 3: 1.4 dS/m Salinity

As discussed in Chapter 13, *Service Providers*, all of the WWTPs would be expected to comply with the SDWQ Alternative 3 without new or modified facilities.

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[5] LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative) would result in implementation of flow objectives identified in the 2006 Bay-Delta Plan. This would include full compliance with the existing southern Delta salinity objectives in the 2006 Bay-Delta Plan. See Chapter 15, *LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)*, for the No Project impact discussion and Appendix D, *Evaluation of LSJR Alternative 1 and SDWQ Alternative 1 (No Project Alternative)*, for the No Project Alternative technical analysis.

Regional Economic Effects

Sewer rates could increase by an unknown amount for ratepayers as a result of expenditures by wastewater treatment agencies to achieve salinity objectives under the SDWQ alternatives. From the perspective of the regional economy of the southern Delta area, rate increases could shift a portion of the spending by residential ratepayers from consumer goods and services to monthly sewer utility bills. This shift, while somewhat speculative and not anticipated to be a large percentage of overall consumer spending in the region, could result in relatively small losses of sales, employment, and income in consumer-serving sectors of the regional economy, such as retail stores and consumer-service businesses. Similarly, increases in sewer utility rates for commercial and industrial ratepayers could shift business spending from wages, supplies, and services to expenditures on higher sewer utility bills. This shift in spending could result in higher prices for goods and services provided by commercial and industrial businesses and lower employment by affected businesses. In both cases, reductions in consumer and business spending on goods and services could result in ripple effects throughout the regional economy. These effects would be centered within the service areas of the agencies potentially affected by the SDWQ alternatives, including those of Stockton, Manteca, and Tracy. (Mountain House is expected to achieve salinity objectives under all three SDWQ alternatives.)

To some extent, these adverse regional economic effects would be offset by increased employment by wastewater treatment agencies as they spend to construct and operate facilities and establish and operate programs to achieve salinity objectives under the alternatives. These agencies and their employees would spend in the regional economy, directly and indirectly generating sales, employment, and income in businesses providing good and services in the region.

The net increase or decrease in regional economic activity from higher sewer utility rates and increased agency spending is not anticipated to be large because changes would largely represent regional shifts in sales, employment, and income rather than overall reductions in regional economic activity.

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