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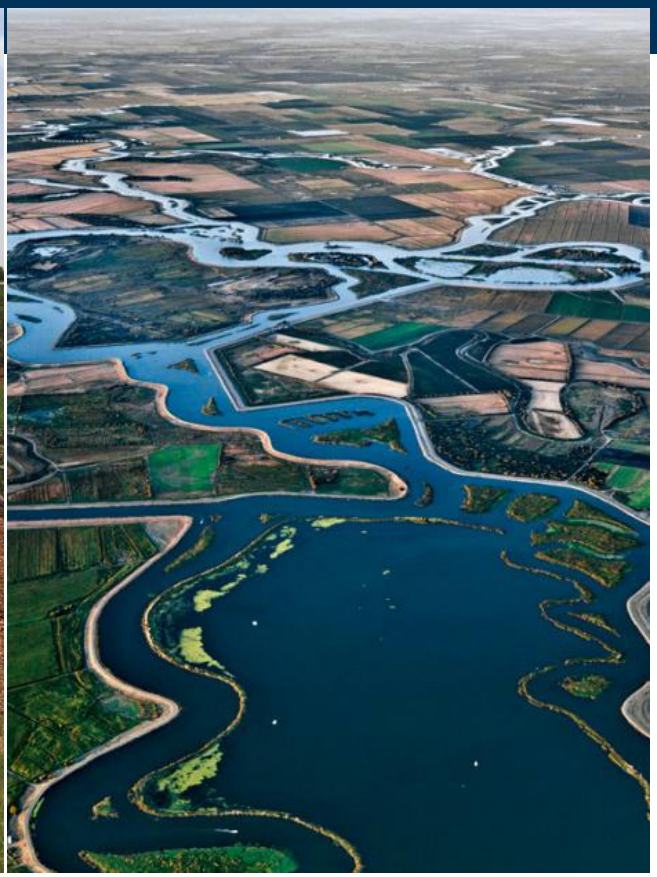
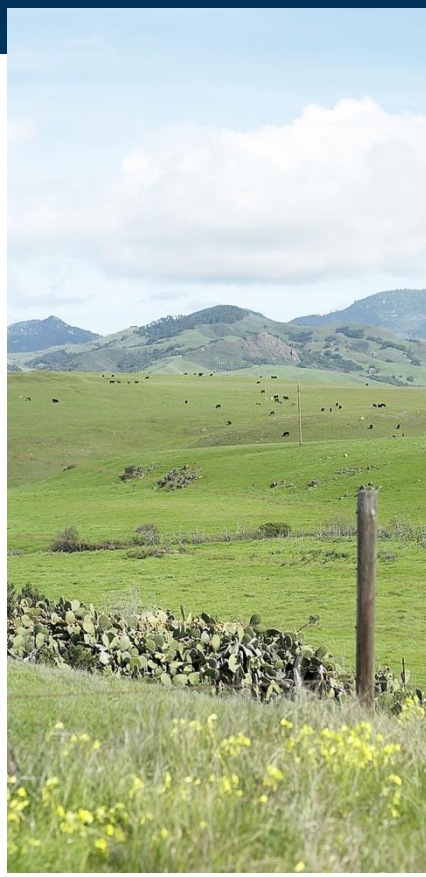

Role and Value of Agriculture

San Joaquin River Exchange Contractors Water Authority

January 2012

Prepared For

San Joaquin River Exchange Contractors Water Authority

Role and Value of Agriculture

San Joaquin River Exchange Contractors Water Authority Service Area

January 2012

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Table of Contents

Tables

Figures

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Executive Summary

The San Joaquin River Exchange Contractors (Exchange Contractors) occupy a unique, highly-productive, and integral part of the western San Joaquin Valley. The entire region developed around agriculture, which has thrived in the Exchange Contractors service area because of the availability and the practiced beneficial use of irrigation water. Much of the land has been farmed for more than 130 years. Without the reliable water supply the Exchange Contractors farmers have used responsibly and productively, the entire west side of the San Joaquin Valley would occupy a much less prominent position in the global agricultural economy.

The four agencies comprising the Exchange Contractors (Central California Irrigation District, Columbia Canal Company, Firebaugh Canal Water District, and San Luis Canal Company) serve 240,000 acres of fertile agricultural land on which a distinct, valuable mix of annual and permanent crops is grown. Land is located in four counties: Fresno, Madera, Merced, and Stanislaus. There are about 1,500 individual farms, making the average farm size 160 acres within the service area, and many are operated by fourth or later generation family members.

About 80 crops are grown commercially, with an aggregate annual farmgate value of $397,500,000. Annual crops make up 90 percent of the acreage and provide 78 percent of total farmgate value. Permanent crops make up 10 percent of the acreage and provide 22 percent of total value. Over time, the proportions of permanent crops, alfalfa, and vegetables have increased while those of cotton and field crops have fallen. Alfalfa acreage has increased over time in direct support of the local dairy and other livestock industries.

The farms in the service area collectively provide employment for 2,073 part-time and full-time employees. Annual payroll is nearly $75,000,000. The service area is also home to 65 dairies with an annual gross output value of more than $208,300,000. The operations support part-time and full-time employment of 1,266 people. Annual payroll is $11,100,000. Output from the dairies is a full 10 percent of the output of all dairies in the four-county area.

In addition to the direct value of crops and milk, production agriculture in the Exchange Contractors service area supports a broad cross section of industries which supply and are supplied by agriculture. Farmers purchase chemicals, seed, feed, fertilizer, equipment and other supplies as well as the services of hired labor, financial institutions and custom operators, termed "backward linkages." In addition, crops and milk are transported, packed, ginned, shipped, brokered, processed, frozen, and otherwise handled before reaching final consumers. This web of businesses is termed "forward linkages."

The aggregation of agricultural and agriculturally-related businesses represents a large part of the entire regional economy, particularly in some of the small towns in the area. The $397,500,000 in crop production supports an additional $149,000,000 in output in such industries as seed, chemical, and farm machinery dealers; banking; utilities; equipment rental; and many others. Thus, total industry output produced by or supported directly by Exchange Contractors crop production is more than $546,000,000, representing an output "multiplier" of 1.36. The 2,073 part time and full-time jobs associated with crop production support an additional 1,547 jobs in

other industries for a total of 3,620 jobs, an employment multiplier of 1.77. Similarly, total output associated directly and indirectly with the dairies within the service area exceeds $293,000,000 annually, an output multiplier of 1.43; and dairies support a total of 1,693 jobs, an employment multiplier of 1.35.

Cropping patterns in the service area have changed somewhat over time. These changes reflect such factors as market forces, water availability, and agronomic issues. Total cropped acreage has changed little since the mid 1980s. However, alfalfa acreage has increased 70 percent, field crops have declined 75 percent, cotton has fallen 32 percent, permanent crops have increased 114 percent, and vegetables have increased 341 percent. The largest acreage among crops grown in the service area is alfalfa, followed by grains, cotton, vegetables, and permanent crops.

The role and importance of agriculture varies within the four counties within which the Exchange Contractors service area is located. Parts of Stanislaus and Fresno Counties have undergone rapid urbanization for more than 20 years, and the relative importance of agriculture has declined in the immediate areas surrounding the cities within which growth has occurred. Many other parts of the service area remain very rural, and agriculture remains the main industry in those areas. Nonetheless, agricultural production and related processing, representing 4.3 percent of total economic output for California, account for 23 percent of the eight-county San Joaquin Valley output.

Agriculture and agriculturally-related businesses specifically within the Exchange Contractors service area account for twice as large a proportion of total employment as that for the four-county area. Agriculturally-related employment accounts for 84 percent of total employment in Mendota, 78 percent in Firebaugh, 56 percent in Dos Palos, and 55 percent in Crows Landing. Thus, agriculture and directly-related industries account for nearly one in every two jobs in the Exchange Contractors service area, versus one in six for the four-county area and one in ten for California overall.

In producing $397,500,000 of crops and $208,300,000 of milk annually, farmers in the service area purchase inputs valued at nearly $347,000,000, including $133,500,000 from local sources. Local purchases of animal feed, agricultural services, and real estate-related services comprise the largest shares of all local input expenditures. Local content is higher for some crops than for others.

Farmers in the service area have annual payrolls of more than $28,000,000. Both family and hired labor are employed in large numbers. Farms in the service area generate more than $7,000,000 in sales and other local taxes and provide more than $127,000,000 in taxable salary and rent and profit income.

Alfalfa is particularly important in the service area because of its local use in dairies and other livestock operations. Alfalfa is bulky and expensive to ship and most alfalfa produced in the area is used locally by dairies, feedlots, poultry and egg producers, and animal feed preparers.

Irrigators in the service area are skilled water managers who maximize their irrigation efficiency levels. In addition to close monitoring of climate and soil conditions, Exchange Contractors farmers employ water-conserving irrigation methods and participate in the programs

implemented by member agencies to conserve water. Member agencies have implemented a variety of measures to conserve water, including data monitoring and control systems, canal lining, use of high-efficiency pumps, and spill reduction programs. These agency and on-farm programs collectively have saved more than 80,000 acre-feet (AF) of irrigation water per year, enabling the Exchange Contractors to transfer water to other local water agencies and wildlife refuges for their respective beneficial uses.

Farmers in the Exchange Contractors service area use water efficiently and beneficially with the full understanding of how the resource has helped to make this an integral part of one of the most important agricultural regions in the nation. While agriculture will remain a core industry throughout the service area, growth in California and the San Joaquin Valley has impacted and will continue to impact some parts of the service area. For example, between 2000 and 2010 population in Firebaugh increased 31 percent, that in Mendota rose 40 percent, Los Banos rose 39 percent, Newman increased 44 percent, and Patterson rose 76 percent.

Although long-term growth projections for individual cities and other sub-county areas are not available from state or county sources, county-level projections show further substantial increases over the next 30 years, Fresno County by 75 percent, Madera County by 98 percent, Merced County by 94 percent, and Stanislaus County by 95 percent. Thus, while agribusiness will remain a cornerstone of the economy in the Exchange Contractors' service area, there will certainly be some shifts of land in the service area to non-agricultural purposes. Nonetheless, the west side of the San Joaquin Valley will continue to be a cornerstone of the California agricultural economy because of the productivity of the land, climate, and reliability of Exchange Contractors water supplies.

Chapter 1

Introduction

1.1 Background

In 1997, Northwest Economic Associates (NEA) completed a study on the role and value of agriculture in the areas served by the four districts in the San Joaquin River Exchange Contractors Water Authority (Exchange Contractors). That study quantified the levels of agricultural production in the service area and the many businesses linked to that production. The 1997 study also cited water management decisions to employ conservation measures, which supported the variety of programs implemented by the four member agencies. The resulting report utilized readily-available secondary information as well as important crop acreage, water use and related information provided by the Exchange Contractors in developing a regional economic model that was subsequently used to quantify the multiple benefits provided by Exchange Contractors agriculture to the entire region.

Since the 1997 report was completed, agriculture in the west side of the San Joaquin Valley has undergone several significant and tumultuous events. Included in these have been pumping restrictions in the Delta begun in 2007 to protect listed species, which have collectively reduced annual irrigation water supplies to the west side of the San Joaquin Valley by more than 450,000 acre feet (AF). Many agricultural districts throughout the San Joaquin Valley have been forced to adjust to years of significantly reduced Central Valley Project (CVP) and State Water Project (SWP) deliveries, and as a result many farmers have gone out of business. The impacts on farmers have been aggravated by the 2007-2009 drought.

Another important change since the 1997 report is the population growth across the San Joaquin Valley and the resulting increased demands for municipal and industrial (M&I) water. Because very little new water has been developed in the last 15 years, M&I is often in direct competition with agricultural uses. The combined pressure of population growth, limitations on water supply, and environmental restrictions pose real threats to agriculture on the west side of the San Joaquin Valley. The Exchange Contractors have a major role in sustaining the critical agricultural sector of the entire San Joaquin Valley. Because of this stewardship of land and water resources, the Exchange Contractors will also have an increasingly-important source of water put to beneficial use in their service area and, through willing seller-willing buyer transactions, to beneficial uses in other water districts in the future.

The purpose of this study is to evaluate the role and value of agriculture in the regional economy associated with the Exchange Contractors service area. Agriculture and agriculturally-related businesses are critical to the local economy, much more than what is suggested by statewide averages. Because of the region's historic and expected future dependence on agriculture, there is an ongoing need for information on the vital important role of agriculture and on the many beneficial ways in which water supplies are used in the service area. This applies to the entire area, particularly given the many small communities and rural areas that are largely or totally dependent upon agriculture and agriculture-related businesses. And it applies as well to the broader economies of the San Joaquin Valley, state, and nation.

1.2 Key Issues

The San Joaquin Valley is comprised of eight counties; Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare. The San Joaquin Valley is the cornerstone of California agriculture and is home to production of nearly $23.5 billion dollars of crop and livestock products annually. The Exchange Contractors service area includes nearly 240,000 acres of highly productive land within the western San Joaquin Valley, specifically in Fresno, Madera, Merced, and Stanislaus Counties. Farm sales in these four counties exceed $7.3 billion annually.

Farmers in the Exchange Contractors service area produce almost 80 annual and permanent crops, including many specialty products that are grown in few or no other places in the country or world. Many of these products are exported and sold in national and international markets.

The Exchange Contractors service area is also home to a large dairy sector that is integral to the production and processing sectors of the entire regional economy. Dairy operations in the area account for 10 percent of the total output in the four-county area.[1] The dairy sector is an important source of demand for locally-produced alfalfa and other feeds, and also provides a consistent flow of high-quality milk that is processed almost entirely in the local area.

The Exchange Contractors service area is dominated by agriculture. The availability and reliability of high-quality irrigation water are critical to the crops produced today in the service area as well as the total regional economy. Changes in regional population growth patterns will, however, have impacts on future agricultural conditions in the regional condition.

1.3 Organization of Study

The study is organized into seven chapters. Following the introduction is a history of the Exchange Contractors. It includes a brief summary of the four member agencies and the origins of their water supplies and rights. Next is a description of the economy in the service area, including demographics, key industries, and other related topics. The discussion then moves to the role of farming in the Exchange Contractors service area and historical cropping patterns and trends. It also includes a description of alfalfa and dairy production. The next chapter is a technical discussion of agriculture as a core goods-producing industry, the linkages and multiplier effects of agriculture in the area, and the regional dependence on it. Next is a review of irrigation and water conservation, including a summary of current water transfer programs. The study concludes with a discussion on future conditions in the service area, including implications for agriculture.

[1] Based on the estimated number of on dairy farms in the service area relative to the number of farms in the entire four-county area. See USDA, NASS, California Field Office. California Agricultural Statistics, 2009. Livestock and Dairy. Sacramento.

Chapter 2

Overview of the Exchange Contractors

2.1 Member Districts

The San Joaquin River Exchange Contractors Water Authority (Exchange Contractors) is comprised of four individual water agencies: the Central California Irrigation District (CCID), Columbia Canal Company (CCC), Firebaugh Canal Water District (FCWD), and San Luis Canal Company (SLCC). The Exchange Contractors monitor environmental, legislative, and legal issues which impact the operations or water rights of the collective interests of the four member agencies. While the four agencies independently manage and operate their respective distribution systems, those entities operate as a single unit by terms of the Exchange Contract.[2] The Authority itself was created in 1992. Total surface water supplies are allocated among the four agencies by historic formulae and are coordinated by a watermaster.

2.2 History of Water Rights

The Exchange Contractors member agencies hold pre-1914 and riparian rights and are some of the oldest water rights in California, dating back to the 1880s. Land in the service areas has been farmed continuously since then. Initial activities were primarily land-extensive grain and livestock production, and lands later transitioned to land-intensive irrigated crops.

During the 1930s, the U.S. Bureau of Reclamation began planning development of the Friant Dam to facilitate development and irrigation of the eastern San Joaquin Valley. To facilitate that development, the Bureau in 1939 entered into an agreement, the "Exchange Contract," by which the Exchange Contractors agreed to accept their water right deliveries from a substitute supply, the Delta-Mendota Canal (DMC), in lieu of continuous deliveries from the San Joaquin River. By terms of their contract, the Exchange Contractors are guaranteed 100 percent of their water allotment in normal years, 840,000 acre-feet (AF), and 650,000 (AF) in critical years. The Exchange Contractors maintain their San Joaquin River water rights, but agree not to exercise those rights if they receive guaranteed deliveries of substitute water through the DMC or from other Bureau sources. If the Bureau is unable to deliver the substitute water in the quantities specified in the Exchange Contract, the Exchange Contractors have the right to receive their water from Friant Dam and down the San Joaquin River.

2.3 Water Sources

Irrigation is necessary to grow the high value crops under production in the service area. However, the crops that are increasingly important within the service area, e.g. vegetables and fruits and vines, cannot be grown commercially without irrigation. The highly-reliable water

[2] U.S. Bureau of Reclamation. March 2009. Draft Environmental Assessment, Transfer of Up to 4,400 acre-feet of Central Valley Project Water from Firebaugh Canal Water District to San Luis Water District or Westlands Water District. EA-09-31. Sacramento.

supplies of the Exchange Contractors support directly the vital agricultural sector within their service area as well as the entire San Joaquin Valley.

Besides surface water, other supplies used in the area include natural precipitation, runoff from west side ephemeral streams, and groundwater. Historically, groundwater was the primary source of irrigation water, but usage became unsustainable because of severe overdraft and land subsidence problems in some west side areas. The importation of Central Valley Project (CVP) water to the San Joaquin Valley arrested the long, secular overdraft and subsidence issues and sustained the vibrant agricultural economy in the area.

Chapter 3

Socioeconomic Profile of the Service Area

The four member Exchange Contractor agencies are located within Fresno, Merced, Madera, and Stanislaus Counties. This section provides a profile of economic conditions in the four-county area overall as well as in the Exchange Contractors service area per se. The information for the Exchange Contractors service area is based on the zip codes of the service areas of the four member agencies. In both cases, the profiles are based on publicly-available information provided by the Census Bureau, California Department of Finance, and others.[3] Data which are available for some variables at the county level, however, are not available for individual zip codes as described in the text.[4]

3.1 Population Trends

3.1.1 Four-County Area

Much of the agricultural land served by the Exchange Contractors is located in rural, unincorporated areas of the four-county region. However, there are several incorporated cities in proximity to farms served by the Exchange Contractors. These include Firebaugh and Mendota (in Fresno County), Dos Palos and Los Banos (in Merced County), and Newman and Patterson (in Stanislaus County).

The four-county region represents a substantial component of the San Joaquin's population base. It accounted for 1.85 million people in 2010, with most of this population concentrated in Stanislaus County and Fresno County (see Table 3-1). Population growth in the region has been steady over the past two decades at approximately 1.8 percent annually. Population in Madera County has grown the most rapidly among the four counties, increasing 71.3 percent from 1990 to 2010.

[3] The geographical boundaries of the Exchange Contractors service area do not match exactly those of the zip codes. Thus, the zip code data shown are approximate values for, and are believed to be very representative of, conditions in the service area.

[4] Data for different years are included in different sections. In some cases, 2010 data are presented to illustrate the most current (annual) data for the area. In other cases, 2008 data are presented for comparison with the data in the input-output model developed using IMPLAN software (see Chapter 5).

Table 3-1 Population and Population Growth in the Four-County Area (1990–2010)

County/Area	Population			Population Growth	
	1990*	2000	2010	1990–2000	2000–2010
Fresno	667,490	799,407	930,450	19.8%	16.4%
Firebaugh	4,429	5,743	7,549	29.7%	31.4%
Mendota	6,821	7,890	11,014	15.7%	39.6%
Merced	178,403	210,554	255,793	18.0%	21.5%
Dos Palos	4,196	4,385	4,950	4.5%	12.9%
Los Banos	14,519	25,869	35,972	78.2%	39.1%
Madera	88,090	123,109	150,865	39.8%	22.5%
Madera	29,283	43,205	61,416	47.5%	42.2%
Stanislaus	370,522	446,997	514,453	20.6%	15.1%
Newman	4,158	7,092	10,224	70.6%	44.2%
Patterson	8,628	11,606	20,413	34.5%	75.9%
Service Area (Total)	**1,304,505**	**1,580,067**	**1,851,561**	**21.1%**	**17.2%**

Sources: California Department of Finance Demographic Research Unit, 2007a and 2010.

Population in the four-county region is projected to increase by 93 percent from 2010 to 2040, from 1.85 million to 3.57 million (see Table 3-2). The rate of growth is expected to decrease over time, with the greatest rate of growth between 2010 and 2020, at 2.9 percent annually. Among counties, Madera and Merced are projected to experience the most rapid growth (128 percent and 112 percent, respectively). Population growth in Fresno County is expected to be 80 percent, while that in Stanislaus County is expected to be 97 percent.

Table 3-2 Population Projections in the Four-County Area (2020-2040)

County/Area	Population			Population Growth (%)		
	2020	2030	2040	2010-2020	2020-2030	2030-2040
Fresno	1,201,792	1,429,228	1,670,542	29.2%	18.9%	16.9%
Merced	348,690	439,905	541,161	36.3%	26.2%	23.0%
Madera	212,874	273,456	344,455	41.1%	28.5%	26.0%
Stanislaus	699,144	857,893	1,014,365	35.5%	22.7%	18.2%
Four County Area (Total)	**2,462,500**	**3,000,482**	**3,570,523**	**33.0%**	**21.8%**	**19.0%**

Sources: California Department of Finance (Demographic Research Unit), 2007b and 2010.

3.1.2 Exchange Contractors Service Area

The Exchange Contractors service area covers parts of nine zip codes in the four counties. Population data for eight of those zip codes are available for 2000 and 2010. Other demographic data, e.g. median household and per capita income, are not yet available from the 2010 Census of population. Population data are shown in Table 3-3. Data are not available for zip code 93661, Santa Rita Park.

As shown, the largest absolute population in both 2000 and 2010 was in zip code 93635, Los Banos. Between 2000 and 2010, the largest percentage growth was in Newman at 38.0 percent, followed by Los Banos at 33.2 percent and Mendota at 29.7 percent.

Table 3-3 Population in the Exchange Contractors Service Area Zip Codes, 2000 and 2010

	Population by Zip Code and City/Town, 2000 and 2010								
	93620	93622	93635	93640	93665	95313	95322	95360	
	Dos Palos	Firebaugh	Los Banos	Mendota	South Dos Palos	Crows Landing	Gustine	Newman	Total
2000	9,386	9,474	29,120	9,160	1,385	1,501	7,868	8,485	76,379
2010	9,591	9,581	38,776	11,880	1,620	1,386	8,942	11,712	93,488
% change	2.18%	1.13%	33.16%	29.69%	16.97%	-7.66%	13.65%	38.03%	22.40%

3.2 Economic Base

3.2.1 Employment

3.2.1.1 Four County Area

Employment by industry[5] for the four-county study area is presented in Table 3-4. The economy in the study area is relatively diverse, although it has a larger agricultural concentration than the state overall. In 2008, farm employment in the four-county area provided over 42,000 jobs or 5.1 percent of total employment in the study area, while related natural resource industry employment and mining provided an additional 5.1 percent.[6] Overall, the largest sector in 2008 was Services, which employed over 320,000 people and accounted for nearly 39 percent of the regional job base.[7] Other leading sectors in the regional economy included federal and state/local Government (15.6 percent of total industry employment) and Wholesale and Retail Trade (13.4 percent).

In 2008, Fresno County provided the greatest absolute number of farm jobs (20,301, or 4.5 percent of total employment); however, on a proportional basis, farming in Merced and Madera counties was larger, accounting for 8.3 percent and 7.9 percent of the county job totals, respectively. Indirectly, agriculture also provides numerous jobs in those industries that supply inputs to farming operations (e.g., farm machinery and fertilizers) and industries that are reliant on agricultural commodities (e.g., food processing plants); these economic linkages are discussed in greater detail below.

[5] The North American Industry Classification System (NAICS) is the standard used by Federal statistical agencies to categorize business establishments for use in the collection, analysis, and publication of statistical data on U.S. businesses. NAICS was implemented in 1997 as a replacement for the older Standard Industrial Classification (SIC) system. Because the NAICS and SIC classifications do not overlap completely, comparisons between 2008 NAICS data and 2000 and earlier SIC data are not possible; therefore, historical trends at the industry level are not presented.

[6] While agriculture is a key employer in many parts of the Exchange Contractors service area, the county level data in Table 3-3 do not provide that level of resolution. Figures in Section 3.2.1.2 do provide greater detail.

[7] U.S. Department of Commerce, Bureau of Economic Analysis. GDP and Personal Income. CA25N. total full-time and part-time employment by NAICS industry. Internet website http://www.bea.gov.

Table 3-4 Employment by Industry in the Four-County Area (2008)

Industry/Sector [1]	Jobs (by County) [2]				Total [3]	Percent of Total
	Fresno	Merced	Madera	Stanislaus		
Farm / Agriculture	20,301	7,766	4,728	9,324	42,119	5.1%
Agriculturally-Related	30,410	4,243	(D)	6,683	*<41,336>*	*<5.0%>*
Mining	437	34	(D)	101	*<572>*	*<0.1%>*
Construction	24,484	4,171	3,151	13,272	45,078	5.4%
Manufacturing	28,861	9,832	3,627	22,928	65,248	7.9%
Wholesale and Retail Trade	60,770	10,092	6,083	34,157	*<111,102>*	*<13.4%>*
Transportation, Warehousing, and Utilities	16,858	(D)	1,783	(D)	*<18,641>*	*<2.3%>*
Finance and Insurance	18,991	2,576	1,218	7,339	30,124	3.6%
Services	178,507	30,990	19,339	92,300	*<321,136>*	*<38.8%>*
Government	70,412	17,335	11,739	29,269	128,755	15.6%
Federal Government	11,583	1,167	559	1,728	15,037	1.8%
State/Local Government	58,829	16,168	11,180	27,541	113,718	13.7%
Total	**450,031**	**93,314**	**60,184**	**223,870**	**827,399**	**100.0%**

1 Industry/sectors based on a summary of NAICS industry classifications

2 (D) = Estimate not available to avoid disclosure of confidential information. Values included in county totals.

3 Italicized numbers in brackets represent partial totals based on available data at the county level and exclude values that were not available due to disclosure issues (see footnote 2). Missing data are included in the totals.

Sources: U.S. Department of Commerce Bureau of Economic Analysis, 2010b

3.2.1.2 Exchange Contractors Service Area

Agriculture and agriculturally-related industries are the anchors of the westside San Joaquin Valley economy, including the Exchange Contractors service area. Table 3-5 combines the four-county figures from Table 3-4 with corresponding figures for the zip codes in the Exchange Contractors service area. As shown in Table 3-5, employment in farming/agriculture and agriculturally-related industries was nearly three times as great in the Exchange Contractors service area than in the combined four-county area (46.1 percent versus 16.9 percent).[8]

Agricultural and related employment also varied widely among zip codes, as shown in the footnote to the table. Employment in construction was relatively lower, that in transportation and warehousing was higher, and services, government, and unclassified industry employment was lower in the service area than across the four counties. Thus, agriculture and industries directly related to agriculture account for nearly half of all jobs in the Exchange Contractors service area in contrast to one in six for the four-county area and one in ten for California.

[8] The four-county total employment in Table 3-5 (824,156) differs slightly from that shown in Table 3-4 (827,399) because different data sources are used for the two tables. The difference, 3,243, is less than 0.4 percent of the totals and does not change the analysis in any way.

Table 3-5 Employment by Industry in the Four-County and Exchange Contractors Service Areas (2008)

	Four County Area		Exchange Contractors Service Area[2]	
Industry /Sector [1]	Total	% of Total	Total	% of Total
Agriculture and Related	139,961	17.0%	14,582	46.1%
Mining	298	0.0%	17	0.1%
Utilities	2,787	0.3%	87	0.3%
Construction	46,360	5.6%	992	3.1%
Manufacturing (Non-Agricultural)	31,103	3.8%	304	1.0%
Wholesale Trade	23,945	2.9%	531	1.7%
Retail Trade	86,507	10.5%	2,880	9.1%
Transportation & Warehousing	29,385	3.6%	1,693	5.4%
Information Services	9,158	1.1%	125	0.4%
Finance & Insurance Services	21,882	2.7%	313	1.0%
Real Estate & Rental Services	26,636	3.2%	484	1.5%
Professional & Technical Services	30,362	3.7%	406	1.3%
Management of Companies	5,933	0.7%	12	0.0%
Administrative & Waste Services	37,456	4.5%	256	0.8%
Educational Services	8,098	1.0%	46	0.1%
Health & Social Services	84,341	10.2%	1,509	4.8%
Arts, Entertainment, & Recreation	8,731	1.1%	108	0.3%
Accommodation & Food Services	47,323	5.7%	1,735	5.5%
Other Services	49,742	6.0%	1,197	3.8%
Government and Unclassified	134,148	16.3%	4,355	13.8%
TOTAL	**824,156**	**100.0%**	**31,632**	**100.0%**

1 Industry/sectors based on a summary of NAICS industry classifications

2 Agricultural and related employment percentages were 56 percent in Dos Palos, 78 percent in Firebaugh, 20 percent in Los Banos, 84 percent in Mendota, 8 percent in South Dos Palos, 47 percent in Gustine, 55 percent in Crows Landing, and 48 percent in the Newman zip codes.

Sources: U.S. Department of Commerce Bureau of Economic Analysis, 2010b; IMPLAN zip code data.

3.2.2 Labor Force and Unemployment

The unemployment rate in the four-county area in which the Exchange Contractors are located is very high. The four-county average in 2010 was 17.4 percent, relative to the California total of 12.4 percent (see Table 3-6). Among the four counties, unemployment was highest in Merced at 18.9 percent and lowest in Stanislaus at 15.6 percent. Comparable data for the individual zip codes comprising the Exchange Contractors service area are not yet available from the 2010 Census of Population and Housing.

Table 3-6 Labor Force and Unemployment in the Four-County Area, 2010[9]

County	Civilian Labor Force	Unemployment Rate (percent)
Fresno	438,400	16.8%
Merced	107,300	18.9%
Madera	545,700	17.2%
Stanislaus	66,900	15.6%
Four-County Area[1]	**1,158,300**	**17.4%**
State	**18,176,200**	**12.4%**

1 Weighted by population

Source: US Census Bureau, 2010.

3.2.3 Major Employers

3.2.3.1 Four County Area

The industries of the major employers within the four counties are varied, from county government agencies to hospitals to food processors and wineries. See Table 3-7.

9 U.S. Census Bureau, Census 2010. 2010. DP-1 Profile of General Population and Housing Characteristics: 2010. Website http://factfinder2.census.gov/main.html, accessed July 1, 2011. Comparable data are not yet available from the Census Bureau by zip code.

Table 3-7 Major Employers in the Four-County Area

County and Top Employers	Employee Size Class
Fresno	
Fresno Unified School District	5,000-9,999
Fresno County	5,000-9,000
Community Medical Center	1,000-4,999
Stamoules Produce	1,000-4,999
Foster Farms	1,000-4,999
Madera	
Children's Hospital	1,000-4,999
D.P. Enterprises	1,000-4,999
Valley State Women's Prison	500-999
Constellation Wines	500-999
Merced	
Merced College	1,000-4,999
Merced County Schools	1,000-4,999
Mercy Medical Center	1,000-4,999
Foster Farms	1,000-4,999
Atwater School District Office	500-999
Stanislaus	
Alcott Ridge Vineyards	1,000-4,999
Carlo Rossi Winery	1,000-4,999
Con Agra Foods	1,000-4,999
Copperidge Winery	1,000-4,999
Del Monte Foods	1,000-4,999

Source: California Employment Development Department. Major Employers in Various Counties. http://www.labormarketinfo.edd.ca.gov, accessed October 3, 2011.

3.2.3.2 Exchange Contractors Service Area

Many of the businesses located within or proximate to the Exchange Contractors service area are agriculturally-related companies. In addition, many other industries are represented, reflective of the general population growth in the area and the economic diversification typical in such areas. Table 3-8 lists major employers for several of the zip code areas which comprise the service area. Numbers of employees by individual business are not available in most cases and are not included in the table.

Table 3-8 Major Employers in Several Cities Within or Proximate to the Exchange Contractors Service Area

County	City	Major Employers
Fresno	Firebaugh	Gargiulo Produce, TomaTek, City of Firebaugh, Mixed Retail
Fresno	Mendota	ADM, Del Monte Foods, Stamoules Produce, Mixed Retail
Merced	Dos Palos	Dos Palos Memorial Hospital, Mixed Retail
Merced	Los Banos	Memorial Hospital, City of Los Banos, Mixed Retail
Stanislaus	Newman	Newman-Crows Landing Unified School District, San Luis Care Center, Mixed Retail

3.3 Socioeconomic Indicators of Social Well Being

Economic indicators of social well-being include per-capita income, median household income, and poverty rates. These three indicators for the four-county area are shown in Table 3-9. In 2008, per-capita personal income was $30,502.[10] Across counties, per-capita income levels was highest in Stanislaus County ($31,673), followed by Fresno County ($31,111), Merced County ($28,003) and Madera County ($26,880). The per-capita income for the state averaged $43,853 in 2008.

The weighted average median household income in the four-county area was $47,376 (2009 dollars), which is about 22 percent lower than the statewide figure of $60,392. Similar to per-capita income, median household income by county was highest in Stanislaus ($51,529), followed by Fresno ($46,230), Madera ($46,083), and Merced County ($43,848).

[10] Weighted by population

Poverty rates established by the U.S. Census Bureau represent the percentage of an area's total population living at or below this threshold. Based on 2010 American Community Survey data using average income data for the period 2005–2009, the weighted poverty rate in the study area was about 19.1 percent, which is higher than the statewide rate of 13.2 percent. The county poverty rate was highest in Merced (21.1 percent), followed by Fresno (20.9 percent), Madera (18.0 percent), and Stanislaus (15.1 percent).[11]

Table 3-9 Socioeconomic Indicators of Social Well-Being in the Four-County Area[12]

County	Per Capita (2008)	Median Household Income (2005-2009)[1]	Poverty Rate (2005-2009)
Fresno	$31,111	$46,230	20.9%
Merced	$28,003	$43,848	21.1%
Madera	$26,880	$46,083	18.0%
Stanislaus	$31,673	$51,529	15.1%
Four-County Area[2]	**$30,502**	**$47,376**	**19.1%**
State	**$43,853**	**$60,392**	**13.2%**

1 Values shown are in 2009 dollars

2 Weighted by population

Source: US Census Bureau, 2010.

11 Comparable data for the zip codes comprising the Exchange Contractors service area are not yet available from the 2010 Census of Population and Housing.

12 U.S. Census Bureau, Census 2010. 2010. DP-1 Profile of General Population and Housing Characteristics: 2010. Internet website http://factfinder2.census.gov/main.html, accessed July 1, 2011.

Chapter 4

Agricultural Production

The San Joaquin Valley is characterized by a semiarid Mediterranean climate of hot, dry summers and cool, rainy winters. Within the approximate 80 mile span served by Exchange Contractor members from Crows Landing in the north to Mendota in the south, weather, water reliability, soil, and other characteristics foster the production of a broad range of both annual and permanent crops. In addition to supporting the U.S. demands for many specialty crops, farmers in the service area provide large supplies of cotton, almonds, walnuts, and other high-value crops for overseas markets.

There are about 1,500 individual farms within the four Exchange Contractors member agencies.[13] The operations are predominantly medium size family-run enterprises. Fewer than two percent are held in non-family corporations, and 79 percent are in either individual/family or family corporation ownership [Archibald 1990]. Another 19 percent are in partnerships, some of which may include families. Many of the farms have been under current or previous generations of family ownership for decades, and are managed actively rather than by absentee owners.[14] Farm size averages 160 acres, but varies within the region.[15] It is common for family members to work on the operations.

In addition to family labor, farms in the four-county area support income for a large hired labor force. About 43 percent of the farms use hired farm labor with an estimated annual payroll of nearly $965,000,000[16] (USDA Census of Agriculture, 2007). The total number of hired farm workers in the four counties is approximately 102,000, and the proportions of farms using hired labor vary from 36 percent in Stanislaus County to 47 percent in Fresno County. Data specific to farms in the Exchange Contractors service area are not available, however.

4.1 Cropping Patterns and Changes Over Time

This section discusses both short-run and long-run cropping patterns. Exchange Contractors farmers make decisions on which crops to plan based on many factors such as soil characteristics, crop prices, crop rotations, input prices and availability, and expectations on domestic and export markets for crops. Because of their reliable water supplies in addition to

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[13] Chedester, Steve. September 21, 2006. TESTIMONY OF SAN JOAQUIN RIVER EXCHANGE CONTRACTORS WATER AUTHORITY TO THE WATER AND POWER SUB-COMMITTEE OF THE HOUSE COMMITTEE ON RESOURCES, p. 3. U.S. House of Representatives. Washington, D.C.

[14] San Joaquin River Exchange Contractors Water Authority. 1997. Role and Value of Agriculture in the San Joaquin River Exchange Contractors Water Authority Service Area. Prepared by Northwest Economic Associates, Sacramento.

[15] Average farm size within the four counties overall is 286 acres and ranges from 192 acres in Stanislaus to 399 in Merced. Median farm size is 36 acres and ranges from 20 acres in Stanislaus to 58 acres in Madera. See USDA. 2009. Census of Agriculture. California County Data, Table 1. Washington D.C.

[16] See Chapter 5 in this report.

favorable climate, soils, and other characteristics, they have been important members of and contributors to the entire San Joaquin Valley agriculture and agribusiness complex, and have helped the region gain an increasingly-important role in meeting both domestic and international market demands.

Exchange Contractors farmers produce a broad variety of permanent and annual crops. While crop acreages vary among years, the primary crops grown over time are cotton, melons, alfalfa hay, grains, vegetables, field crops, fruits and nuts, and grapes. All crops are irrigated because of limited rainfall. Within certain sub-regions, some crops are more dominant than others because of climate, soil, and water table considerations. A list of the key crops, by category, is shown in Table 4-1.

Table 4-1 Principal Crops Grown in the Exchange Contractors Service Area

Field Crops and Grains	Fruits/Nuts/Vines and Melons	Vegetables
Alfalfa	Corn nuts	Artichokes
Alfalfa seed	Flowers	Asparagus
Corn	Grapes	Basil
Grain	Melons	Beans (green)
Milo	Nursery (trees)	Broccoli
Oats	Almonds	Brocoflower
Rice/Seed	Apples	Cabbage
Sorghum	Apricots	Carrots
Wheat	Cherries	Cauliflower
Barley	Olives	Celery
Beans (Dry)	Oranges	Cucumbers
Beets (sugar)	Peaches	Garlic
Canola	Pecans	Kale
Garbanzos	Pistachios	Lettuce
Grape Seed	Pluots	Onions
Misc.	Plums	Parsley
Safflower	Pomegranates	Peas
Sunflower	Prunes	Peppers
	Walnuts	Pumpkins
		Radishes
		Spinach
		Squash
		Tomatoes
		Misc. Vegetables

Sources: Exchange Contractors, 2011; and Cardno ENTRIX, 2011.

4.1.1 Short Run Cropping Patterns

Over the last five years, total cropped acreage within the Exchange Contractors service area has varied from 218,635 in 2006 to 250,794 in 2008 and 229,155 in 2010.[17] Average cropped land

[17] These figures include multiple crops grown on some parcels within a single year.

over the five years has been 232,969 acres. During that period, alfalfa hay and seed has averaged 27.6 percent to total cropped acreage, grains 23.5 percent, cotton 19.1 percent, vegetables 10.2 percent, and fruits, nuts, trees, and vines 8.2 percent; the remaining crops have averaged 11.4 percent (see Table 4-2 and Figure 4-1).

As shown in Table 4-2, cotton acreage changed significantly between 2006 and 2010, from a maximum of 66,198 acres in 2006 to a low of 25,458 acres in 2009 before increasing to 39,255 acres in 2010. Field crops ranged from 7,432 to 13,164 acres, melons from 3,719 to 6,330 acres, vegetables from 19,572 to 28,380 acres, grains from 33,011 to 74,992 acres, and pasture/hay/forage from 6,875 to 9,428 acres.

Alfalfa acreage remained relatively stable, with only minor fluctuations, while acreage of fruits, nuts, and vines more than doubled over the five years. The stability of alfalfa acreage is likely due to its crop rotation value for soil management purposes, and to the continued demands for high-quality forage from dairies in the area. The increasing trend in acreages of fruits, nuts, and vines is relatively recent and is related directly to the reliability of irrigation water, without which these crops would not be grown. All are characterized by significant up-front investments and large annual operating costs that closely integrate farm-level production with the supporting agribusiness complex throughout the area. The data in Table 3-5 reflect this close integration and the importance of agriculture to the area economy.

Table 4-2 Exchange Contractors Service Area Crop Acreage, by Year 2006-2010 and Average

Year	Alfalfa	Cotton	Field Crops	Fruits/nuts/vines	Melons	Vegetables	Grains	Pasture/hay/forage	Fallow	Total
2006	62,513	66,198	11,372	12,741	3,719	19,572	33,011	7,135	2,374	218,635
2007	60,289	56,859	13,164	14,814	3,985	22,652	56,291	8,342	2,275	238,671
2008	70,663	35,804	11,242	21,307	4,706	20,457	74,922	9,428	2,265	250,794
2009	66,908	25,458	9,720	22,889	6,294	28,383	58,814	6,875	2,251	227,592
2010	62,299	39,255	7,432	23,962	6,330	28,580	51,803	7,359	2,135	229,155
Annual Average	**64,534**	**44,715**	**10,586**	**19,143**	**5,007**	**23,929**	**54,968**	**7,828**	**3,007**	**232,969**

Sources: Exchange Contractors, 2011

Note: Includes double cropping, excludes duck ponds.

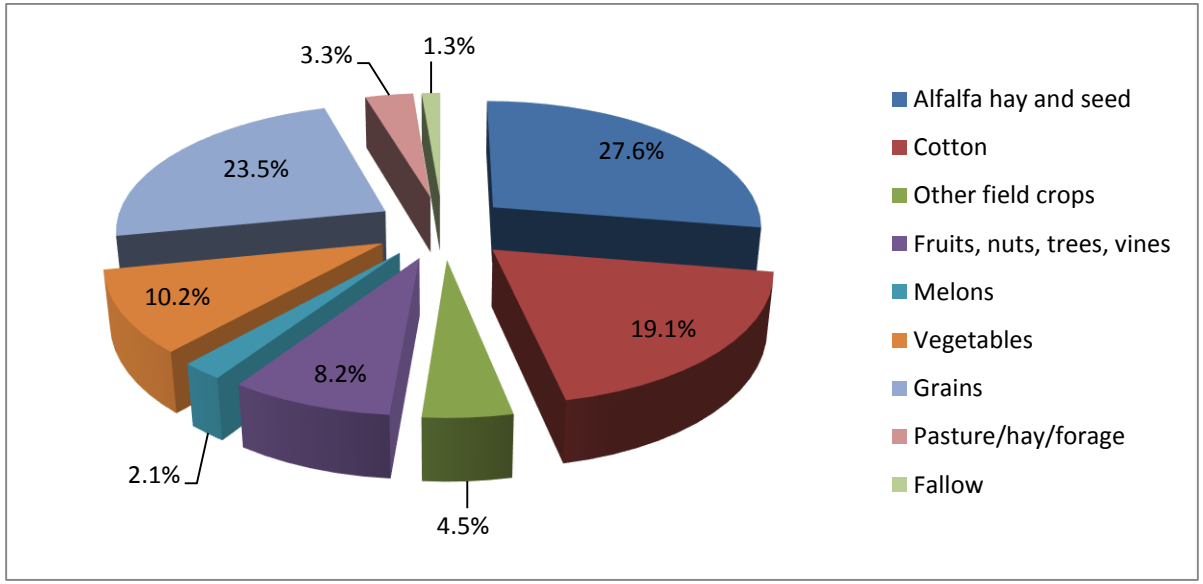

Figure 4-1 Exchange Contractors Service Area Average Crop Acreages by Crop Group, 2006-2010

The cropping patterns within the Exchange Contractors service area differ from the patterns for the total four-county area within which the service area is located. For example, from 2006-2010, fruit, nuts, trees and vine crops accounted for 8.2 percent of acreage within the Exchange Contractors area and 19.9 percent in the total four-county area. In addition, alfalfa hay and seed crops accounted for 27.6 percent of Exchange Contractors service area land and 5.3 percent of the four-county area. Vegetable acreage accounted for 10.2 percent of Exchange Contractors service area land and 6.4 percent of the four-county area.

4.1.2 Long Run Cropping Patterns

Total cropped acreage in the service area has changed very little over time, e.g. increasing by less than one percent between 1995 and 2010. However, acreage of some crop groups has changed significantly. These changes are summarized in Table 4-3 and Figure 4-2. As shown, vegetable acreage increased by over 98 percent from 1985 to 1995 and a further 122 percent from 1995 to 2010. Acreage in fruits, nuts, and vines dropped by nearly 26 percent from 1985 to 1995, but then increased by 190 percent from 1995 to 2010. Grain acreage decreased by almost 29 percent from 1985 to 1995, but rose 52 percent from 1995 to 2010. Cotton acreage increased by nearly 30 percent from 1985 to 1995, but subsequently decreased by more than 52 percent from 1995 to 2010. Field crops, pasture/hay/forage, and fallowed land decreased over the entire 15-year time period. The increase shown for miscellaneous and other crops is related to changes in data collection procedures by the districts rather than to changes in cropping patterns.

Table 4-3 Exchange Contractors Service Area Long Term Cropping Patterns

Crop Group	1985	1995	2010	Percent Change (1985-1995)	Percent Change (1995-2010)
Alfalfa hay and seed	36,725	54,042	62,299	47.2%	15.3%
Cotton	63,437	82,129	39,255	29.5%	-52.2%
Field crops	29,599	16,717	7,432	-43.5%	-55.5%
Fruits/nuts/vines	11,155	8,264	23,962	-25.9%	190.0%
Melons	7,096	10,016	6,330	41.2%	-36.8%
Vegetables	6,479	12,858	28,580	98.4%	122.3%
Grains	47,634	33,985	51,803	-28.7%	52.4%
Pasture/hay/forage	8,387	7,530	7,359	-10.2%	-2.3%
Misc/other	1,372	21	2,134	-98.5%	10061.9%
Fallow	11,272	3,382	1,688	-70.0%	-50.1%
Total	**223,156**	**228,943**	**230,842**	**2.6%**	**0.8%**

Sources: Exchange Contractors, 2011

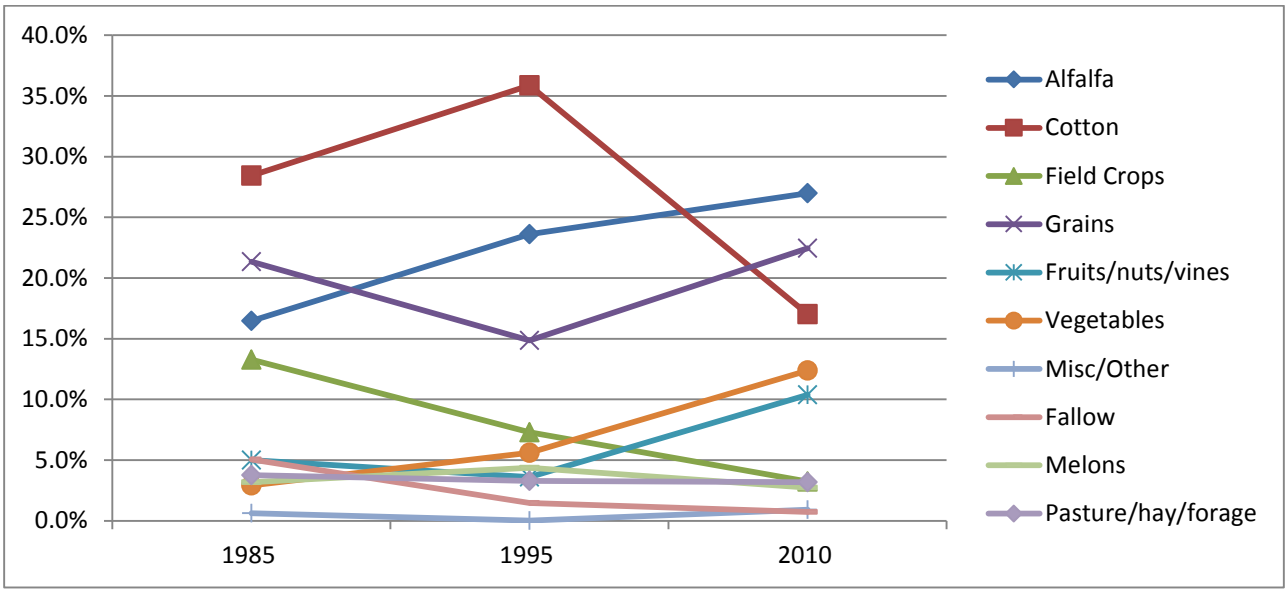

Figure 4-2 Crop Acreage Trends in the Exchange Contractor's Service Area (1985-2010)

4.2 Dairy Production and Alfalfa/Feed Use

California has been the leading dairy state in the U.S. since the mid 1990s. It ranks number one in the U.S. in the production of fluid milk, butter, ice cream, and nonfat dry milk. The California dairy industry has suffered in recent years, however, due to historic low product prices, high costs of feed and other production inputs, and other economic conditions. Additional contributing factors include the high costs of new air and water regulations.

There are 65 dairy farms within the Exchange Contractors service area (see Table 4-4).[18] Those operations collectively house 61,105 milking cows. Both data points represent fully 9.5 percent of the respective totals for the entire four-county area, underscoring the importance of the dairy sector in the service area.

Exchange Contractors farmers produce large amounts of alfalfa, the most important input used in the dairy industry. Dairy cows consume an estimated 75 to 85 percent of the alfalfa grown in California. The forage is not only used extensively by the dairy industry throughout the San Joaquin Valley, but is also exported to markets outside the state in cubes and other forms. The vast majority of both baled and cubed alfalfa goes to dairies in Japan.[19]

Alfalfa hay is a bulky commodity and very expensive to ship long distances. For the San Joaquin Valley, imports into the area from such areas as the Imperial Valley and Nevada provide

[18] White, Joann, San Joaquin River Exchange Contractors Water Authority. September 2011. Personal communication with Duane Paul, Cardno ENTRIX. In addition, there are three other dairies, for goats and dry cows.

[19] See Klonsky, Reed, and Putnam.

only a short-run increment in supplies and do not represent a viable long-run source of supply for dairy producers. Soil, climate, and water conditions give Exchange Contractors farmers a strong competitive advantage in producing alfalfa, and they in turn directly support the competitive strength of the San Joaquin Valley dairy industry.

Table 4-4 Dairies in the Four-County and Exchange Contractor's Service Area

Category	Exchange Contractor	Four-County Total
Number of Dairy Operations	65	684
Number of Other Dairies[1]	3	
Number of Milking Cows[2]	61,015	630,996
Number of Other Dairy Cows	21,800	21,800

1 Includes goat and dry cow dairies

2 Based on average number of cows per operation

Sources: San Joaquin River Exchange Contractors, 2011; and USDA, NASS, California Field Office, 2010.

4.3 Value of Crops and Dairy Production

4.3.1 Important Differences in Distribution of Crop Acreages and Crop Values

Farmers in the Exchange Contractors service area produced crops with an annual farmgate (gross) value averaging almost $400 million from 2006-2010. Fruits, nuts, tree, and vine crops accounted for nearly 22 percent of the total, at almost $87 million. Other major crops included alfalfa, processing tomatoes, cotton, and grains. Between 2006 and 2010, annual crops made up 78.2 percent of the value and permanent crops 21.8 percent (see Table 4-5 and Figure 4-3).

Within the Exchange Contractors service area, the distribution of crop value differs substantially from that for crop acreage. From 2006-2010, permanent crops accounted for 8.2 percent of cropped acreage, but 21.8 percent of farmgate value. Vegetables accounted for 11 percent of acreage and 19 percent of farmgate value, while grains accounted for 24 percent of acreage but 11 percent of value. These differences have important implications for the regional economic impacts of crop production, discussed in Chapter 5.

Table 4-5 Crop Acreage and Value in the Exchange Contractor Service Area, Average 2006-2010

Crop Group	Acres	Percent of Acres	Total Value	Percent of Value	Value per Acre
Alfalfa hay and seed	64,534	27.6%	$80,965,425	20.4%	$1,255
Cotton	44,715	19.1%	$70,965,236	17.9%	$1,587
Other field crops[1/]	10,586	4.5%	$10,427,655	2.6%	$985
Fruits, nuts, trees, vines	19,143	8.2%	$86,706,971	21.8%	$4,530
Melons	5,007	2.1%	$25,928,916	6.5%	$5,179
Vegetables	23,929	10.2%	$75,181,276	18.9%	$3,142
Grains	54,968	23.5%	$45,486,143	11.4%	$827
Pasture/hay/forage	7,828	3.3%	$1,814,880	0.5%	$232
Fallow	3,007	1.3%	$0	0.0%	$0
TOTAL	**233,717**	**100.0%**	**$397,476,502**	**100.0%**	**$1,701**

1/ Includes sugar beets and other field crops.

Source: San Joaquin River Exchange Contractors, 2011

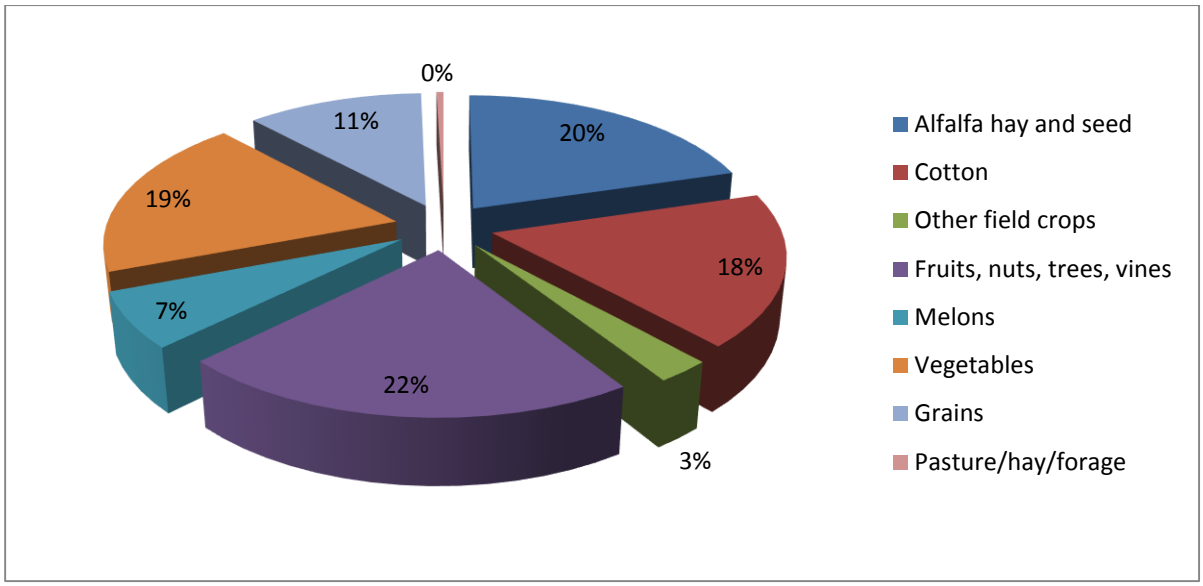

Figure 4-3 Exchange Contractors Service Area Farmgate Values by Crop Group, Average 2006-2010

4.3.2 Dairy Production Value

The dairy farms in the Exchange Contractors service area with 61,105 milking and 21,800 non-milking cows account for about 10 percent of the total dairy farm sector in the four-county area (based on herd size) and produce an estimated $208.3 million (farm value) of milk annually.[20] In addition, the dairies annually purchase inputs valued at about $129.4 million,[21] with approximately 46 percent of these inputs, valued at $59.1 million, produced within the region. The dairy sector thus represents an important part of both the producing and purchasing sides of the agricultural economy.

Local dairy farms provide nearly 95 percent of the milk inputs to the dairy processing plants in the region. These operations, including fluid milk, condensed milk, cheese, butter and ice cream and frozen dessert manufacturing, produce almost $2.4 billion of products annually in the four-county region.[22] There are four such plants in the service area and 22 in the four-county area,[23] and they rely on milk from dairy farms in the Exchange Contractor service area. Assuming plants are relatively uniform and of comparable efficiency, the processing plants in the Exchange

[20] Calculated based on number of dairy cows in the Exchange Contractor service area (61,105 cows), average pounds of milk produced per cow (21,886 pounds); and weighted average historic price for fluid and manufacturing milk in the region ($15.60/cwt), reported in 2011 dollars.

[21] Inputs include animals purchased for herd replacement

[22] Based on the IMPLAN data base

[23] Based on information compiled by the California Department of Food and Agriculture. Milk and Dairy Food Safety. Internet website http://www.cdfa.ca.gov/ahfss/Milk_and_Dairy_Food_Safety, accessed September 23, 2011.

Contractors service area jointly produce $430.6 million of dairy products annually, which reflect the "direct" output value of these operations.[24] In total, dairy farm production and processing within the Exchange Contractors' service area jointly provide $638.9 million of regional output annually.

[24] Direct output excludes the linkages from these to other industries, which are discussed in Chapter 5 of this report.

Chapter 5

Agriculture within the Regional Economy

This section describes the key integrated role of agricultural production and agribusinesses to the San Joaquin Valley economy and specifically to the Exchange Contractors service area. The west side of the San Joaquin Valley is one of the most productive, important agricultural regions in the country. Within the Valley, farmers in the Exchange Contractors service area enjoy a distinct comparative advantage over other regions because of the availability and practiced beneficial and efficient use of irrigation water.

While large San Joaquin Valley cities such as Fresno and Bakersfield have diversified into many sectors, agriculture is the primary or only employer in other parts of the region. While agricultural production and processing account for 4.3 percent of economic output, 3.8 percent of employment, and 2.5 percent of labor income for the entire state, the percentages for the San Joaquin Valley are much higher: 23.0 percent of regional economic output, 19.7 percent of employment, and 13.7 percent of labor income.[25] Moreover, because of the concentration of agricultural activities within the Exchange Contractors service area relative to the San Joaquin Valley overall, the percentages within the service area are even higher.

5.1 Economic Linkages From Agriculture to the Regional Economy

To understand how an economy is affected by a business or industry, such as agricultural production, it is important to recognize the extent to which different industries in the economy are linked to each other. Changes that occur at the farm production level set in motion a series of "ripple effects" throughout the local economy based on inter-industry linkages, which collectively affect local and regional output, employment, and income levels.

Farmers purchase equipment, chemicals, seed, and other supplies, as well as the services of labor, financial institutions, and custom service providers. Such effects are referred to as "backward linkages." After harvest, crops are frequently processed or handled by many businesses before they are delivered in final form to consumers. Examples include fruits and vegetables that are packed, frozen, or canned; cotton that is ginned locally; and milk that is processed for fresh and manufactured products. This web of economic activity, which also includes other businesses such as trucking, financing, and brokers, sets in motion a series of ripple effects throughout the local economy and which collectively affect local and regional output, employment, and income. These impacts are referred to as "forward linkages."

Table 5-1 shows the key sectors supplying goods and services to, and purchasing goods from, farming operations in the four-county area. The data represent estimates of the magnitudes of backward and forward linkages in the area. As shown, the major suppliers of inputs to agriculture include trucking operations, various unspecified support activities, and farm

[25] University of California Agricultural Issues Center. August 2009. The Measure of California Agriculture. Davis.

machinery and equipment manufacturing. The key purchasers of agricultural products within the four-county area are fruit and vegetable processors, dairy product processing, wineries, and other food processing.

Table 5-1 Output, Labor Income, and Employment in Agricultural-Related Industries in the Four-County Region

Industry	Output ($ million)	Income ($ million)	Employment (Jobs)
Suppliers of Agricultural Inputs			
Support activities for agriculture and forestry	$1,405.9	$1,454.0	51,941
Farm machinery and equipment manufacturing	$545.4	$71.6	920
Truck transportation	$2,187.1	$806.0	16,796
Wood container and pallet manufacturing	$74.6	$23.0	524
Warehousing and storage	$259.2	$152.3	3,462
Buyers of Agricultural Commodities			
Frozen food manufacturing	$552.4	$76.1	1,751
Fruit and vegetable canning and drying	$4,695.2	$488.6	8,840
Diary product processing	$2,368.4	$204.5	2,744
Cattle ranching and farming	$430.8	$33.2	3,487
Poultry and egg production	$235.7	$27.5	284
Animal production - except cattle and poultry	$50.4	$6.3	760
Animal slaughtering, except poultry	$1,603.5	$160.8	3,304
Other animal food manufacturing	$1,007.9	$65.3	996
All other food processing	$4,018.7	$570.4	11,642
Wineries	$2,086.5	$385.0	3,504

Source: IMPLAN (2008), 2011 dollars

The ripple effects reflected in backward linkages are frequently expressed as "multipliers." The size of those multipliers is a function of the relative proportions of the ripple effect spending that ultimately stay within or leave the region. Purchases made from outside the local economy are considered "imports," while items produced within and sold outside the local area are considered "exports." The size of the multiplier effect represents the extent to which "new" money from exports of an industry such as agriculture recirculate and is re-spent in the local economy. Some of the money received by the industry is spent to procure local supplies from backward-linked industries, and these local suppliers make other purchases with those funds. If there are many other local suppliers from which local businesses can purchase goods and services, less of this money leaves the local economy to buy imports. Thus, the size of the multiplier depends on how local businesses are linked together and the extent to which funds "leak" as purchases of goods and services produced in outside areas. If the economy has numerous sectors that are linked, multipliers will be higher than if there are few linkages among sectors.

5.1.1 Input-Output Models and Metrics

For this study, the regional economic impacts of agriculture in the Exchange Contractors service area are estimated with IMPLAN (Impact Analysis for Planning), a commonly-used system comprising input-output (I-O) methodology and data. I-O models are constructed reflecting the

concept that all industries within an economy are linked together. The output of one industry becomes the input of another industry until all final goods and services are produced. I-O models can be used both to analyze the structure of a regional economy and to estimate the total economic impact of projects or policies. For this analysis, an economic model was developed including the four counties in which the Exchange Contractors service area is located.[26]

IMPLAN I-O models provide three economic measures that describe the economy: output, income, and employment. Output is the total value of the goods and services produced by businesses in a region. Income is the sum of employee compensation (including all payroll and benefits), proprietor income (income for self-employed work), and other property income (payments for rents, royalties, and dividends). Employment represents the annual average number of employees, whether full or part-time, of the businesses producing output. Income and employment represent the net economic benefits that accrue to the region as a result of increased economic output.

Total economic effects include direct effects attributed to the activity being analyzed, as well as the additional indirect and induced effects resulting from money circulating throughout the economy. For example, because farming operations within a local economy are linked together through the purchase and sale patterns of goods and services produced in the local area, an action that has a direct impact on one or more local industries is likely to have an indirect impact on many other businesses in the region such as chemical dealers, labor contractors, and banks. Those firms would increase or reduce their industry outputs depending on the underlying changes in demand from farming. These additional effects are known as the indirect economic impacts. As household income is affected by the changes in regional economic activity, additional impacts occur. The additional effects generated by changes in household spending are known as induced economic impacts.

5.1.2 Multipliers

The size of the indirect and induced effects is measured by the multiplier, which as noted above, is a measure of the strength of the linkages in the local economy and the degree to which spending results in purchases from local businesses rather from those outside the area. IMPLAN can be used to estimate the total multiplier effects of a change in output in the industry under study, in this case agriculture, that are due to the resultant change in demand for labor and goods and services used as inputs to agriculture. However, agriculture has not only backward linkages to businesses such as farm equipment dealers that supply inputs, but also has forward linkages to industries that purchase agricultural outputs, such as food processing industries. IMPLAN does not directly measure the impacts to forward linked industries; these must be assessed outside the model and then entered as a direct change in output to the forward-linked industry.

Table 5-2 shows output, employment, and income multipliers for key agricultural sectors in the four-county area within which the Exchange Contractors service area is located. The multipliers are taken from an I-O model developed for the four-county region.[27] Each multiplier shows by

[26] Sub-county models are highly sensitive and less reliable than larger county-level models and were not considered appropriate for this study.

[27] Data limitations prohibit the development of a model to match the service area boundaries.

what amount total regional output, income, and employment change with a unit change in these parameters across agricultural sectors. For example, the employment multiplier for dairy production is 1.43, meaning that every job created in the dairy farm products sectors supports the creation of an additional 0.43 jobs in all other sectors of the local economy. Hence, if the demands for dairy products increase and cause employment in that sector to increase by 1,000 jobs, employment in other sectors will increase by another 430 people. These include other farm sectors, such as hay and feed grains, as well as businesses in such sectors as transportation, financial services, veterinary care, equipment repairs, and utilities. Similarly, the output multiplier for cotton production is 1.37, hence if cotton acreage in the region expands and the value of cotton output increases by $1,000,000, that increase will lead to increased output of $370,000 in other sectors associated with cotton. These include farm chemicals, farm machinery, custom services, transportation, and many others.

Using the data shown in Table 5-2 for the four-county area and the average 2006-2010 crop acres within the Exchange Contractors service area, the weighted output, income, and employment multipliers across all crop production sectors in the Exchange Contractors' service area are 1.36, 1.92, and 1.77, respectively. Thus, for every $1,000,000 increase in output of the crops produced by Exchange Contractors farmers, overall economic output within the region increases another $360,000. Similarly, for every $1,000,000 increase in income associated with crop production, overall income in the region increases by an additional $920,000. And for every 1,000 agricultural jobs supported by agriculture in the Exchange Contractors service area, an additional 770 jobs are supported elsewhere in the regional economy. The corresponding multipliers for the dairy farm sector are 1.43, 2.68, and 1.35, respectively, and can be interpreted similarly. Changes in agricultural production clearly have important effects throughout the regional economy.

Table 5-2 Economic Multipliers in Key Agricultural Sectors in the Four-County Area, including the Service Area of the San Joaquin Exchange Contractors

	Multiplier [1]		
Sector	Output	Labor Income	Employment
Oilseed farming	1.271597	2.340634	1.267384
Grain farming	1.260438	2.234306	1.230090
Vegetable and melon farming	1.397054	1.715179	2.414561
Fruit farming	1.434718	1.704600	1.744886
Tree nut farming	1.378006	1.675526	1.771363
Greenhouse and nursery production	1.403754	1.358223	1.922856
Cotton farming	1.368234	1.678006	1.703672
Sugar beet farming	1.413306	1.588909	1.091166
All other crop farming	1.392437	1.965369	1.938153
Dairy cattle and milk production	1.427254	2.684028	1.345416

1/ Type SAM multipliers based in four-county IMPLAN model (2008 data)

The multipliers reflect the local purchases by farmers and the businesses they patronize. If the products purchased by farmers are produced within a local area, the multiplier effects are larger, all other factors equal, because more of the original and linked purchases remain within the

region. Examples are feeds, rental equipment, and retail businesses which carry a broad variety of inputs. Conversely, most large tractors and similar machinery and equipment and some chemicals are produced outside the four-county area, and the multipliers for those products are lower even though the multipliers for the retail stores which handle those inputs may be relatively high.

5.1.1 Inter-Industry Purchases

Farmers in the Exchange Contractors service area purchase large amounts of inputs that are produced both inside and outside the region. These include purchases annually of $133.5 million from local sources and $346.9 million from all sources, of inputs such as feed grains, hay, chemicals and fertilizer, and machinery and equipment. They also utilize specialized providers for such services as soil preparation, planting, thinning, spraying, harvesting, and farm management (see Table 5-3).

The continuous production of crops and milk within the Exchange Contractors service area directly supports the local provision of the inputs needed by those operations. Input suppliers require a "critical mass" of farming operations in order to develop and maintain a business within a specific area. For example, seed, fertilizer and chemical, and farm machinery dealers have located in the vicinity because of the agricultural demands for their products and services. Hay producers have located in the area because of a ready market for their outputs from dairies, feedlots, and other local livestock operations. And, more broadly, the employment and output multipliers discussed previously are a direct result of these many and extensive linkages.

Table 5-3 Annual Purchases of Locally-Produced Inputs by Farmers in the Exchange Contractors Service Area

Commodity	Local Purchases ($)	Percent (%)
Other animal food	$33,643,758	25.2%
Agriculture and forestry support services	$23,321,952	17.5%
Real estate buying and selling, leasing, managing, and related services	$19,434,403	14.6%
Wholesale trade distribution services	$10,070,118	7.5%
Electricity, and distribution services	$8,354,367	6.3%
Monetary authorities and depository credit intermediation services	$6,844,137	5.1%
Water, sewage treatment, and other utility services	$3,907,815	2.9%
Truck transportation services	$3,465,069	2.6%
Pesticides and other agricultural chemicals	$2,608,969	2.0%
Cotton seed	$2,208,100	1.7%
All Other Commodities	$19,679,757	14.7%
Total Local Purchases	$133,538,445	100.0%
Purchases of Inputs from Outside the Region	$213,399,890	--

Source: IMPLAN (2008)

5.1.2 Value Added

In addition to purchasing inputs from other industries, crop and dairy operations in the Exchange Contractors service area annually provide more than $52.9 million in employee compensation,

including wages and salaries and benefits, and an additional $34.2 million in proprietor income (see Table 5-4). Farming enterprises in the service area also pay more than $11.4 million in sales and other taxes to local jurisdictions and provide over $160.3 million in other property income, which includes rents and profits. These flows are important contributors to the regional economy, as income, rents, and profits are spent on a variety of goods and services, and taxes support the operations of local governments.

Table 5-4 Value Added to Crop and Dairy Production in the Exchange Contractors Service Area

Component	Value ($)	Percent (%)
Employee Compensation	$52,880,956	20.4%
Proprietor Income	$34,191,627	13.2%
Other Property Type Income	$160,343,206	61.9%
Indirect Business Tax	$11,428,124	4.4%
Total Value Added	**$**258,843,913	**100.0%**

Source: IMPLAN (2008)

5.2 Regional Economic Benefits of Agriculture in the Exchange Contractor Service Area

All of the factors of production and input services sold within and proximate to the Exchange Contractors service area are attributable to and a reflection of the size and importance of the economy which has built up around agricultural production in the service area. Accordingly, the regional economic effects attributable to crop production in the Exchange Contractor service area are substantial. Based on 2010 crop data, agricultural production within the service area generated farmgate value of $397.5 million, $74.8 million in labor income, and 2,073 jobs. Across all sectors in the four-county area, crop production by Exchange Contractors farmers generated $546.5 million in total output, $131.7 million in total labor income, and 3,620 total jobs (see Table 5-5).

Table 5-5 Regional Economic Impacts from Existing Agricultural Production in the Exchange Contractor Service Area [1,2,3]

	Type of Effect			
Economic Measure	**Direct**	**Indirect**	**Induced**	**Total Effect**
Output ($ Million)	$397.5	$84.1	$64.9	**$546.5**
Labor Income ($ Million)	$74.8	$36.5	$20.5	**$131.7**
Employment (Jobs)	2,073	1,030	517	**3,620**

[1] Values represent effects in the four-county study area (Fresno, Madera, Merced, and Stanislaus) based on IMPLAN modeling
[2] Values reported in 2011 dollars
[3] Existing agricultural production is calculated based on 2010 production data
Source: Cardno ENTRIX, 2011

Dairy producers in the Exchange Contractors service area also purchase large amounts of inputs for their operations – feed, supplies, veterinary services, equipment purchases and rentals, trucking, and other. Dairy producers both purchase and grow large amounts of alfalfa, which in turn supports many other industries. These production inputs are also produced within and outside the four-county area within which the Exchange Contractors service area is located. As a result, the regional economic effects attributable to dairy production within the service area are

large and complement those associated with crop production. Direct output from dairy farms in the service area is estimated at $208.3 million annually, generating labor income of $11.1 million and supporting 1,266 jobs. After accounting for all backward linkages throughout the regional economy, Exchange Contractors dairy operations generate total annual regional output of $293.1 million and labor income of $29.4 million while supporting 1,693 jobs (see Table 5-6).

Table 5-6 Regional Economic Impacts from Dairy Farm Operations in the Exchange Contractors Service Area [1,2]

Economic Measure	Type of Effect			Total Effect
	Direct	Indirect	Induced	
Output ($ Million)	$208.3	$70.5	$14.3	**$293.1**
Labor Income ($ Million)	$11.1	$13.8	$4.5	**$29.4**
Employment (Jobs)	1,266	314	113	**1,693**

[1] Values represent effects in the four-county study area (Fresno, Madera, Merced, and Stanislaus) based on IMPLAN modeling
[2] Values reported in 2011 dollars

Source: Cardno ENTRIX, 2011

As noted above, many crops as well as milk produced within the Exchange Contractors service area are purchased by food processing, milk, and other businesses. Without this local agricultural production, high transportation costs to ship in commodities from other areas would force many of these industries to relocate to remain profitable.

Chapter 6

Water Use and Transfers

The Exchange Contractors Water Authority was created in 1992 even though the four member agencies have pre-1914 and riparian rights on the San Joaquin River which date back over 130 years. Exchange Contractors farmers have been irrigating land in the western San Joaquin Valley since the 1880s and in the process of wisely and effectively using water have contributed directly to the creation and sustenance of the entire agricultural economy of the region.

6.1 Water Use Efficiency and Beneficial Uses of Water in Service Area

Farmers in the Exchange Contractors service area are skilled, efficient water managers who operate at maximum reasonably-achievable levels of irrigation efficiency. A large portion of those able to use sprinkler and micro/drip irrigation for their particular crops have converted to those systems. They closely monitor soil moisture and weather conditions in managing irrigation in order to both avoid waste and minimize crop stress. They use their own experience and information from many other sources to determine when and how much water to apply and how to operate their irrigation systems for peak efficiency. They minimize excessive deep percolation, and have incorporated on-farm practices that show clearly their understanding of the vital nature of the water resource.

Thus, as careful stewards of water, farmers in the Exchange Contractors service area utilize cutting edge design, delivery, and management practices which increase agricultural production efficiency while conserving water. In addition, Exchange Contractors member agencies have implemented a variety of pricing and other incentives to maximize the beneficial use of water throughout the service area. These programs, which include both large district-wide and smaller on-farm conservation projects as well as tiered pricing, have resulted in both improved water service to farmers in the area and the availability of nearly 80,000 AF per year for transfer to other local water agencies and wildlife refuges for their beneficial use.

Total investment in these programs exceeds more than $90 million,[28] supporting local businesses while the programs have achieved self-sustainability through resulting water sales. Member agencies have invested nearly $52 million in district-wide conservation projects, resulting in cumulative savings of about 60,000 AF per year. Key projects have included SCADA (Supervisory Control and Data Acquisition) systems which efficiently monitor and control water transmission and distribution systems; canal lining; construction of regulating reservoirs to better control water movements within District boundaries; installation of high-efficiency pumps; and programs to reduce spills.

[28] San Joaquin River Exchange Contractors Water Authority. July 2011. Efficient Water Use and Water Transfers. Los Banos.

The benefits of application of surface water in the Exchange Contractors service area extend well beyond the resultant nearly $400 million of annual farmgate value from crops produced. For example, irrigation and canal seepage contribute importantly to groundwater recharge, helping to mitigate the overdraft situation in parts of the service area and surrounding areas. In addition, tailwater is collected and recirculated for irrigation, and any tailwater not reused flows into the San Joaquin River, where the flows are available for instream purposes and diversions for irrigation and wildlife by downstream irrigators.

6.2 Water Transfer Programs

The Exchange Contractors have regularly participated in water transfer programs to the benefit of other agricultural water users, wildlife refuges, and M&I users. The conservation programs implemented have directly supported these transfers and, in the process, enhanced the overall beneficial use of water in the service area and surrounding areas as well.

The Exchange Contractors transferred to the U.S. Fish and Wildlife Service (Service) water under a three-year Interim Water Acquisition Program (WAP) for Incremental Level 4 refuge from 1995-1998. In 1999, the Exchange Contractors transferred 20,000 AF to the U.S. Department of the Interior (Interior) WAP for the refuges and an additional 40,000 AF to westside agricultural users. Subsequently, the Exchange Contractors transferred varying amounts of water to combinations of refuges, agricultural users and urban water users. The WAP continues, administered by Reclamation and the Service, remains in place, and the Exchange Contractors have transferred up to 88,132 AF in a year (see Table 6 1). These transfers by the Exchange Contractors have been critical in addressing the ongoing water needs for the refuges as well as other agricultural and non-agricultural users.

Table 6-1 Exchange Contractors Water Transfer Summary, 1999-2010

Year	To South of Delta CVP Agricultural and M&I Users (acre-feet)	To Reclamation for Refuges (acre-feet)	Total (acre-feet)
1999	40,000	20,000	60,000
2000	43,000	21,500	64,500
2001	15,500	49,000	64,500
2002	2,134	63,500	65,634
2003	11,637	60,000	71,637
2004	30,000	50,210	80,210
2005	72,795	7,800	80,595
2006	30,417	49,583	80,000
2007	50,228	30,000	80,228
2008	61,026	24,132	85,158
2009	69,445	18,687	88,132
2010	56,981	27,714	84,695

Source: San Joaquin River Exchange Contractors Water Authority, 2011.

Chapter 7

Future Agricultural Conditions in the Exchange Contractors Service Area

7.1 Population Growth in the Area

Agriculture is a major goods-producing industry in California. It has been the economic heart of the Exchange Contractors service area for 130 years. From the continued, reliable availability of irrigation water, a large diverse agricultural sector has evolved in the area, as has an inclusive infrastructure of industries selling to and buying from these enterprises. As a result, agriculture in the service area successfully weathered the inevitable cycles which characterize the industry.

As is true for many other areas in California, some regions within the San Joaquin Valley have been urbanized and have become less dependent upon agriculture. For example, while such cities as Fresno, Merced, and Los Banos remain important parts of the San Joaquin Valley agricultural sector, the size of agriculture in these cities and their immediate surrounding areas has declined relative to the wholesale and retail trade, services, and other industries that have grown in parallel with population.

California's population will continue to grow for many decades, a result of both net in-migration and natural increase. The patterns of the last three decades, greater percentage growth in the inland than in the more expensive and land-constrained coastal areas, will continue, borne out by both historical data since 2000 and projections through 2040 prepared by the California Department of Finance Demographics Research Unit. And the patterns have affected and will continue to affect cities and areas proximate to and within the Exchange Contractors service area, including Firebaugh, Mendota, Los Banos, Dos Palos, Gustine, Newman, and Patterson.

Population in Fresno County overall increased 16 percent between 2000 and 2010, but Firebaugh increased 31 percent and Mendota rose 40 percent. Madera County overall increased 23 percent. Merced County overall increased 21 percent, including 39 percent in Los Banos and 13 percent in Dos Palos and 17 percent in Gustine. Stanislaus County increased 15 percent, but Newman increased 44 percent and Patterson 76 percent.[29]

Projections show population increasing at substantially-different rates among the four counties between 2010 and 2040. For example, Fresno County population is projected to increase by 75 percent, Madera County by 98 percent, Merced County by 94 percent, and Stanislaus County by 95 percent.[30] These estimates were prepared prior to the 2010 Census, and the projections, when

[29] California Department of Finance, Demographics Research Unit. August 2011 (revised September 2011). E-4, Population Estimates for Cities, Counties and the State, 2001-2010, with 2000 and 2010 Census Counts. Sacramento.

[30] California Department of Finance, Demographics Research Unit. July 2007. Population Projections for California and Its Counties 2000-2050, by Age, Gender and Race/Ethnicity. Sacramento.

revised in 2012 or 2013, may vary from those shown. However, the growth patterns implied in the projections are likely to continue for many decades and place sustained pressure on San Joaquin Valley agriculture and its water usage.

7.2 Implications for Agriculture in the Area

Efficient agricultural operations depend on ready access to resources and markets. Farms are typically concentrated in certain areas and thus provide efficient, compact production areas for both suppliers of farm inputs and purchasers of farm products -- farm supply companies, equipment dealers, farm workers, transportation providers, custom operators, processors, and other agribusiness resources. These businesses depend on a minimum volume of revenue to operate efficiently in an area, thus a critical mass of agricultural producers. These "network externalities" help reduce the costs of operating businesses which supply goods and services to farms and which purchase or handle products from farms.

Conversely, if scattered parcels of farmland in an area go out of production, these economies are reduced or eliminated, and costs then increase for the remaining farmers and suppliers and supporting operations, which may in turn be forced out of business. If some farmland in an area is converted to non-agricultural purposes, remaining farmers in the area may be restricted from the use of certain types of chemicals for pest control. They may also need to change other production practices. These conversions also threaten efficient agricultural production by creating enclaves of farming proximate to new housing developments. New urban residents frequently cite the noises and odors associated with farming, often leading to changes in operating practices and cultural activities, lowering the stream of farm income available from the land and, accordingly, the value of that and remaining farmland in the area.

The California Department of Water Resources projects that San Joaquin Valley agricultural water demand will decrease through 2050 because of declines in irrigated acreage and increased conservation. The declines in water use range from 14 percent to 19 percent depending upon the assumed growth scenarios for the state.[31] DWR projections also indicate that agriculture will remain a dominant influence in west side of the San Joaquin Valley, including the Exchange Contractors service area. However, for reasons noted above, changes in urban growth patterns in west side cities and surrounding areas may have adverse impacts on agricultural land use patterns.

Clearly, individual decisions on whether to keep land in production agriculture or convert it to non-agricultural purposes are driven by many factors which are beyond the scope of this analysis. However, as such conversions occur within the Exchange Contractors service area, the demands for the water previously applied to those lands will be intense. Exchange Contractors water will continue to have much higher inherent value than other supplies because of its reliability, and the non-agricultural as well as agricultural demands for that resource will remain strong.

[31] California Department of Water Resources. 2009. Bulletin 160, California Water Plan Update 2009. San Joaquin River. Volume 3, Regional Reports, pp. SJ-38 and SJ-39.

Chapter 8

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