# CHAPTER 2. EXISTING AND FUTURE CONDITIONS

## EXISTING CONDITIONS

This chapter presents a general description of existing water resources facilities and conditions in the study area, and describes how they are expected to change in the foreseeable future. It is included to provide an understanding of existing water management operations that could be affected by the development of additional water supplies in the Upper San Joaquin River Basin.

The San Joaquin Valley is approximately 250 miles long, 30 to 60 miles across, and is bounded on the north by the Sacramento-San Joaquin Delta, on the south by the Tehachapi Mountains, on the east by the Sierra Nevada foothills, and on the west by the Coast Range (Figure 2-1). Irrigated agriculture has been the mainstay of the San Joaquin Valley economy since the first water diversions for irrigation began in the 1860s. Since that time, agriculture has developed to become a major economic contribution to both the State of California and the Nation. Three of the counties in the study area – Fresno, Kern, and Tulare – consistently rank among the Nation's top four counties in agricultural revenue. Exports of cotton, citrus, and produce also contribute substantially to the international market.

### Hydrology

The San Joaquin River originates in the Sierra Nevada at an elevation over 10,000 feet and enters the San Joaquin Valley near Friant. Below Friant Dam, the river flows west to the center of the Valley, then turns sharply north at Mendota Pool and flows through the San Joaquin Valley to the Delta. Along the Valley floor, the San Joaquin River receives flow from the Merced, Tuolumne, and Stanislaus rivers as well as from smaller tributaries from the east and west sides of the Valley.

The California Data Exchange Center (CDEC) has estimates of unimpaired flow at four locations in the Upper San Joaquin River Basin. Since 1980, estimates of unimpaired flow are only provided at San Joaquin River below Friant Dam, where the annual average unimpaired runoff is about 1,800 TAF. As indicated on Table 2-1, annual runoff from the Upper San Joaquin River Basin (at Friant Dam) varies widely, ranging from a recorded low of about 362 TAF in 1977 to a recorded high of 4,642 TAF in 1983.

**TABLE 2-1**
**SUMMARY OF RUNOFF IN THE UPPER SAN JOAQUIN RIVER BASIN**

| Station (CDEC ID) | Record Period | Annual Runoff (acre-feet) | | |
|---|---|---|---|---|
| | | Maximum | Average | Minimum |
| Big Creek below Huntington Lake (BHN) | 2/1905 – 9/1980 | 297,800 | 110,640 | 14,363 |
| San Joaquin South Fork near Florence (SFR) | 10/1900 – 9/1980 | 248,864 | 652,500 | 71,306 |
| San Joaquin River at Mammoth Pool (SJM) | 10/1905 – 9/1980 | 2,964,120 | 1,323,776 | 307,870 |
| San Joaquin River below Friant Dam (SJF) | 10/1900 – present | 4,641,880 | 1,830,331 | 361,550 |
| Source: California Data Exchange Center (CDEC) | | | | |

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**FIGURE 2-1. STUDY AREA EMPHASIS**

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## Surface Water Resources in the Study Area

The east side of the San Joaquin Valley includes numerous streams and rivers that drain the western slope of the Sierra Nevada Mountains into the Central Valley. During the past 50 years, water resources on all major rivers have been developed through the construction of dams and reservoirs for water supply, flood control, and hydropower generation purposes. Table 2-2 provides a summary of major reservoirs in the eastern San Joaquin Valley. With the exception of the San Joaquin River, the table lists only the largest water supply and flood control reservoir on each river.

The largest reservoir on the San Joaquin River is Millerton Lake, formed by Friant Dam. These facilities are part of the Friant Division of the Central Valley Project (CVP), and their operation significantly affect the flow in the San Joaquin River. Inflow to Millerton lake is influenced by the operation of several upstream hydopower generation projects. Dams and reservoir upstream of Millerton Lake are identified on Table 2-2 and shown in Figure 2-2.

### *Friant Division of the CVP*

The Friant Division of the CVP provides water to over one million acres of irrigable land on the east side of the southern San Joaquin Valley, from near the Chowchilla River in the north to the Tehachapi Mountains in the south. The principal features of the Friant Division were completed in the 1940s, including Friant Dam and Millerton Lake located northeast of Fresno on the San Joaquin River; and the Madera and Friant-Kern canals, which convey water north and south to agricultural and urban water contractors. Figure 2-3 shows locations of water districts in the San Joaquin Valley.

Millerton Lake, the largest reservoir in the Upper San Joaquin River Basin has a storage capacity of 520,500 acre-feet and is operated to provide water supply to agricultural and urban areas in the eastern San Joaqun Valley and for flood control on the San Joaquin River. Minimum storage for canal diversion is about 130,000 acre-feet, resulting in active conservation storage of about 390,500 acre-feet.

During the flood season of October through March, up to 170,000 acre-feet of available storage space must be maintained for control of rain floods. Under present operating rules, up to 85,000 acre-feet of flood control requirement in Millerton Lake may be provided by an equal amount of space in Mammoth Pool (Figure 2-4).

The limited active conservation storage and the requirement for flood space reservation result in very little opportunity for carryover storage operations. Thus, Millerton Lake is operated as an annual reservoir with no specific provision for carryover storage. Annual water allocations and release schedules are developed with the intention of lowering reservoir storage to minimum levels by the end of September. In cases where demands are lower or inflow is greater than typical, end of year storage may be above minimum levels resulting in incidental carry over storage.

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## TABLE 2-2
## RESERVOIRS ON THE EAST SIDE OF THE SAN JOAQUIN VALLEY

| Reservoir Name | River or Creek | Owner | Storage (acre-feet) | Year | Operational Objectives | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | FC | WS | HP | RF | WQ |
| **Reservoirs in the San Joaquin River Watershed** | | | | | | | | | |
| Millerton Lake | San Joaquin River | USBR | 520,500 | 1942 | X | X | | | |
| Kerckhoff | San Joaquin River | PG&E | 4,200 | 1920 | | | X | X | |
| Redinger | San Joaquin River | SCE | 35,000 | 1951 | | | X | X | |
| Florence Lake | San Joaquin River South Fork | SCE | 64,404 | 1926 | | | X | X | |
| Huntington | Big Creek | SCE | 88,834 | 1917 | | | X | X | |
| Shaver | Stevenson Creek | SCE | 135,283 | 1927 | | | X | X | |
| Thomas Edison | Mono Creek | SCE | 125,000 | 1954 | | | X | X | |
| Mammoth Pool | San Joaquin River | SCE | 123,000 | 1960 | | | X | X | |
| **Reservoirs in the Other San Joaquin Valley Watersheds** | | | | | | | | | |
| New Melones | Stanislaus River | USBR | 2,420,000 | 1978 | X | X | X | X | X |
| Don Pedro | Toulumne River | MID/TID | 2,030,000 | 1970 | X | X | X | X | |
| Lake McClure | Merced River | MID | 1,025,000 | 1967 | X | X | X | X | |
| Eastman Lake | Chowchilla River | USACE | 150,000 | 1975 | X | X | | | |
| Hensley Lake | Fresno River | USACE | 90,000 | 1975 | X | X | | | |
| Pine Flat | Kings River | USACE | 1,000,000 | 1954 | X | X | | | |
| Kaweah[1] | Kaweah River | USACE | 143,000 | 1962 | X | X | | | |
| Success[1] | Tule River | USACE | 82,300 | 1961 | X | X | | | |
| Isabella | Kern River | USACE | 568,000 | 1953 | X | X | | | |

[1] Enlargement of Kaweah and Success lakes has been authorized. Table reflects existing capacity

Owners
- USBR U.S. Bureau of Reclamation
- USACE U.S. Army Corps of Engineers
- SCE Southern California Edison
- PG&E Pacific Gas and Electric
- MID/TID Modesto Irrigation District and Turlock Irrigation District
- MID Merced Irrigation District

Operational Objectives
- FC Flood control – these reservoirs have dedicated flood control storage space
- WS Water supply for irrigation, domestic, municipal, and industrial uses
- HP Hydropower generation
- RF Downstream river instream flow requirements
- WQ Delta water quality

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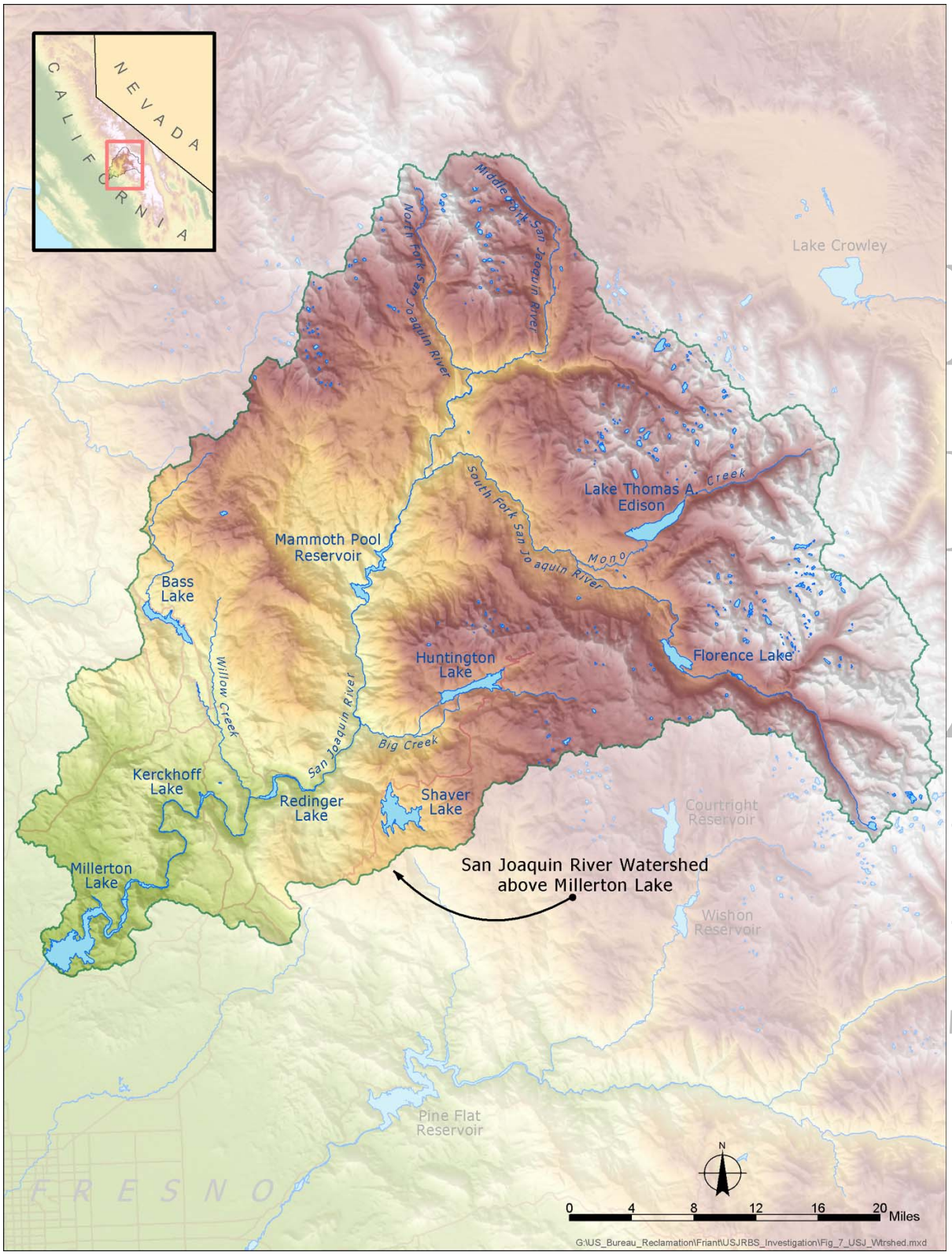


**FIGURE 2-2. FACILITES UPSTREAM OF MILLERTON LAKE**

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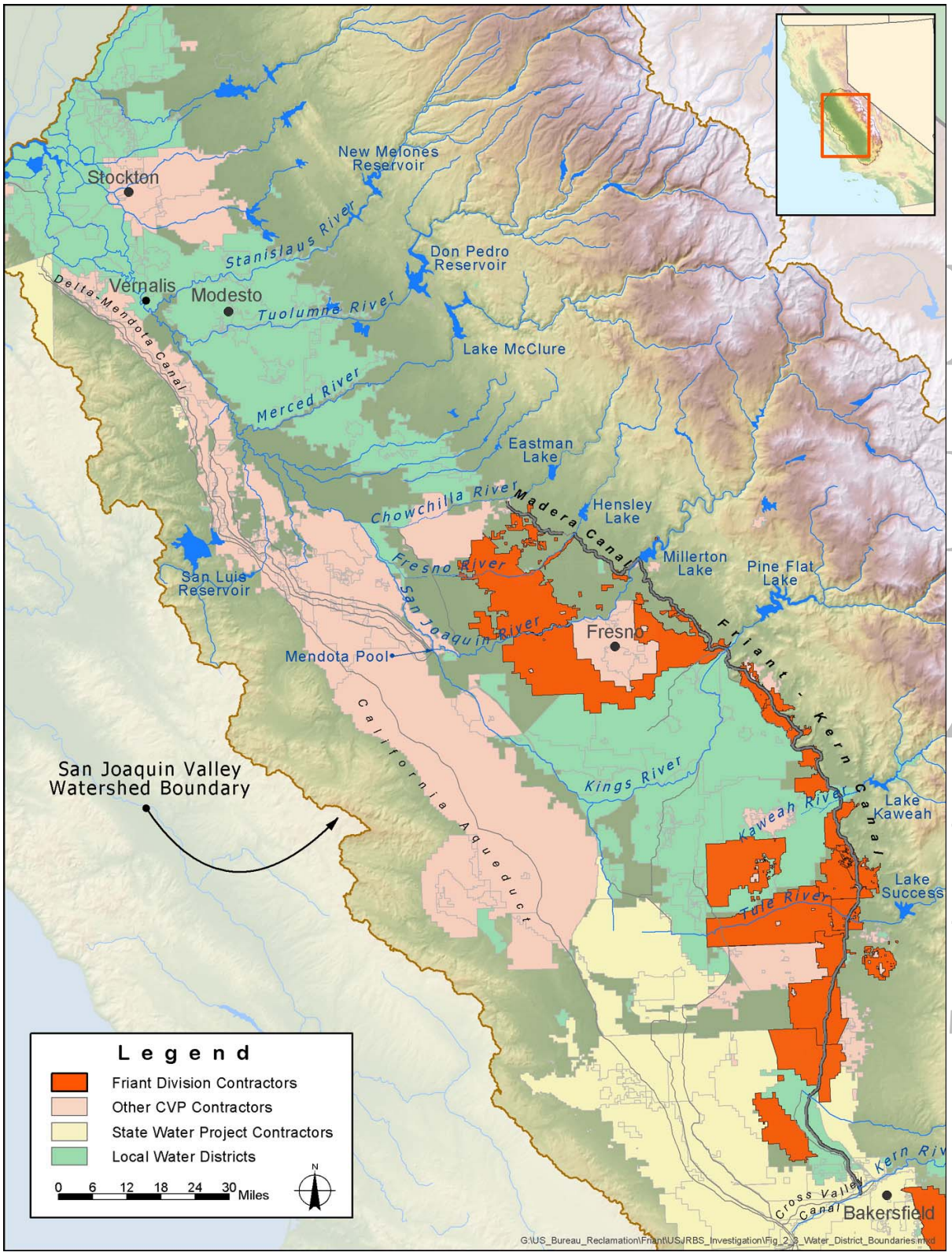


**FIGURE 2-3. WATER DISTRICTS IN THE SAN JOAQUIN VALLEY**

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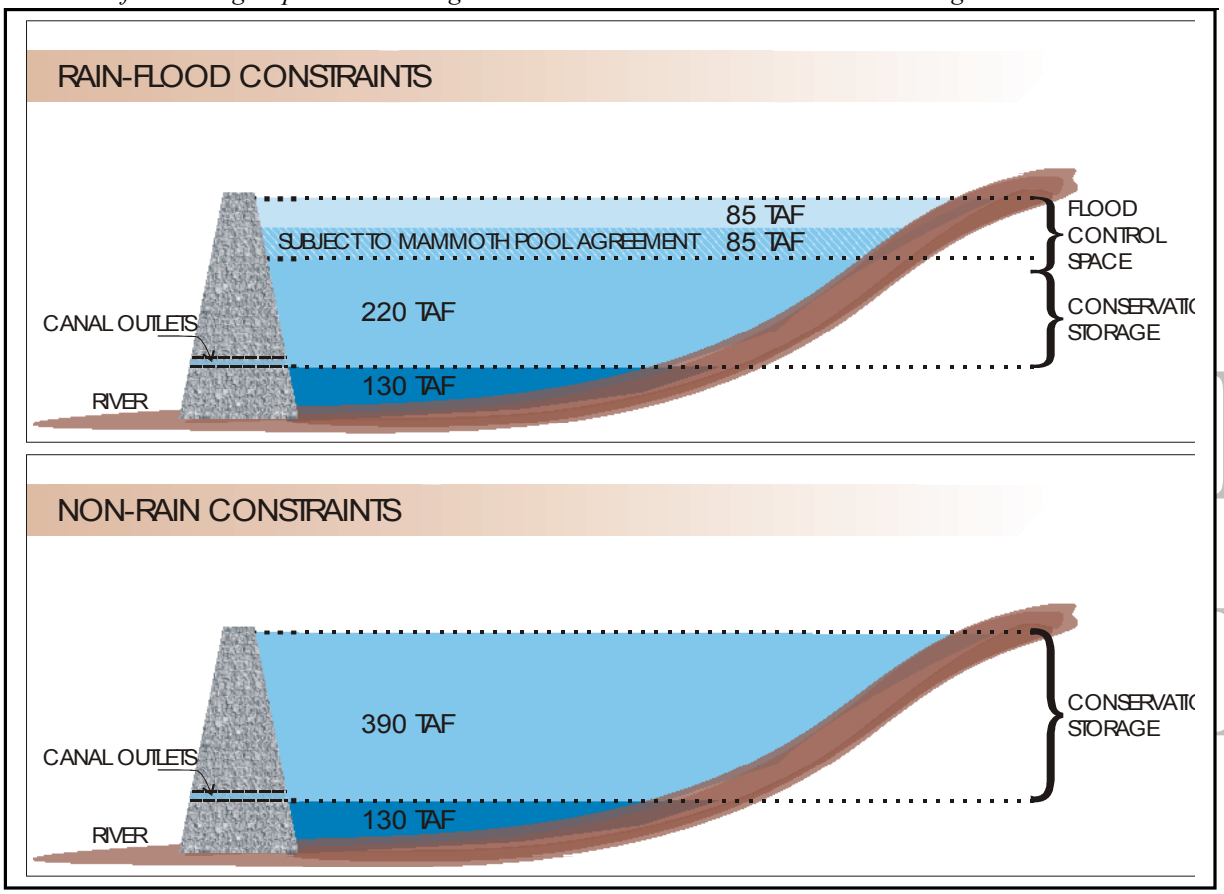


**FIGURE 2-4. SCHEMATIC OF RESERVOIR STORAGE REQUIREMENTS**

Reclamation obtained the majority of the water rights to the San Joaquin River allowing for the diversion of water at Friant Dam through purchase and exchange agreements with individuals and entities that held those rights at the time the project was developed. The largest of these agreements requires annual delivery of approximately 800,000 acre-feet of water to the Mendota Pool to serve water rights holders along the San Joaquin River. This obligation is met with water exported from the Delta via the Delta-Mendota Canal in accordance with in the San Joaquin River Exchange Contracts. If Delta water is not available to meet these commitments, Reclamation would be required to release water from Friant Dam to meet San Joaquin River water rights obligations. With the exception of flood control operations, water released from Friant Dam to the San Joaquin River is limited to that necessary to satisfy seepage losses and riparian water rights along the San Joaquin River between Friant Dam and the Gravelly Ford.

### *Friant Division Contract Types and Water Deliveries*

The Friant Division was designed and is operated to support conjunctive water management in an area that was subject to groundwater overdraft prior to construction of Friant Dam and remains in a state of overdraft today. Reclamation employs a two-class system of water allocation to take advantage of water during wetter years. Friant Division contract amounts for each contractor are listed in Table 2-3.

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Class 1 contracts, which are based on a firm water supply, are generally assigned to municipal and industrial (M&I) and agricultural water users that have limited access to good quality groundwater. These lands primarily include upslope areas planted in citrus or deciduous fruit. During project operations, the first 800,000 acre-feet of annual water supply is delivered under Class 1 contracts.

Class 2 water is used as a supplemental supply and is delivered directly for agricultural use or for groundwater recharge, generally in areas that experience groundwater overdraft. Class 2 contractors typically have access to good quality groundwater supplies and can continue to operate with recurrent deficiencies by using groundwater. Many Class 2 contractors are in areas with high groundwater recharge capability and operate dedicated groundwater recharge facilities. The location of water districts in the San Joaquin Valley, including Friant Division contractors, is shown in Figure 2-3.

In addition to Class 1 and Class 2 water deliveries, Reclamation is authorized to deliver water that would otherwise be released for flood control purposes. Section 215 of the Reclamation Reform Act of 1982 authorizes the delivery of unstorable irrigation water that would be released due to flood control criteria or unmanaged flood flows. The delivery of Section 215 water has enabled groundwater replenishment at levels higher than Class 1 and Class 2 contract deliveries would support in the southern San Joaquin Valley.

**TABLE 2-3**
**HISTORICAL FRIANT ALLOCATIONS**

| Year | Class 1 Contract | Class 2 Contract |
|---|---|---|
| 1957 | 100% | 0% |
| 1958 | 100% | 0% |
| 1959 | 100% | 0% |
| 1960 | 100% | 0% |
| 1961 | 75% | 0% |
| 1962 | 100% | 62% |
| 1963 | 100% | 80% |
| 1964 | 100% | 12% |
| 1965 | 100% | 99% |
| 1966 | 100% | 23% |
| 1967 | 100% | 99% |
| 1968 | 54% | 0% |
| 1969 | 100% | 99% |
| 1970 | 100% | 29% |
| 1971 | 100% | 35% |
| 1972 | 100% | 40% |
| 1973 | 100% | 76% |
| 1974 | 100% | 81% |
| 1975 | 100% | 59% |
| 1976 | 75% | 0% |
| 1977 | 25% | 0% |
| 1978 | 100% | 99% |
| 1979 | 100% | 62% |
| 1980 | 100% | 98% |
| 1981 | 100% | 22% |
| 1982 | 100% | 98% |
| 1983 | 100% | 98% |
| 1984 | 100% | 49% |
| 1985 | 100% | 14% |
| 1986 | 100% | 93% |
| 1987 | 91% | 0% |
| 1988 | 78% | 0% |
| 1989 | 98% | 0% |
| 1990 | 68% | 0% |
| 1991 | 100% | 0% |
| 1992 | 83% | 0% |
| 1993 | 100% | 90% |
| 1994 | 80% | 0% |
| 1995 | 75% | 100% |
| 1996 | 100% | 55% |
| 1997 | 100% | 30% |
| 1998 | 91% | 10% |
| 1999 | 100% | 20% |
| 2000 | 100% | 17% |
| 2001 | 100% | 5% |
| 2002 | 100% | 8% |

Source: Friant Water Users Authority

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Historically, the Friant Division has delivered an average of about 1.3 million acre-feet of water annually. Releases from Friant Dam to the San Joaquin River for downstream riparian right holders and flood control purposes average about 530,000 acre-feet per year, however, this average annual amount is strongly influenced by large flood releases in a few years. The median annual release to the San Joaquin River from Friant Dam since 1949 has been about 129,000 acre-feet, which is slightly higher than approximately 117,000 acre-feet that required to meet downstream water right diversions above Gravelly Ford and account for seepage. The historical allocation of water to Friant Division contractors, expressed as a percentage of total amounts of Class 1 and Class 2 contracts (Table 2-4) varies widely in response to hydrologic conditions.

During the period from 1957 through 2001, annual allocations of Class 1 water typically have been at or above 75 percent of contract amount, except in three extremely dry years. In this same period, full allocation of Class 2 water supplies occurred in about one fourth of the years.

During the extended drought from 1987 through 1992, no Class 2 water was available and Class 1 allocations were below full contract amounts, except in one year. During this and other historical drought periods, water contractors relied heavily on groundwater to meet water demands.

In addition to the Class 1, Class 2, and conjunctive management aspects of the Friant Division operations, a very productive program of transfers between districts takes place annually. This program provides opportunities to improve water management within the Friant service area. In wet years, water that is surplus to one district's need can be transferred to other districts that have the ability to recharge groundwater. Conversely, in dry years, water is returned to those districts that have little or no groundwater supply, thereby providing an ongoing informal groundwater banking program within the Friant Division.

The Cross-Valley Canal, a locally-financed facility completed in 1975, enables delivery of water from the California Aqueduct to the east side of the southern San Joaquin Valley near the City of Bakersfield. A complex series of water purchase, transport, and exchange agreements allow for the exchange of equivalent amounts of water between Arvin-Edison Water Storage District (a long-term Friant contractor) and eight entities that hold CVP contracts for CVP water exported from the Delta.

When conditions permit, water can be is delivered to Arvin Edison from the California Aqueduct in exchange for water that would have been delivered from Millerton Lake. Through the exchange agreements, up to 128,300 acre-feet annually can be delivered to other Friant Division contractors.

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## TABLE 2-4
## FRIANT DIVISION LONG-TERM CONTRACTS

| CONTRACT TYPE/CONTRACTOR | Class 1 | Class 2 | Cross Valley Exchange |
|---|---|---|---|
| **Friant-Kern Canal Agricultural** | | | |
| Arvin-Edison WSD | 40,000 | 311,675 | |
| Delano-Earlimart | 108,800 | 74,500 | |
| Exeter ID | 11,500 | 19,000 | |
| Fresno ID | | 75,000 | |
| Garfield WD | 3,500 | | |
| International WD | 1,200 | | |
| Ivanhoe ID | 7,700 | 7,900 | |
| Lewis Creek WD | 1,450 | | |
| Lindmore ID | 33,000 | 22,000 | |
| Lindsay-Strathmore ID | 27,500 | | |
| Lower Tule River ID | 61,200 | 238,000 | |
| Orange Cove ID | 39,200 | | |
| Porterville ID | 16,000 | 30,000 | |
| Saucelito ID | 21,200 | 32,800 | |
| Shafter-Wasco ID | 50,000 | 39,600 | |
| Southern San Joaquin MUD | 97,000 | 50,000 | |
| Stone Corral ID | 10,000 | | |
| Tea Pot Dome WD | 7,500 | | |
| Terra Bella ID | 29,000 | | |
| Tulare ID | 30,000 | 141,000 | |
| **Sub-Total Friant-Kern Canal Agricultural** | **595,750** | **1,041,475** | |
| **Madera Canal Agricultural** | | | |
| Chowchilla WD | 55,000 | 160,000 | |
| Madera ID | 85,000 | 186,000 | |
| **Sub-Total Madera Canal Agricultural** | **140,000** | **346,000** | |
| **San Joaquin River Agricultural** | | | |
| Gravelly Ford WD | | 14,000 | |
| **Total Friant Division Agricultural** | **735,750** | **1,401,475** | |
| **Friant Division M&I** | | | |
| City of Fresno | 60,000 | | |
| City of Orange Cove | 1,400 | | |
| City of Lindsay | 2,500 | | |
| Fresno County Water Works District No. 18 | 150 | | |
| Madera County | 200 | | |
| **Total Friant Division M&I** | **64,250** | | |
| **Total Friant Division Contracts** | **800,000** | **1,401,475** | |
| **Cross Valley Canal Exchange Contracts** | | | |
| Fresno County | | | 3,000 |
| Tulare County | | | 5,308 |
| Hills Valley I.D. | | | 3,346 |
| Kern-Tulare W.D. | | | 40,000 |
| Lower Tule River I.D. | | | 31,102 |
| Pixley I.D. | | | 31,102 |
| Rag Gulch W.D. | | | 13,300 |
| Tri-Valley W.D | | | 1,142 |
| **Total Cross Valley Canal Exchange** | | | **128,300** |

Source: Friant Water Users Authority Informational Report

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### *Facilities Upstream of Millerton Lake*

Upstream of Millerton Lake, Pacific Gas & Electric (PG&E) and Southern California Edison (SCE) own and operate several dams and reservoirs for the primary purpose of hydropower generation. The operation of these facilities affects the flow of water into Millerton Lake and consequently affects the quantity and timing of available water for the Friant Division. The east side of the southern San Joaquin Valley also includes numerous other surface water reservoirs that were developed for flood control and water conservation and that deliver significant water supplies to the same general area as the Friant Division.

## Groundwater Resources

The San Joaquin Valley Groundwater Basin is a structural trough up to 200 miles long and 70 miles filled with up to 32,000 feet of marine and continental sediments deposited during periodic inundation by the Pacific Ocean and erosion of surrounding mountains. Continental deposits form an alluvial wedge that thickens from the valley margins toward the axis of the structural trough, which is generally oriented along a north-south alignment.

Groundwater is a major source of agricultural and urban water supplies in the study area. The locations of groundwater basins underlying the San Joaquin Valley within the study area are shown in Figure 2-5. Typical groundwater production conditions for each sub-basin are listed in Table 2-5, based on information from DWR Bulletin 160-98. At a 1995 level of development, annual average groundwater overdraft is estimated at about 240,000 acre-feet per year in the San Joaquin River hydrologic region and at about 820,000 acre-feet per year in the Tulare Lake hydrologic region (Bulletin 160-98).

**TABLE 2-5**
**PRODUCTION CONDITIONS IN SAN JOAQUIN VALLEY GROUNDWATER SUB-BASINS**

| Basin Number[1] | Basin Name | Extraction (TAF/year) | Well Yields (gpm) | Pumping Lifts (feet) |
|---|---|---|---|---|
| **San Joaquin River Basin** | | | | |
| 765 | Modesto | 230 | 1,000 – 2,000 | 90 |
| 776 | Delta-Mendota | 510 | 800 – 2,000 | 35 – 150 |
| 778 | Turlock | 450 | 1,000 – 2,000 | 90 |
| 784 | Merced | 560 | 1,500 – 1,900 | 110 |
| 795 | Madera | 570 | 750 – 2,000 | 160 |
| 796 | Chowchilla | 260 | 1,500 – 1,900 | 110 |
| **Tulare Lake Basin** | | | | |
| 821 | Kings | 1,790 | 500 – 1,500 | 150 |
| 831 | Westside | 210 | 800 – 1,500 | 200 - 800 |
| 849 | Kaweah | 760 | 1,000 – 2,000 | 125 - 250 |
| 861 | Tulare Lake | 670 | 300 – 1,000 | 270 |
| 898 | Tule | 660 | N/A | 150 - 200 |
| 891 | Pleasant Valley | 100 | N/A | 350 |
| 1058 | Kern | 1,400 | 1,500 – 2,500 | 200 - 250 |

Source: California Department of Water Resources Bulletin 160-98.
Note: 1) Groundwater basin number as shown on Figure 2-5.

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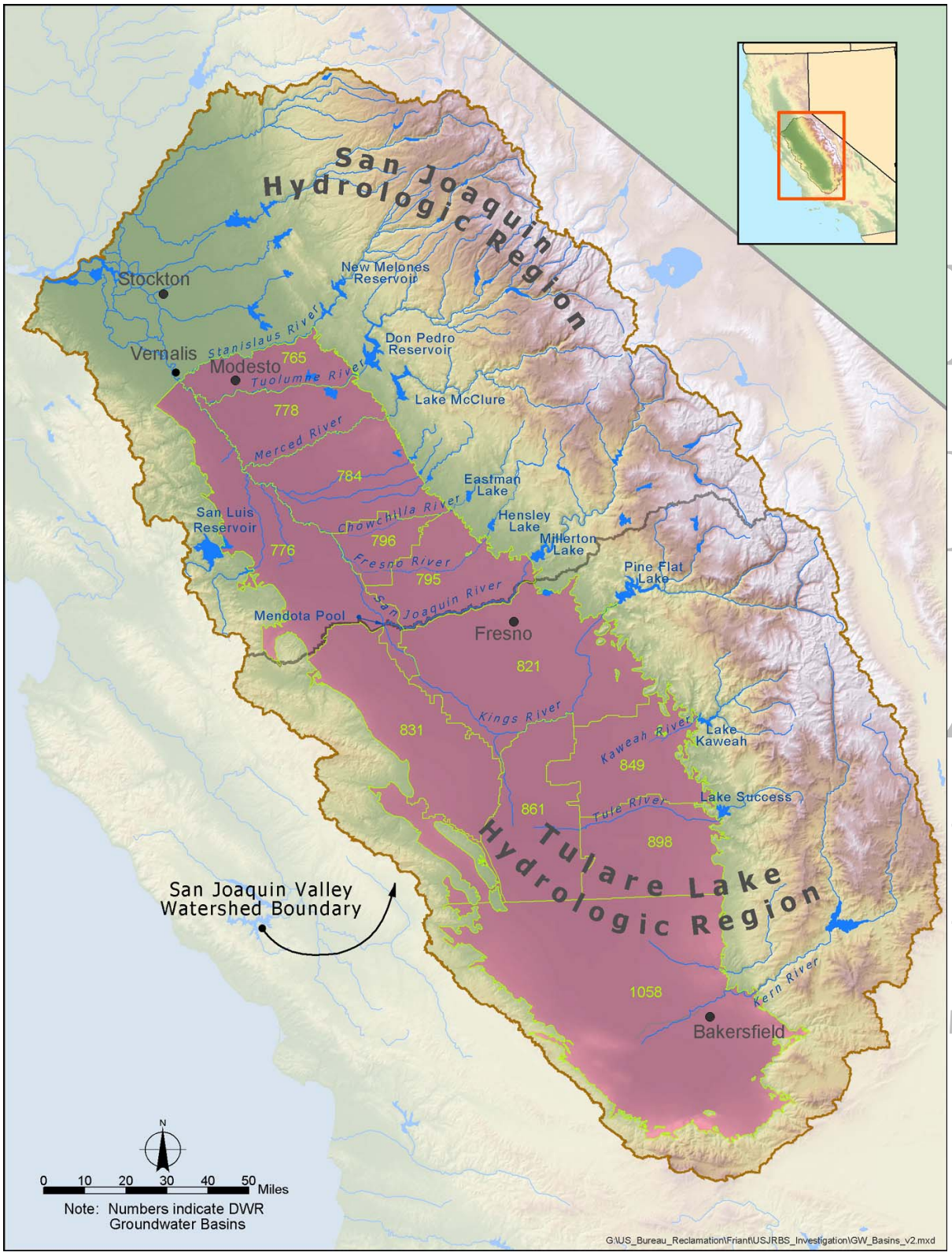


**FIGURE 2-5. SAN JOAQUIN VALLEY GROUNDWATER SUB-BASINS IN THE STUDY AREA**

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## FUTURE WITHOUT-PROJECT CONDITIONS

Water resources in the study area are not sufficient to meet the demands of current water uses. Local water users, CALFED, and numerous other entities have been considering potential projects and actions that would help meet current water needs, provide water for other purposes such as restoration of the San Joaquin River, and improve flood protection along the San Joaquin River. At this time, most of these initiatives are still under investigation and projects have not been sufficiently permitted, authorized, or funded to assure their completion and provide a basis for future planning.

The CALFED Program is developing a consistent set of assumptions regarding the definition of future without project conditions throughout the CALFED solution area. Those actions or projects that are foreseeable and certain during the planning time frame will be included in the future without-project condition. Assumptions regarding actions or projects that are foreseeable but not certain to be implemented during the planning time frame or the details of the implementation are not fully known at this time may also be considered for comparison purposes. Assumptions regarding such actions and projects may be included in an alternative alternate baseline for comparison or may be incorporated to project alternatives.

During the remainder of Phase 1, and during Phase 2 of the Investigation, assumptions regarding water demands, ecosystem needs, and other CALFED actions and projects will be further refined by CALFED agencies and project study teams. The following sections describe the approach that is under way in defining the future without project conditions for programs that could affect the availability and use of water in the Upper San Joaquin River Basin, including conjunctive management, demand management, and exchanges and transfers.

### Conjunctive Management

The CALFED Program is preparing an inventory of potential locally-initiated conjunctive management projects based on information provided through grant and loan applications during the past few years. The inventory will identify those projects that would be developed independent of new surface storage. During Phase 2, the conceptual development of conjunctive management projects in the future without project condition will need to consider water sources, changes to existing project operations, conveyance needs, and effects on regional groundwater conditions.

### Demand Management

The CALFED Program has made preliminary assumptions regarding actions that would be taken at the local level to reduce water demands or increase the use of existing supplies. Water conservation and recycling projects undertaken at the local would be developed to help reduce local water resources problems, such as water quality or groundwater overdraft, but would not result in a reduction in surface water demand. This assumption recognizes that surface water supplies are not adequate to meet current and future demands without an over-reliance on groundwater. Thus, demand management actions implemented consistent with the CALFED ROD would likely result in reduced groundwater pumping, but would not reduce demands for surface water from Friant Dam.

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## Exchanges and Transfers

Similar to the approach in developing assumptions regarding future conjunctive management, the CALFED Program will compile a list of potential exchanges and water transfers that could be implemented independent of new storage projects. This work is in the formative stage and as of this date, a list has not yet been developed. Criteria for determining which exchanges and transfers would be included in a future without-project condition have not been fully defined.

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