Section D

Water Supply, Demand and Water Budget

Section D – Water Supply, Demand, and Water Budget

The Tule River Basin IRWM planning area is approximately 673 square miles and is situated within The Tule Subbasin of the San Juaquin Valley Groundwater Basin. The region supports both urban and agricultural water demands. A balance between water supply and water demand is necessary for economic and ecologic sustainability.

D.1 Introduction

This section of the Tule River Basin IRWMP provides a discussion and analysis of the current and projected water supply and demand for the Tule River Basin IRWM planning area from 2020-2040. The section begins with a discussion of surface water supplies and water demand for each water management district. This is followed by an analysis of groundwater supply, which is discussed at a regional level due to the shared nature of groundwater resources. The section concludes with a summary of the region's water supply demand balance, and a discussion of future impacts on the water budget.

D.1.1 Use of IRWM Plan for Determining Adequacy of Water Supplies Under Senate Bill 610 and 221

Senate Bill 221	SB 221 requires all cities and counties to include, as a condition in their approval of a tentative subdivision map for a large residential subdivision, that a sufficient water supply must be available.
Senate Bill 610	SB 610 expanded the requirement for public water systems to prepare water supply assessments for development projects. Specifically, the bill increases the number of projects subject to a water supply assessment and compliance with SB 221.

This section does not make any conclusions on the adequacy of water supplies to meet water demands, but does discuss likely deficiencies and probable actions. The rigor of analysis required as part of the required study of sustainable water supplies under Senate Bills 610 and 221 for new developments should be done as a separate evaluation supported by the latest local UWMPs and groundwater management plans.

D.2 Water Management Districts

D.2.1 Lower Tule River Irrigation District

The Lower Tule River Irrigation District is one of the largest irrigation districts in the State of California. The district is bordered by the Pixley Irrigation District to the south, the Porterville Irrigation District to the East, and the Saucelito Irrigation District on the southeast corner. As of 2010, the Tule River Irrigation District is comprised 103,086 acres, 84,169 of which are under irrigated agricultural use. The following water supply and demand data was taken from the 2012 Lower Tule River Irrigation District Water Management Plan and the 2017 Central Valley Project Operations Report.

Surface Water Supply

The majority of surface water supply within the district is derived from water diversions from the Friant-Kern Canal under two separate long term surface water contracts (Class 1 and Class 2) with the U.S. Bureau of Reclamation via the Central Valley Project. The district has a maximum entitlement of 61,200 AF/Year under the class 1 Contract and 238,000 AF/Year under the Class 2 Contract. The amount of water delivered varies significantly depending on total water availability. In a normal water year, CVP typically delivers much less than the maximum contracted amount. For example, from 2001-2010, the average amount of water supplied per year to the District through Class 1 and 2 Contracts was 120,166 AF. This supply dipped to zero at the peak of the California drought (2015) but increased to the full contract allocation in 2017.

In addition to Federal Agricultural Water entitlements, the District has Tule River Rights based on pre-1914 water rights. The water received from Lake Success is associated with the District's Tule River Rights. The average annual yield of those combined rights is approximately 70,000 AF per year. However, these water rights are currently impaired by limited storage conditions behind Success Dam which are limited by the Army Corps of Engineers due to concerns about the safety of the dam. The actual average supply from this source from 2001-2010 was 57,891 AF/Year, however supply varies greatly from year to year.

Table D-1. Lower Tule River Irrigation District Surface Water Supplies

Water Supply Source	AF/Year (2010 Data)	AF/Year (Average 2001-2010)
Federal Agricultural Water	171,428	120,166
Local Surface Water	89,215	57,891
Transferred Water	8,100	8,100*
Total	268,743	178,057

Demand

Because there are no urban water users within the District, 100% of water demand is due to agriculture. There are 209 farms and 610 total delivery points within the district. Corn is the most dominant crop cultivated by farms within the district and has an average evapotranspiration rate of 3.4 acre-feet per acre. Distribution losses are almost entirely due to seepage, which is when water percolates from canals and other conveyance systems into the surrounding soil.

Table D-2. Lower Tule River Irrigation District Water Demand (2010 Data)

Demand Source	AF/Year (2010 Data)
Applied Crop Water Use	367,038
Distribution Losses	105,259
Total	472,297

D.2.2 Pixley Irrigation District

The Pixley Irrigation District was formed in 1958 to promote flood control and secure supplemental irrigation water supply from the Federal Central Valley Project and other agencies. Pixley Irrigation district is bordered by the Lower Tule River Irrigation District to the north and Saucelito Irrigation District to the east. The district covers 69,571 acres, 59,283 of which are under irrigated agricultural uses.

The following water supply and demand data was taken from the 2012 Lower Tule River Irrigation District Water Management Plan and the 2017 Central Valley Project Operations Report.

Surface Water Supply

The Pixley Irrigation District contains very limited surface water supplies, Water transfers from the Lower Tule River and Porterville Irrigation Districts are the primary source of surface water supply in the Pixley district. Combined, these districts supplied 30,296 AF of water in 2010.

In addition to water transfers from other districts, Deer Creek, a local surface water resource, provides a small contribution to the districts water supply. Local surface water from Deer Creek supplied an average of 2,156 AF/Year between 2001 and 2010.

The Pixley Irrigation District documents a maximum annual entitlement of 31,102 AF/Year with the U.S. Bureau of Reclamation via the Central Valley Project in its 2012 Water Management Plan. However, the plan records zero delivery from this source between 2001 and 2010.

Table D-3: Pixley Irrigation District Surface Water Supplies

Surface Water Supply Source	AF/Year (2010 Data)	AF/Year (Average 2001-2010)
Water Transfers	30,296	30,296[1]
Local Surface Water	1,000	2,165
Total	31,296	32,461[1]

*2010 water transfer data is used as 2001-2010 average in calculation of total due to data availability.

Demand

As an irrigation district, water demands are entirely related to agriculture. The district contains 59,283 irrigated acres with a total of 94 separate farms and 166 water delivery points. Corn is the most dominant crop cultivated by farms within the district and has an average evapotranspiration rate of 3.4 acre-feet per acre. Distribution losses contribute to water demand within the district. Distribution losses are almost entirely due to seepage, which is when water percolates from canals and other conveyance systems into the surrounding soil.

Table D-4. Pixley Irrigation District Water Demand (2010 Data)

Demand Source	AF/Year
Applied Crop Water Use	182,746
Distribution Losses	11,503
Total	194,249

D.2.3 Porterville Irrigation District

The Porterville Irrigation District was formed in 1949 to establish a water supply contract from the Central Valley Project. The district is located west of the City of Porterville, east of the Lower Tule River Irrigation District, and north of the Saucelito Irrigation District. The district covers approximately 16,900 acres, 12,672 of which are under irrigated agricultural uses. The following water supply and demand data was taken from the 2012 Porterville Irrigation District Agricultural Water Management Plan.

Surface Water Supply

The majority of surface water supply within the district is derived from water diversions from the Friant-Kern Canal under two separate long-term surface water contracts (Class 1 and Class 2) with the U.S. Bureau of Reclamation via the Central Valley Project. The district has a maximum entitlement of 16,000 AF/Year under the class 1 Contract and 30,000 AF/Year under the Class 2 Contract.

The amount of water delivered varies significantly depending on total water availability. In a normal water year, CVP typically delivers much less than the maximum contracted amount. For example, from 2001-2010, the average amount of water supplied per year to the District through Class 1 and 2 Contracts was 19,856 acre-feet. This supply dipped to zero at the peak of the California drought (2015) but increased to the full contract allocation in 2017. Recirculated water from the Central Valley Project provided a small contribution to total water supply in 2010.

In addition to Federal Agricultural Water entitlements, the District has Tule River Rights based on pre-1914 water rights. The district is contracted 10,000 acre-feet per year, however these water rights are currently impaired by limited storage conditions behind Success Dam which are limited by the Army Corps of Engineers due to concerns about the safety of the dam. Thus, actual supply varies greatly from year to year. This source supplied an average of 6,682 acre-feet per year between 2001 and 2010.

Table D-5: Porterville Irrigation District Surface Water Supply

Surface Water Supply Source	AF/Year (2010 Data)	AF/Year (Average 2001-2010)
Federal Agricultural Water	12,814	19,856
Local Surface Water (Tule River)	6,978	6,682
Other* (Recirculation Water)	941	94
Total	20,733	26,631

*"Other" water was CVP recirculation water that was delivered to the District during the months of August 2010 and September 2010.

Demand

Because there are no urban water users within the Irrigation District, 100% of water demand is due to agriculture. There are 91 farms and 138 total delivery points within the district. Walnuts are the most dominant crop cultivated by farms within the district and have an average evapotranspiration rate of 2.7 acre-feet per acre.

Water transfers to the Pixley Irrigation District are a significant contributor to water demand within the district. Water transfers are used to support agricultural production in the neighboring district and totaled 17,004 acre-feet in 2010.

Distribution losses also contribute to total water demand within the district. Water loss during distribution is entirely due to seepage, which is when water percolates from canals and other conveyance systems into the surrounding soil. The Porterville Irrigation District Water Management Plan estimates seepage loss using average flow measurements throughout the distribution system.

Table D-6: Porterville Irrigation District Water Demand

Demand Source	AF/Year (2010 Data)
Applied Crop Water Use	44,466
Transfers (To Pixley Irrigation District)	17,004
Distribution Losses	5,529
Total	66,999

D.2.4 Saucelito Irrigation District

The Saucelito Irrigation District was formed in 1941 to supply agricultural water to district lands. The district is located east of the Pixley Irrigation District, south of the Porterville and Lower Tule River Irrigation Districts and covers approximately 19,737 acres. The Saucelito Irrigation District is entirely composed of agricultural users. The following water supply and demand data was taken from the 2012 Saucelito Irrigation District Agricultural Water Management Plan.

Surface Water Supply

The majority of surface water supply within the district is derived from water diversions from the Friant-Kern Canal under two separate long-term surface water contracts (Class 1 and Class 2) with the U.S. Bureau of Reclamation via the Central Valley Project. The district has a maximum entitlement of 21,200 AF/Year under the class 1 Contract and 32,800 AF/Year under the Class 2 Contract.

The amount of water delivered varies significantly depending on total water availability. In a normal water year, CVP typically delivers much less than the maximum contracted amount. For example, from 2001-2010, the average amount of water supplied per year to the District through Class 1 and 2 Contracts was 29,734 AF. This supply dipped to zero at the peak of the California drought (2015) but increased to the full contract allocation in 2017. Local Surface Water also provides a small annual contribution to the District's water supply.

In 2010, irregular water supplies totaling 5,202 acre-feet were created through recovered water systems and transfers from other districts.

Table D-7: Saucelito Irrigation District Surface Water Supplies

Surface Water Supply Source	AF/Year (2010 Data)	AF/Year (Average 2001-2010)
Federal Agricultural Water	36,934	29,734
Local Surface Water	413	338
Other*	5,202	520
Total	42,549	30,592

*"Other water" was transfers in in the amounts of 3,034 acre-feet and 1,200 acre-feet and Recovered Water Account supplies in the amounts of 516 AF and 452 AF.

<u>Demand</u>

Because there are no urban water users within the District, 100% of water demand is due to agriculture. There are 88 farms and 215 total delivery points within the district. Grapes are the most dominant crop cultivated within the district. Grapes have an average evapotranspiration rate of 2.7 acre-feet per acre and account for 3,476 acres within the district.

Distribution losses are entirely due to seepage, which is when water percolates from canals and other conveyance systems into the surrounding soil. The Saucelito Irrigation District Water Management Plan acknowledges that seepage does occur, but identifies it as a source of groundwater replenishment.

Table D-8: Saucelito Irrigation District Water Demand

Demand Source	AF/Year (2010 Data)
Applied Crop Water Use	52,727
Distribution losses	372
Total	53,099

D.2.5 Tea Pot Dome Water District

The Tea Pot Dome Water District was formed in 1954 and is located south of the City of Porterville and North of the Terra Bella Irrigation District. The district covers approximately 3,481 acres, 3,282 of which are under irrigated agricultural use. All water use within the district is designated as agricultural.

The following water supply and demand data was taken from the 2011 Tea Pot Dome Water District Water Management Plan.

<u>Surface Water Supply</u>

All surface water is supplied to the district through water diversions from the Friant-Kern Canal under long term surface water contracts with the U.S. Bureau of Reclamation via the Central Valley Project. The district has a maximum entitlement of 7,500 AF/Year under this contract, however actual water deliveries are usually lower than the maximum entitlement and dependent on water availability. For example, the district received an average of 6,120 acre-feet per year between 2001 and 2011. Federal agricultural surface water supplies were not delivered at the peak of the California drought (2015), however deliveries increased to the full contract allocation in 2017.

Table D-9: Tea Pot Dome Surface Water Supply

Surface Water Supply Source	AF/Year (2010 Data)	AF/Year (Average 2001-2010)
Federal Agricultural Water	5,944	6,128
Total	5,944	6,128

Demand

Because there are no urban water users within the District, 100% of water demand is due to agriculture. There are 65 farms and 125 total delivery points within the district. Citrus is the most dominant crop cultivated within the district. Citrus has an average evapotranspiration rate of 3.4 acre-feet per acre and accounts for 2,997 acres within the district.

Distribution losses are entirely due to seepage, which is when water percolates from canals and other conveyance systems into the surrounding soil. The Tea Pot Dome Water District Water Management Plan estimates a 2% loss from seepage for every 100 feet of pipe.

Table D-10. Tea Pot Dome Water Management District Water Demand

Demand Source	AF/Year (2010 Data)
Applied Crop Water Use	8,038
Distribution losses	23
Total	8,061

D.2.6 Terra Bella Irrigation District

The Terra Bella Irrigation District was formed in 1915 to obtain agricultural water for district lands. The district is located in the south-east corner of the IRWM planning area and covers approximately 13,962 acres, 12,739 of which are under irrigated agricultural use. The district serves both urban and agricultural users. The following water supply and demand data was taken from the 2013 Terra Bella Irrigation District Agricultural Water Management Plan.

Surface Water Supply

Surface water supplies to the Terra Bella Irrigation District are entirely composed of water diverted from the Friant-Kern Canal under two separate long-term surface water contracts (Class 1 and Class 2) with the U.S. Bureau of Reclamation via the Central Valley Project. The district has a maximum entitlement of 29,000 AF/Year under the class 1 Contract and 1,200 AF/Year under the Class 2 Contract. Federal urban deliveries are made under these contracts.

The amount of water delivered per year varies significantly depending on total water availability. In a normal water year, CVP typically delivers much less than the maximum contracted amount. For example, federal contracts supplied an average of 18,129 acre-feet of agricultural water and 1,044 acre-feet of urban water per year from 2001-2010. This supply dipped to zero at the peak of the California drought (2015) but increased to the full contract allocation in 2017.

Table D-11: Terra Bella Irrigation District Surface Water Supply

Surface Water Supply Source	AF/Year (2010 Data)	AF/Year (Average 2001-2010)
Federal Urban Water	1,182	1,044
Federal Agricultural Water	15,985	18,129
Local Surface Water		
Other (Transport)*	12,980	1,298
Total	30,147	20,472

* “Other” water was Federal CVP contract supply.

<u>Demand</u>

The Terra Bella Irrigation District supports both urban and agricultural water demands.
The majority of water demand is due to agricultural land use. The district contains 1,222 farms and 1,473 total delivery points. Citrus is the primary crop cultivated within the district and has an average evapotranspiration rate of 3.4 acre-feet per acre.

In addition to agricultural water demand, urban users contribute to the district’s total water demand. There are 668 urban connections. All urban connections are metered, which encourages water conservation.

The district does not quantify any distribution losses. The Districts Water Management Plan cites continuous maintenance and system repair as sufficient measures to reduce distribution losses to less than significant levels.

Table D-12: Terra Bella Irrigation District Water Demand

Demand Source	AF/Year (2010 Data)
Applied Crop Water Use	30,475
Urban Use (Single Family-Residential)	1,182
Total	31,657

D.2.7 Porterville (2015 Urban Water Management Plan)

The City of Porterville is the only incorporated city within the IRWMP region. The Porterville Urban Water Management Plan was adopted in 2010 and updated in 2014. The Porterville Urban Planning area covers 36,341 acres and includes the city as well as unincorporated areas outside the city that are of interest for long-term planning. The following water supply and demand data was taken from the 2015 City of Porterville Urban Water Management Plan.

<u>Surface Water Supply</u>

The City of Porterville Urban Water Management Planning Area does not receive any supplies from surface water and depends entirely on groundwater. However, the City anticipates purchasing surface water from Porterville Irrigation District and receiving surface water transfers in the future.

<u>Demand</u>

The City of Porterville Urban Water Management Planning Area supports a variety of urban water uses. Future demand was projected based on general plan land uses, projected growth rates, and historic demands.

Table D-13: City of Porterville Water Demand

Demand Source	AF/Year (2010 Data)
Single Family	7,051
Multi-Family	1,788
Commercial/Institutional	2,007
Industrial	78
Landscape Irrigation	410
Other	427
Agricultural Irrigation	0
System Losses	619
Total	12,380

D.2.8 Unincorporated Urban Community Service Districts

There are eight unincorporated urban communities within the IRWMP region. Unincorporated communities cover 50 square miles within the IRWM planning area and make up 30% or the region's total population. Local Community Service Districts own and operate private wells which are used to provide water for residential, commercial, and industrial uses. The unincorporated communities located within the IRWMP region are as follows:

- East Porterville
- Terra Bella
- Tipton
- Pixley
- Woodville
- Poplar
- Allensworth
- Teviston

<u>Surface Water Supply</u>

Unincorporated urban communities within the IRWMP region do not receive any surface water supplies because surface water is used to meet agricultural water demands. Instead, these communities derive water resources entirely from the Tule Sub Basin.

<u>Demand</u>

Water demand for unincorporated communities within the IRWMP region is difficult to quantify because most water hookups are unmetered and well production is generally unmeasured. This makes it impossible to accurately determine the community's water use. Additionally, water use data that is available is out of date and based on much smaller populations. For this reason, water demand was estimated for each community district by multiplying the average water use per capita per day as identified in Tulare County General Plan (160 gallons per capita per day) with the community's 2010 population.

Table D-14: Urban water demand in unincorporated communities within the IRWMP region.

Urban Water Demand					
Community	**Population (2010)**	**Per Capita Water Use (Gallons Per Day)**	**Community Water Use (Gallons Per Day)**	**Community Water Use (Gallons Per Year)**	**Community Water Use (Ac-Ft Per Year)**
East Porterville	7331	160	1172960	428130400	**1314**
Terra Bella	3310	160	529600	193304000	**593**
Tipton	2543	160	406880	148511200	**456**
Pixley	3310	160	529600	193304000	**593**
Woodville	1740	160	278400	101616000	**312**
Poplar	2470	160	395200	144248000	**443**
Allensworth	471	160	75360	27506400	**84**
Teviston	1214	160	194240	70897600	**218**
Total	**30926**		**3582240**	**1307517600**	**4013**

D.3 Groundwater Supply: The Tule Sub Basin

All Water Management Districts within the IRWM planning area receive groundwater supplies from the Tule Basin, a Subbasin of the San Joaquin Valley Groundwater Basin. Because the Sub basin is shared by IRWMP member districts, groundwater supply will be discussed with regard to the IRWMP region as a whole.

The basin is composed of two extensive and usable groundwater aquifers. The upper aquifer is unconfined and highly receptive to recharge from locations throughout the District extending east into the foothills of the Sierra Nevada Mountains. The lower aquifer is confined under the Corcoran Clay layer and can be effectively recharged from areas east of Highway 99.

The Tule River is the primary source of groundwater replenishment within the Lower Tule River Irrigation District. Recharge is accomplished primarily by seepage from the Tule River channels and from distribution canals, by deep percolation from irrigation, and by artificial percolation from spreading basins.

Total groundwater supply was determined using safe yield. The safe yield of a groundwater basin is the rate at which groundwater can be extracted without causing long-term water level decline. Safe yield is generally considered equal to the average replenishment rate of the basin from natural and artificial recharge. Using safe yield, rather than actual yield, to determine average annual groundwater supply will result in a responsible water budget that can be used to develop sustainable groundwater management practices.

A Water Supply Evaluation Report was prepared in 2009 for the Tulare County General Plan 2030 update. This report estimates the basin's natural recharge at 34,400 acre-feet per year and applied water recharge at 201,000 acre-feet per year. These values were used to estimate the basin's safe yield at 235,400 acre-feet per year.

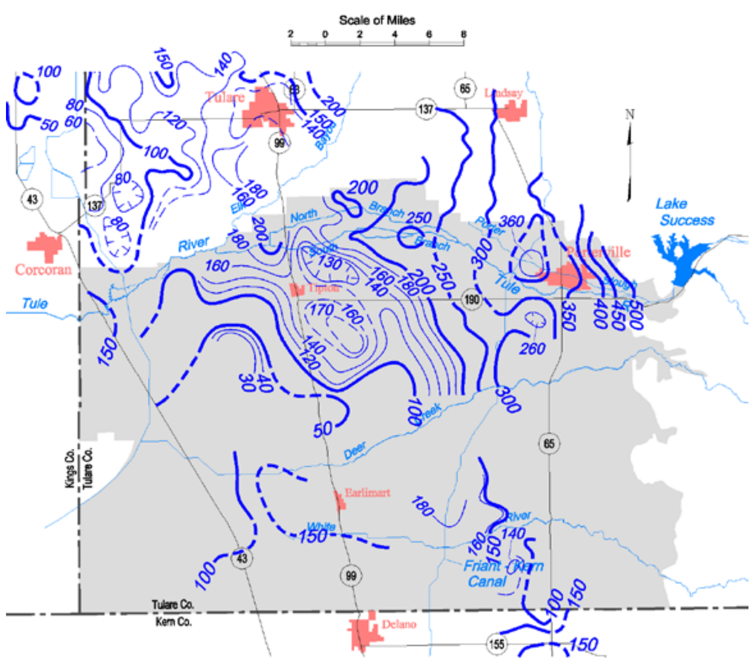

Figure D-1. Lines of Equal Elevation of Water in Wells, Unconfined Aquifer (Spring 2010)

D.4 Regional Supply and Demand Balance

The difference between supply and demand is demonstrative of demand exceeding supply. This finding is confirmed by the declining groundwater table within the DCTRA IRWMP area. Although water management districts within the IRWMP region have been able to meet their water demands using groundwater thus far, they will not be able to do so indefinitely at the current rate of groundwater extraction.

Table D-15. Table summarizing of the region's water supply and demand balance.

Water Supply-Demand Balance						
	Average Surface Water Supplies (2001-2010)	Groundwater Supply (Based on Tule Basin Safe Yield, AF/Year)*	Groundwater Demand (District Demand - District Surface Supply)	% of Total Groundwater Demand	Total Water Demand (2010 Data, AF/Year)	Water Supply Demand Balance (AF/Year)
Lower Tule River ID	178,057	126,299	294,240	53.65%	472,297	**-167,941**
Pixley ID	32,461	69,446	161,788	29.50%	194,249	**-92,342**
Porterville ID	26,631	17,327	40,368	7.36%	66,999	**-23,041**
Saucelito ID	30,592	9,661	22,507	4.10%	53,099	**-12,846**
Tea Pot Dome WD	6,128	830	1,933	0.35%	8,061	**-1,103**
Terra Bella ID	20,472	4,801	11,185	2.04%	31,657	**-6,384**
City of Porterville	0	5,314	12,380	2.26%	12,380	**-7,066**
East Porterville	0	564	1,314	0.24%	1,314	**-750**
Terra Bella	0	255	593	0.11%	593	**-338**
Tipton	0	196	456	0.08%	456	**-260**
Pixley	0	255	593	0.11%	593	**-338**
Woodville	0	134	312	0.06%	312	**-178**
Poplar	0	190	443	0.08%	443	**-253**
Allensworth	0	36	84	0.02%	84	**-48**
Teviston	0	94	218	0.04%	218	**-124**
IRWMP Region	**294,341**	**235,400**	**548,414**	**100.00%**	**842,755**	**-313,014**

*Each district's groundwater supply values are based on the district's percentage of total groundwater demand in relationship with the Tule Basin's safe yield and was calculated using the following equation:

$$District\ Groundwater\ Supply = \frac{District\ Water\ Demand - District\ Surface\ Supplies}{Regional\ Water\ Demand - Regional\ Surface\ Supplies}\ x\ Tule\ Basin\ Safe\ Yield$$

** Tule Sub Basin safe yield, as identified in the 2009 Water Supply Evaluation Report prepared for the 2030 Tulare County General Plan.

D.5 Water Supplies and Demand Through 2040

Ensuring water availability into the future is a primary objective of this IRWMP. By evaluating the factors that influence water use, it is possible to predict future water supply and demand. Although all water supply and demand predictions are inherently uncertain and based on assumptions, the practice of evaluating future water supply and demand encourages water resource managers to make decisions based on their long-term benefits. This section was developed to satisfy the 2016 IRWMP Guideline requirement to develop a water budget with a 20 year planning horizon. The section is organized in the following order:

- Projected Urban Water Demand
- Projected Agriculture Demand
- Predicted Changes to Regional Water Supply
- Plan to Reduce Dependence on the San Joaquin Delta Supply

D.5.1 Projected Urban Water Demand

There is one incorporated and nine unincorporated urban areas within the IRWM planning area. Future water demand for these areas is based on assumed growth rate and per capita water use. Average per capita water use values were assumed based on the Tulare County General Plan, which identifies an average of 160 gallons per capita per day as the average per capita water use within the county. Predicted growth rates are based off information provided in the Tulare County and City of Porterville General Plans. The average annual growth rate for unincorporated communities used in this analysis was taken from the 2010 Tulare County General Plan Background Report, which identifies a 1.3% projected annual growth rate for unincorporated areas of Tulare County. The average annual growth rate for the City of Porterville was provided by the City of Porterville General Plan, which predicts that the city's population will grow by 3.7% annually.

Based on these annual average growth rates, the IRWMP region's population is expected to grow from 76,554 to 194,080 between 2010 and 2040. As shown in figure D-2, this increase in population will have large impact on urban water demand. To ensure adequate water supplies to support future population growth, water availability should be taken into account when considering new urban development projects within the IRWMP region.

Table D-16: Projected Urban water demand in Acre-Feet / year through 2040.

Projected Urban Water Demand (Acre-Feet/Year)							
Year	**2010**	**2015**	**2020**	**2025**	**2030**	**2035**	**2040**
Porterville	9,708	11,641	13,960	16,741	20,076	24,076	28,872
East Porterville	1,314	1,402	1,495	1,595	1,701	1,815	1,936
Terra Bella	593	633	675	720	768	819	874
Tipton	456	486	519	553	590	629	671
Pixley	593	633	675	720	768	819	874
Woodville	312	333	355	379	404	431	459
Poplar	443	472	504	537	573	611	652
Allensworth	84	90	96	102	109	117	124
Teviston	218	232	248	264	282	301	321
Total	**13,720**	**15,922**	**18,526**	**21,612**	**25,272**	**29,618**	**34,784**

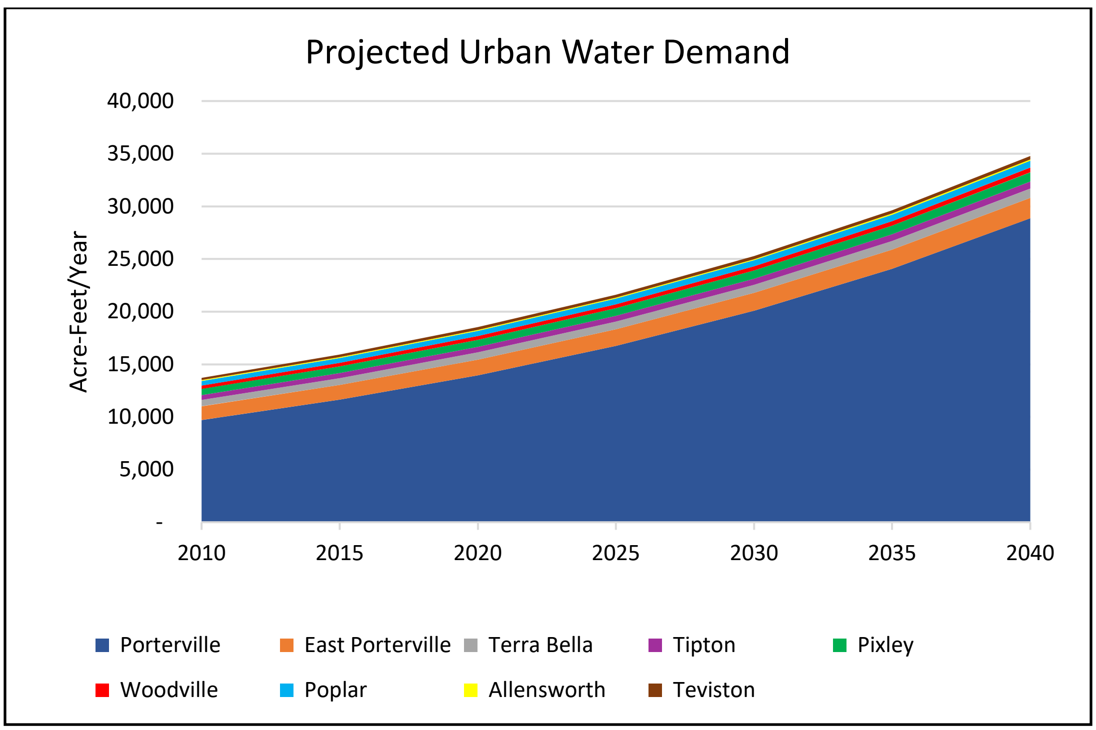

Figure D-2. Projected future urban water demand in Acre-Feet/year through 2040 based on expected population growth

D.5.2 Projected Agricultural Water Demand

Unlike urban water demand, agricultural water demand is not directly related to population size. Instead, agricultural water demand depends on a multitude of variables, including crop type, irrigation efficiency, temperature, precipitation, etc. Any combination of these variables would have a different impact on agricultural water demand. For this reason, it is very difficult to predict future agricultural water demands with accuracy.

There are a few factors that could decrease future agricultural water demand. Regional population growth would likely lead to decreased agricultural water demand as agricultural lands are converted for urban use. Additionally, increased irrigation efficiency resulting from technological advances would further reduce agricultural water demand. These variables and their impacts on agricultural water demand are somewhat predictable, however changes in crop type, precipitation, or temperature could either increase or decrease future agricultural water demand from year to year.

While some factors may decrease future agricultural water demand, it is more likely that climate change will increase agricultural water demand while making water supply more unreliable. The following provides a summary of likely climate change impacts on agricultural water demand; however, a more in-depth discussion is available in Section O – Climate Change.

- Increased temperatures would result in increased evapotranspiration rates and increased crop water demand. This, in conjunction with extreme drought periods, would increase the amount of applied water needed to support crops.
- Extreme storm events are also anticipated as a result of climate change. Although heavy rains could provide a temporary increase in water supply, it is more likely that large amounts of water would be lost from evaporation as timing would be insufficient for crops to utilize it.

Agricultural water use creates the vast majority of water demand within the region. Ensuring that adequate supplies exist to meet this demand is a primary objective of this IRWMP. For this reason, changes in agricultural water demand as a result of climate change or other factors should be monitored closely as part of IRWMP implementation.

D.5.3 Predicted Changes to Regional Water Supply

As previously discussed, climate change is anticipated to have significant impacts on regional water supply. The following provides a summary of likely climate change impacts on regional water supply; however, a more in-depth discussion is available in Section O – Climate Change.

- Reduced snow melt would result in further reduction of water supply during warmer months and limit the reliability of water flow from the Tule River and Deer Creek. This would increase reliance on groundwater resources, which are already in overdraft to support crops.
- Extended drought events could create severe water shortages for both agricultural and urban water users.
- Extreme storm events as a result of climate change could bring heavy rains that temporarily increase water supply. However, it is likely that large amounts of water would be lost from evaporation as timing would be insufficient for groundwater recharge to occur.

- Salt water intrusion into the San Joaquin Delta as a result of sea level rise could lead to reductions in federally contracted water supplies.

D.5.4 Plan to Reduce Dependence on the Sacramento-San Joaquin Delta Supply

As shown in figure D-3, water that is federally contracted from the Sacramento-San Joaquin Delta addresses approximately 24% of the region's total water demand. Decreasing dependence on the delta will promote sustainable water use and increase regional and state resilience to climate change impacts. Increasing groundwater and local surface water supplies while decreasing water demands will lead to decreased dependence on the delta.

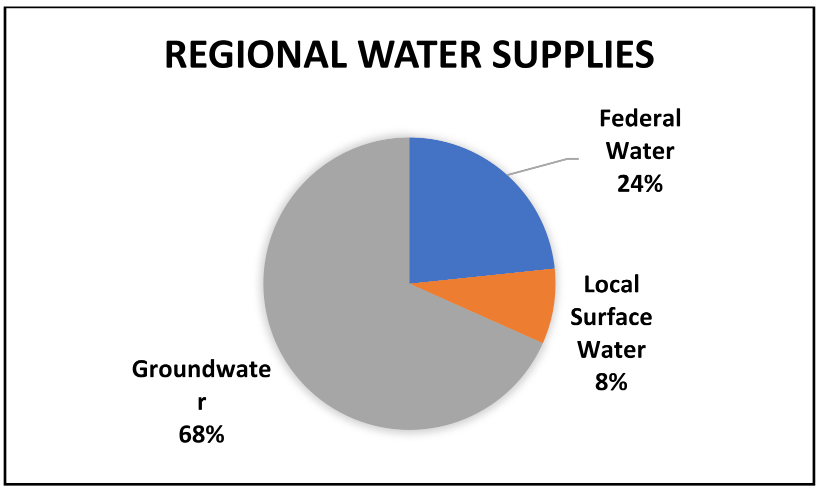

Figure D-3: Water supply sources

Groundwater supplies can be increased through conjunctive use of local surface and groundwater resources. Conjunctive use programs involve the maximum utilization of water resources by using excess surface water to replenish groundwater in wet years, which can then be used to supplement water supplies in dry years. Increasing groundwater recharge opportunities will increase the Tule Sub basin's safe yield while also reducing dependence on the Sacramento-San Joaquin Delta. Existing policies promote IRWMP member districts to preserve and enhance conjunctive use opportunities by developing water banking arrangements with other agencies and utilizing available groundwater storage capacity during wet years.

While local surface water supplies are mostly dependent on precipitation and snowmelt, there are a few ways in which they can be optimized. Increasing surface water storage, particularly during wet years, could increase water supply availability and decrease dependence on the delta. One opportunity for this is the expansion of Success Reservoir. Success Dam is used to control the flow of the Tule River, which is a primary local surface water supply. Increasing the capacity of Success Reservoir could allow for larger surface water distributions downstream. Surface water could also be increased using precipitation enhancement techniques such as cloud seeding to increase precipitation. This would increase surface water supplies while also adding to groundwater recharge.

Water demand is the component of the water budget that can be most influenced through infrastructure and policy. Decreasing water demand would directly decrease dependence on the San Joaquin Delta water supply. Major ways to reduce regional water demand could include the installation of meters to all water hookups in unincorporated communities and requiring private well owners to measure their well production. Presently, water meters are only required for new development projects or transfer of ownership. Increasingly efficient water delivery systems as a result of technological advances will also reduce regional water demand and dependence on the delta.

It should be said, however, that agriculture makes up a large majority of the region's total water demand, and the region produces far more agriculture than it consumes. The central valley produces 8% of the nation's total agricultural output and accounts for only 0.47% of the nation's land area. For this reason, it is unlikely that the region will be completely self-sufficient with regard to water while it is a primary supplier of food for areas outside the region. However, efforts to increase local water supplies will be supported.