Chapter 2 ESIRWM Region

2.1 Region Description

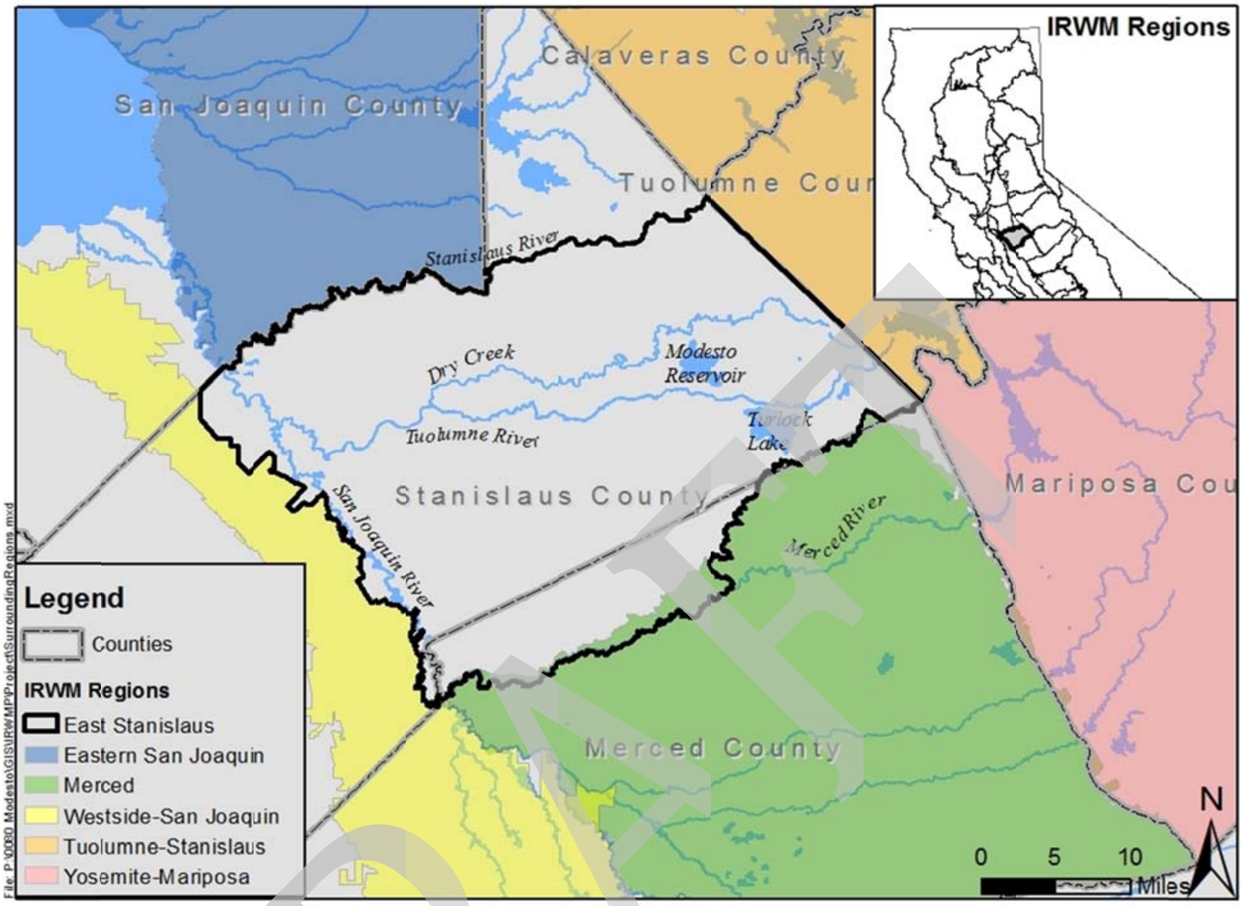
> An IRWMP must include a description of the region being managed by the RWMG. This section should describe:
>
> - Watersheds and water systems within the region.
> - Internal boundaries within the region.
> - Water supplies and demands for a minimum of a 20-year planning horizon.
> - Current and future water quality condition in the region.
> - Social and cultural makeup of the regional community.
> - Major water related objectives and conflicts (in Section 4.1 of this Plan).
> - An explanation of how the IRWM regional boundary was determined.
> - Neighboring and/or overlapping IRWM efforts.
>
> - *Proposition 84 & 1E IRWM Guidelines*, November 2012, Pages 19 to 20

2.1.1 Region Boundaries

The need for integrated regional planning in Stanislaus County, and therefore the need for an Integrated Regional Water Management (IRWM) region, is most easily noted visually when viewing DWR's 2010 IRWM Regional Map. At the time, there was a void in IRWM coverage over the Cities of Modesto, Hughson, Turlock, and Ceres, in between the following five IRWM regions: Central California (now referred to as Yosemite-Mariposa), Merced, Eastern San Joaquin, Tuolumne-Stanislaus and Westside-San Joaquin. As with other areas of the Central Valley, water resource conflicts are present as agricultural and urban demands collide, groundwater and surface water resources become impacted, and as the region continues to grow. In response to this current environment, the East Stanislaus Regional Water Management Partnership (ESRWMP) was formed and the East Stanislaus IRWM Region developed, as shown in Figure 2-1, in an effort to create a regional management solution for long-term water resources management.

The East Stanislaus IRWM Region has common boundaries with the Merced, Eastern San Joaquin, Tuolumne-Stanislaus and Westside-San Joaquin IRWM regions, and with some local agency and environmental boundaries. By using the boundaries of neighboring IRWM regions as a starting point, the East Stanislaus Region was formulated to cover an area of California that lacked integrated regional water planning and to avoid major overlaps with neighboring IRWM regions.

Figure 2-1: Boundaries of the East Stanislaus Region



The boundaries of the East Stanislaus IRWM Region result from a combination of IRWM and local jurisdictional boundaries and geographical and environmental considerations, and are as follows:

North Boundary: The north boundary of the East Stanislaus Region is defined by the Stanislaus River, Modesto Groundwater Subbasin, and also a portion of the Stanislaus County border. The boundary also aligns with the Eastern San Joaquin IRWM boundary. Importance was placed on natural water boundaries and not solely political or jurisdictional boundaries. This resulted in the exclusion of north-eastern portion of Stanislaus County. This area was not chosen to be part of the region because it cannot be justified from a watershed perspective. However, the communities in this area are invited to participate in the East Stanislaus Region.

South Boundary: The Merced River, the Turlock Groundwater Subbasin, and the Turlock Irrigation District (TID) boundaries were used to delineate the southern boundary of the East Stanislaus IRWM Region. The southern boundary of the Region is located within the Merced IRWM Region and creates a small overlap. The two IRWM regions have been coordinating during the plan development process and have discussed the overlap during development of each region's boundaries. At present, it has been agreed that each region will address its entire region in the planning process, and as such, the East Stanislaus Region is including its entire region, including the overlap area in the planning efforts currently underway. Should a project be identified in the overlap area or a need arise that further coordination with the Merced Region be required, the

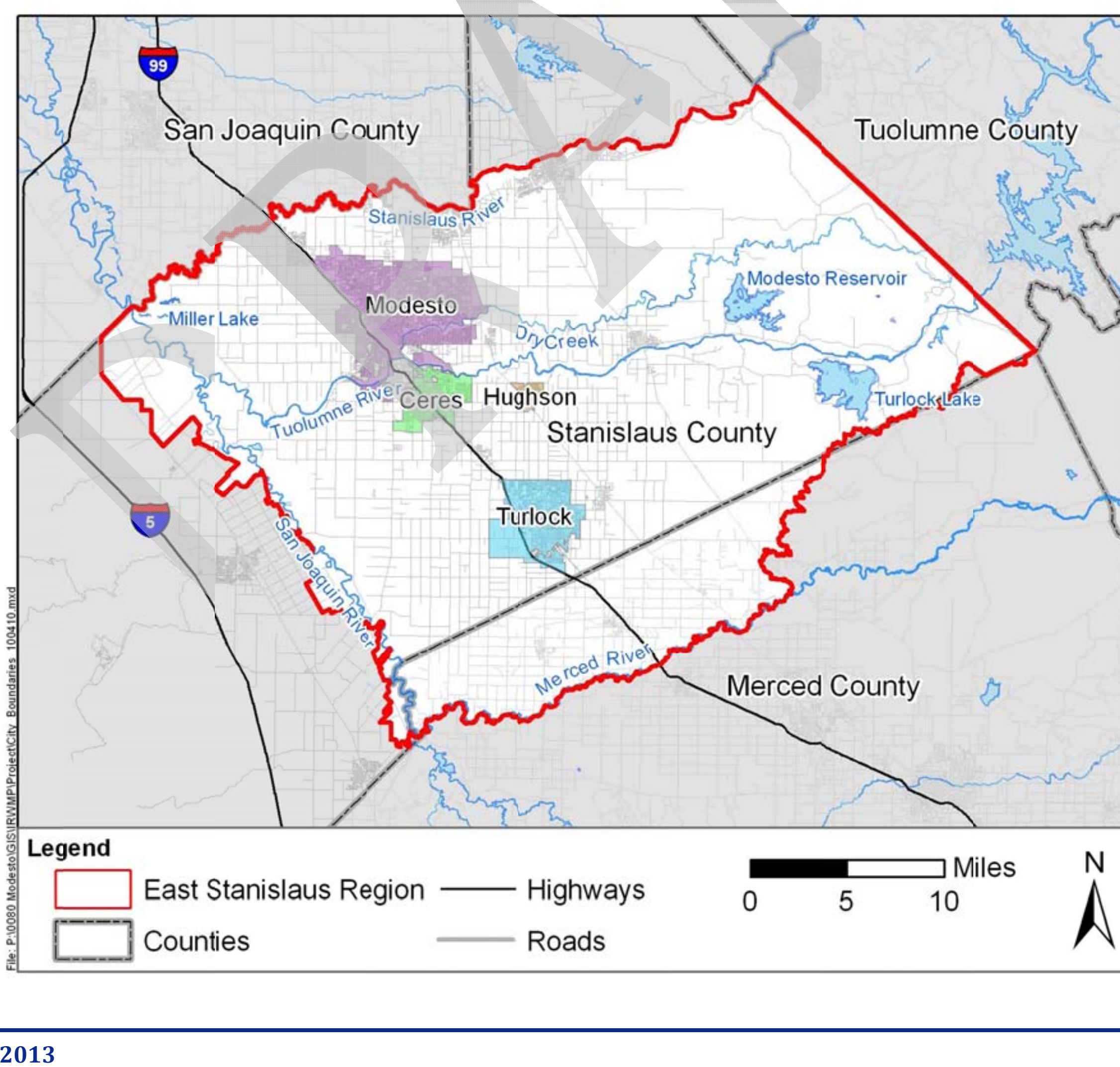
ESRWMP will do so accordingly. Both IRWM regions recognize coordination in this area is required and both are willing to cooperate.

Eastern Boundary: The existing Tuolumne-Stanislaus IRWM Region boundary was used to form the eastern boundary of the East Stanislaus Region. By aligning the region boundary with the neighboring IRWM region's boundary, unnecessary confusion is avoided and inter-regional water management strategies can still be employed. The location of the eastern boundary also ensures that the Turlock and Modesto Groundwater Subbasins are located within the East Stanislaus Region.

Western Boundary: The San Joaquin River and the Westside-San Joaquin IRWM Region boundaries were used for the western boundary of the East Stanislaus region. The western boundary of both the Turlock and Modesto Groundwater Subbasins is the San Joaquin River; therefore the East Stanislaus Region fully encompasses these groundwater subbasins.

The East Stanislaus Region incorporates portions of both Stanislaus and Merced counties. The major cities located within the Region are the Cities of Modesto, Hughson, Turlock, and Ceres, which also comprise the ESRWMP (Figure 2-2); however, all cities within Stanislaus and Merced Counties, as well as neighboring counties, have been, and will continue to be, invited to participate in the IRWM process. The entire East Stanislaus Region is located within Central Valley Regional Water Quality Control Board's jurisdiction.

Figure 2-2: Major Cities Located in the East Stanislaus Region



2.1.2 Climate

The East Stanislaus Region has a Mediterranean climate with hot, dry summers and cool winters, with most of the annual precipitation occurring between November and April. The average annual maximum temperature is 74.6 degrees Fahrenheit (°F), as shown in the following table, but it is not uncommon for summer temperatures to exceed 100°F. Extreme winter lows can reach the teens with the first freeze usually in December and the last in February.

Table 2-1: Average Temperatures and ETo in the East Stanislaus Region

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Monthly Average ETo (in)[a]	0.87	1.71	3.43	5.24	6.70	7.40	7.85	6.75	4.93	3.37	1.66	0.87	50.78
Average Total Precipitation (in)[b]	2.47	2.08	1.91	1.03	0.46	0.12	0.02	0.04	0.18	0.63	1.23	2.06	12.22
Average Max Temperature (°F)[b]	53.8	60.9	67.0	73.3	81.2	88.4	94.3	92.2	87.6	77.9	64.6	54.3	74.6
Average Min Temperature[b]	37.6	40.8	43.5	46.8	51.8	56.6	59.9	58.8	55.9	49.5	41.7	37.7	48.4

a. Data from California Irrigation Management Information System (CIMIS) Station#71.
b. Data from Western Regional Climate Center for Modesto, CA. Period of record is March 1, 1906 to July 31, 2010.

2.1.3 Watersheds and Water Systems

Watersheds

Within the Central Valley, three major watersheds were delineated – the Sacramento River Basin, the San Joaquin River Basin, and the Tulare Lake Basin. The East Stanislaus Region is within the San Joaquin River Basin, which is bound by the crest of the Sierra Nevada on the east and the Klamath Mountains on the west. The San Joaquin River Basin covers about 15,880 square miles and includes the San Joaquin River and its larger tributaries – the Cosumnes, Mokelumne, Calaveras Stanislaus, Tuolumne, Merced, Chowchilla, and Fresno Rivers. The San Joaquin River Basin can be further divided into other watersheds and sub-watersheds (CVRWQCB, 2004). The Merced, Stanislaus and Tuolumne River watersheds are three watersheds within the San Joaquin River Basin and these are the primary surface water watersheds that drain to the Middle San Joaquin-Lower Merced-Lower Stanislaus Watershed in which the East Stanislaus region is almost entirely located (Figure 2-3). The Merced, Tuolumne, and Merced Rivers are approximately 145, 149, and 96 miles long, respectively. Table 2-2 summarizes the key characteristics of the four rivers in the East Stanislaus Region.

Figure 2-3: Watersheds Within and Around the East Stanislaus Region

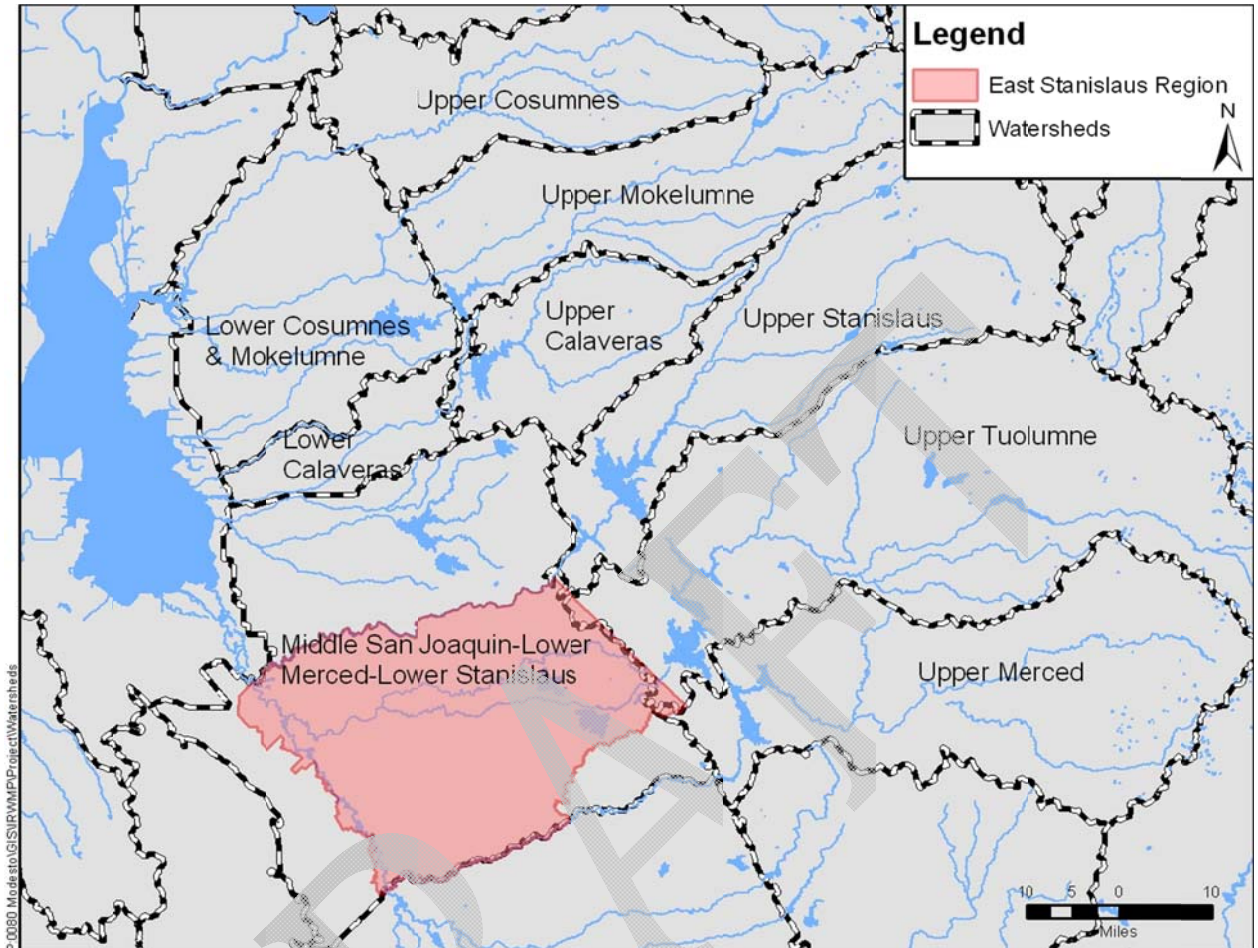


Table 2-2: Watershed and Reservoir Characteristics in the San Joaquin River Basin

Characteristic	Lower San Joaquin River			Upper San Joaquin River
	Stanislaus River	Tuolumne River	Merced River	
Median Annual Unimpaired Flow (1923-2008)	1.08 MAF	1.72 MAF	0.85 MAF	1.44 MAF (upstream of Friant Dam)
Drainage Area of Tributary at Confluence with San Joaquin (and percent of tributary upstream of mouth)[1]	1.195 square miles (82% upstream of Goodwin)	1.870 square miles (82% upstream of LaGrange)	1.270 square miles (84% upstream of Merced Falls)	1.675 square miles (100% upstream of Friant Dam)
Total River Length	161 miles	155 miles	135 miles	330 miles
Miles Downstream of Major Dam	New Melones: 62 miles Goodwin: 59 miles	New Don Pedro: 55 miles LaGrange: 52 miles	New Exchequer: 63 miles Crocker-Huffman: 52 miles	Friant: 266 miles
Confluence with LSJR River Miles (RM) Upstream of Sacramento River Confluence	RM 75	RM 83	RM 118	RM 266
Number of Dams	28 DSOD[a]	27 DSOD	8 DSOD	19 DSOD
Total Reservoir Storage	2.85 MAF	2.94 MAF	1.04 MAF	1.15 MAF
Most Downstream Dam (with year built and capacity)	Goodwin, 59 miles upstream of SJR (1912, 500 AF)	LaGrange, 52 miles upstream of LSJR (1893, 500 AF)	Crocker-Huffman, 52 miles upstream of LSJR (1910, 200 AF)	Friant, 260 miles upstream of the Merced confluence (1942, 520 TAF)
Major Downstream Dams (with year built and reservoir capacity)	New Melones (1978, 2.4 MAF) Tulloch, Beardsley, Donnells "Tri-dams project" (1958, 203 TAF)	New Don Pedro (1971, 2.03 MAF)	New Exchequer (1967, 1.02 MAF) McSwain (1966, 9.7 TAF)	Friant (1942, 520 TAF)
Major Upstream Dams (with year built and reservoir capacity)	New Spicer Meadows (1988, 189 TAF)	Hetch Hetchy (1923, 360 TAF) Cherry Valley (1956, 273 TAF)	None	Shaver Lake (1927, 135 TAF) Thomas Edison Lake (1965, 125 TAF) Mammoth Pool (1960, 123 TAF)

Source: *Evaluation of San Joaquin River Flow and Southern Delta Water Quality Objectives and Implementation*, ICF, December 2012.
a. DSOD dams are those greater than 50 ft. in height and/or greater than 50 AF in capacity, with some exceptions.
MAF – million acre-feet
RM – river mile
DSOD – Division of Safety of Dams
AF – acre-feet
TAF – thousand acre-feet

San Joaquin River

The San Joaquin River Basin covers approximately 32,000 square miles in the northern part of the San Joaquin Valley, roughly from Fresno to Stockton (San Joaquin River Group Authority, 1999). The San Joaquin River is 330 miles in length, from its headwaters to its confluence with the Sacramento River. The portion of the river in the East Stanislaus Region is located north along the western edge of the Region. The primary sources of surface water to the basin are rivers that drain the western slope of the Sierra Nevada Range. Each of these rivers (the San Joaquin, Merced, Tuolumne, Stanislaus, Calaveras, Mokelumne and Cosumnes Rivers) drains large areas of high elevation watershed that supply snowmelt runoff during the late spring and early summer months. Historically, peak flows occurred in May and June, and flooding occurred in most years along all the major rivers. However, construction and operation of the numerous water supply, hydroelectric, and flood control efforts during the 20th century have modified the historic flows (San Joaquin River Group Authority, 1999).

The Lower San Joaquin River is defined as the river's confluence with the Merced River, north to the Delta. This stretch of the river is characterized by the combination of flows from tributary streams, major rivers, groundwater accretions and agricultural drainage water (San Joaquin River Group Authority, 1999).

Overall, the San Joaquin River is the second longest river in California, and habitats along the river have been heavily affected by the river's control upstream at Friant Dam and by adjacent land uses. One primary river habitat within the East Stanislaus Region is the San Joaquin River National Wildlife Refuge (SJRNWR). The Refuge is located west of Modesto, within the historic floodplain of the confluences of the San Joaquin, Stanislaus, and Tuolumne Rivers. The Refuge was established in 1987 because of the importance of the area as habitat for the Aleutian Canada goose. Refuge lands consist of oak-cottonwood-willow riparian forest, pastures, agricultural fields, and wetlands, with habitats for a diversity of wildlife including numerous special species such as Swainson's hawks, herons and cormorants, and the endangered riparian brush rabbits. The Refuge presently encompasses more than 6,500 acres; expansion of the refuge is currently consideration with expansions to the north, south and east along the San Joaquin River, Stanislaus River and Tuolumne River corridors.

In December 2012, the SWRCB issued a Draft Substitute Environmental Document (SED) in Support of Potential Changes to the Water Quality Control Plan for the Bay-Delta: San Joaquin River Flows and Southern Delta Water Quality. The preferred alternative identified in the SED called for 35 percent unimpaired flows from February through June within the Merced, Tuolumne and Stanislaus Rivers to support spring fish populations. This proposed action has the potential to significantly change water management on all three rivers, restricting water purveyors' ability to divert surface water and conjunctively manage the rivers and their underlying groundwater subbasins. Additionally, the proposed action has the potential to negatively impact fall-run Chinook as the changes will likely lead to increased temperatures of releases from reservoirs

Stanislaus River

The Stanislaus River watershed is approximately 578,000 acres, located in the central Sierra Nevada, and is one of the largest tributaries to the San Joaquin River in the Central Valley. Snowmelt runoff contributes the largest portion of the flows in the Stanislaus River, with the highest monthly flows in May and June (San Joaquin River Group Authority, 1999). Within the Stanislaus River watershed, there are 18 dams and 10 powerhouses. The lower Stanislaus River also has 16 parks or river access areas. There are 11 riverside parks between Knight's Ferry and the confluence with the San Joaquin River that are managed by the U.S. Army Corps of Engineers. The parks provide camping, fishing, and boating access to the River. The Stanislaus River at Highway 99 and downstream includes Caswell Memorial State Park, as well as smaller parks such as Modesto's Oak Grove Park. The Army Corps of Engineers developed a plan for a series of access parks along the Stanislaus River called the "String of Pearls" (ESA, 2013).

Flow control in the lower Stanislaus River is provided by the New Melones Reservoir, which has a capacity of 2.4 million acre-feet (AF) and is operated by the Bureau of Reclamation (USBR). Releases from New Melones Reservoir are re-regulated downstream at Tulloch Reservoir. The main water diversion point on the Stanislaus River is Goodwin Dam, which provides deliveries to Oakdale Irrigation District and the South San Joaquin Irrigation District in San Joaquin County. Goodwin Dam is also used to divert water into the Goodwin Tunnel for deliveries to Central San Joaquin Water Conservation District and the Stockton East Water District, also in San Joaquin County (San Joaquin River Group Authority, 1999).

The major habitat type along the lower Stanislaus River is valley foothill riparian, primarily bordering the river. This habitat is characterized by a canopy layer of cottonwoods, California sycamores and valley oaks. Annual grassland is also found in this area, within reach of the river. This habitat is characterized as an open habitat dominated by annual grasses. The California Department of Fish and Wildlife conducted surveys along 59 miles of the Stanislaus River from the confluence with San Joaquin River upstream to Goodwin Dam. Some of the identified species of concern in the watershed include fall-run Chinook salmon (species of concern), steelhead trout (threatened), California tiger salamander, California red-legged frog, riparian brush rabbit, and riparian woodrat (California Department of Fish and Wildlife, 1995).

Tuolumne River

The headwaters of the Tuolumne River begin in Yosemite National Park in the Sierra Nevada at an elevation of about 13,000 feet. The Tuolumne River's two primary sources begin on Mount Dana and Mount Lyell, the tallest peak in the Park. The Dana and Lyell tributaries meet at the eastern edge of Tuolumne Meadows forming the Tuolumne River. From Tuolumne Meadows, the river descends 4,000 feet to the Hetch Hetchy Reservoir. Other creeks also enter Hetch Hetchy Reservoir, including Return, Paiute, Rancheria, and Falls Creeks above the O'Shaughnessy Dam. At the dam, approximately 33% of the river's flow is diverted through Canyon Tunnel, and ultimately to the San Francisco Bay Area, where it provides water to nearly 2.5 million people. Below O'Shaughnessy Dam, the Tuolumne River exits Yosemite National Park and enters the Stanislaus National Forest. Between Kirkwood Powerhouse and Don Pedro Reservoir, the Tuolumne River is known for its world-class whitewater rapids for recreation. The various reaches of the Tuolumne River are described below:

- The Middle Tuolumne River begins at an elevation between 7,000 and 8,000 feet inside Yosemite National Park and joins the South Fork of the Tuolumne River outside the Park.
- The South Fork of the Tuolumne River's headwaters is between White Wolf and Yosemite Valley, at an elevation of about 8,000 feet. The South Fork exits the park slightly north of Hodgdon Meadow and upstream of its confluence with the main Tuolumne River.
- The North Fork of the Tuolumne River begins near Dodge Ridge, south of Highway 108 in Stanislaus National Forest. It joins the Tuolumne River above Don Pedro Reservoir.
- Dry Creek is the largest tributary to the Tuolumne River, beginning north of La Grange and entering Tuolumne River in the City of Modesto.

Flows in the lower portion of the Tuolumne River are controlled primarily by the operation of New Don Pedro Dam, which was constructed in 1971 jointly by TID and MID with participation by the City and County of San Francisco. The 2.03 million AF reservoir stores water for irrigation, hydroelectric generation, fish and wildlife enhancement, recreation, and flood control purposes.

The districts divert water to the Modesto Main Canal and the TID Main Canal a short distance downstream from New Don Pedro Dam at La Grange Dam (San Joaquin River Group Authority, 1999).

The Tuolumne watershed has an area of approximately 980,000 acres and provides wildlife habitat supporting many species of wildlife, including bald eagles, spotted owls, prairie falcons, and trout. The lower Tuolumne River is a site to which thousands of Chinook salmon return every fall to spawn. Within the Tuolumne River itself, a diverse assortment of animals seek food, water and shelter, including many special-status species. Some of these species include fall-run Chinook salmon (species of concern), steelhead trout (threatened), Riparian Brush Rabbit (endangered), Riparian Wood Rat (endangered), Valley Elderberry Longhorn Beetle (threatened), Least Bell's Vireo (threatened), and Swainson's Hawk (species of concern) (Tuolumne River Trust, 2009).

The Tuolumne River Regional Park (TRRP), near Highway 99 and the cities of Modesto and Ceres, is being developed by the two cities and Stanislaus County. It is being developed on 500 acres of public land along seven miles of the Tuolumne River in a series of separate parks. Upon completion, it will include 150 acres of park lands, pedestrians/bike trails, and over 350 acres of land designated for riparian habitat conservation and restoration. Five of the parks have been fully or partially developed to date, and one more will be completed in the future. Other river-oriented County parks are also located along the Tuolumne River (e.g. Riverdale Park). The Tuolumne River Trust has an active Lower Tuolumne River Parkway initiative, working with a larger coalition of interests to accomplish an array of goals (ESA, 2013).

<u>Merced River</u>

The Merced River watershed is also located in the central Sierra Nevada with its upper reaches in Yosemite National park. The watershed encompasses about 663,000 acres from its headwaters near Triple Divide Peak to a major hydroelectric project at the New Exchequer Dam that impounds 1 million AF at Lake McClure. Releases from Lake McClure pass through a series of power plants and small diversions, and are re-regulated at McSwain Reservoir. Below McSwain Dam, water is diverted to Merced Irrigation District at the Pacific Gas and Electric Company (PG&E) Merced Falls Dam and further downstream at the Crocker Huffman Dam (San Joaquin River Group Authority, 1999).

A large portion of the Merced River watershed lies within Yosemite National Park, while another large portion falls under National Forests and Bureau of Land Management jurisdiction. Much of the watershed is considered alpine climate; the upper portion receives heavy snowfall during winter months which is usually enough to feed the Merced River and its tributaries the remainder of the year. The middle and lower portions of the watershed are considered to have Mediterranean or semi-desert climates. Like the Tuolumne River, the Merced River provides habitat to many wildlife species. A study was conducted in 2006 which identified 37 species of fish, 127 bird species, and 140 insect and invertebrate species within the Merced River watershed. Of the 37 species of fish, 26 species were found in the lower Central Valley portion of the river. The Chinook salmon, Pacific lamprey, and striped bass are three anadromous fish species found in the lower Merced River.

Water Systems

The interior of the East Stanislaus Region includes Dry Creek, the Merced, San Joaquin, Stanislaus, and Tuolumne Rivers, as well as Modesto Reservoir and Turlock Lake. The Region overlies the San Joaquin Valley Groundwater Basin, which is divided into nine subbasins including the Turlock, Modesto and Delta-Mendota Subbasins. The Region overlies the entire Turlock and Modesto

Groundwater Subbasins, as shown in Figure 2-4, and also includes a portion of the Delta-Mendota Groundwater Subbasin. Percolation of water used for irrigation on lands overlying the groundwater subbasins is the largest inflow to the groundwater subbasins and provides an important role in maintaining groundwater storage and sustaining recharge. Additional information about the Turlock and Modesto Groundwater Subbasins is included in Section 2.2.1, below.

The East Stanislaus Region encompasses the service areas of multiple local agencies and maximizes opportunities for integrated water management activities. The four ESRWMP members have jurisdiction over water supply and quality, wastewater, recycled water, stormwater, and watershed/habitat in their respective service areas. The other entities that have water management responsibilities within the Region include other cities and communities, irrigation and water districts, and Stanislaus and Merced Counties. Other (non-ESRWMP) local agencies within the Region include:

- City of Riverbank
- City of Waterford
- City of Oakdale
- Keyes Community Services District
- Denair Community Services District
- Community of Del Rio
- Community of Grayson
- Community of Hickman
- Community of Empire
- Community of Riverdale
- Turlock Irrigation District (TID)
- Modesto Irrigation District (MID)
- Eastside Water District
- Oakdale Irrigation District (OID)
- Merced Irrigation District
- Ballico-Cortez Water District
- Delhi County Water District
- Hilmar County Water District
- Stanislaus County
- Merced County
- Monterey Park Tract CSD

Figure 2-5 shows the locations of the primary water services areas within the East Stanislaus Region. Water system facilities in the Region are summarized in Table 2-3. Because critical groundwater basins, surface water supplies, habitat features and the agencies managing these resources are all located within the East Stanislaus Region, water supply reliability, water quality, environmental and flood protection can be effectively integrated through the development of the East Stanislaus IRWM Plan.

Figure 2-4: Surface Water and Groundwater Features in and adjacent to the East Stanislaus Region

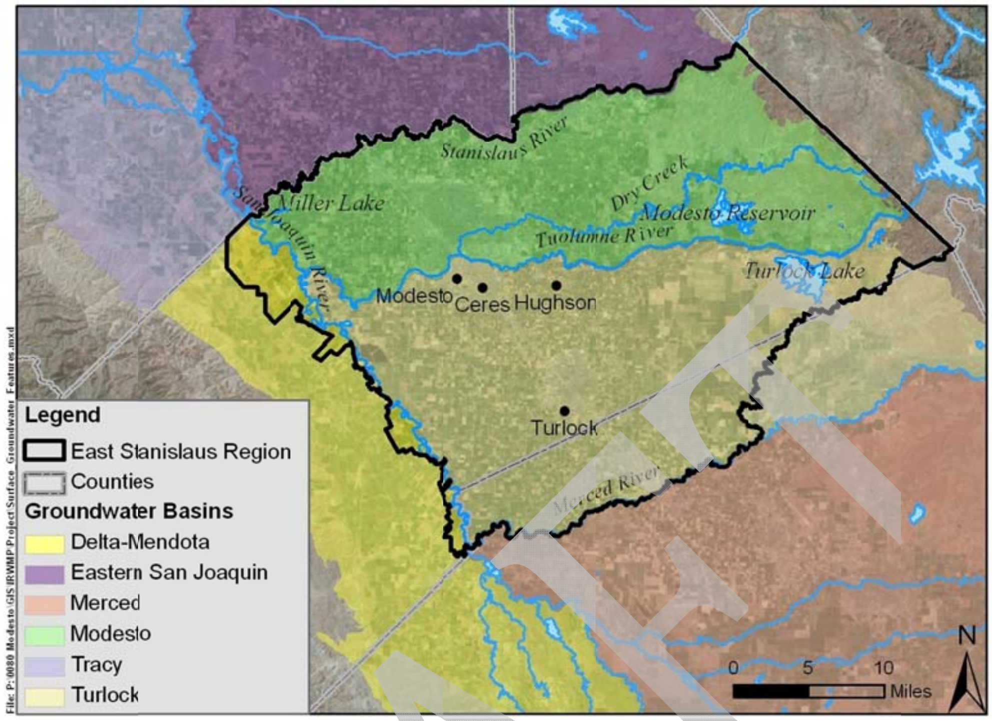
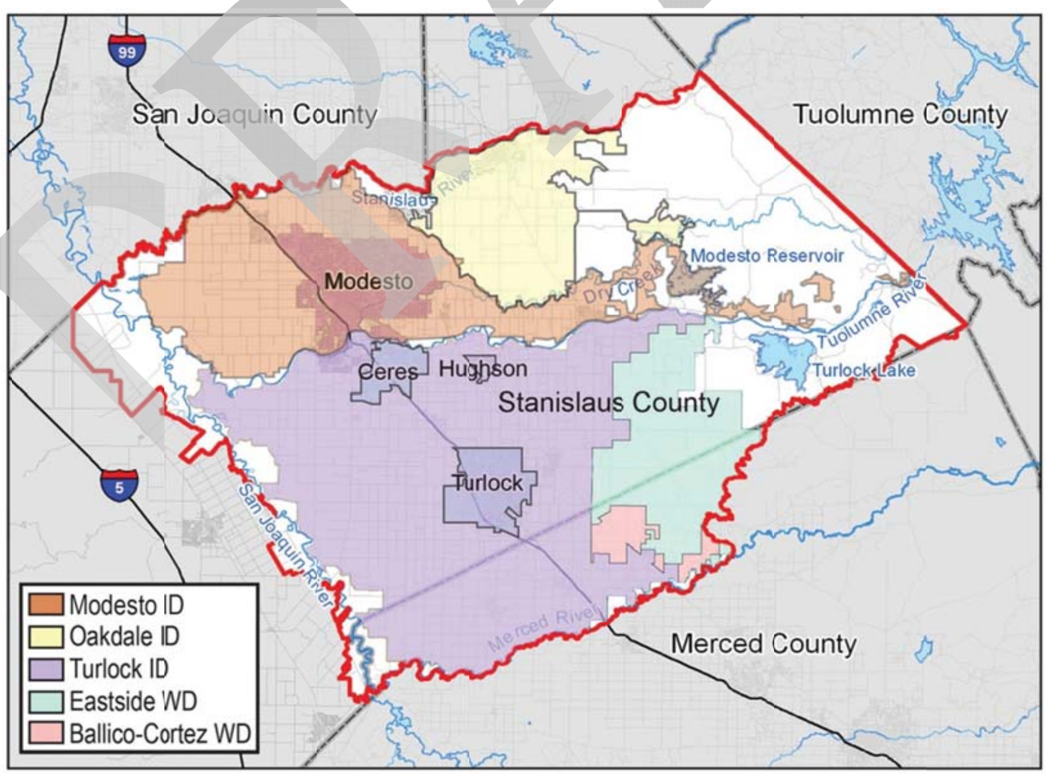


Figure 2-5: Primary Water Services Areas in the East Stanislaus Region



The water system facilities owned and operated by the ESRWMP entities are summarized in the following table. Additional facilities (such as groundwater wells) are owned by other regional stakeholders such as the irrigation districts and community services districts.

Table 2-3: Major Water System Facilities in East Stanislaus Region

Water System Facility	Owner	Description
Modesto Reservoir	MID and Stanislaus County	A raw water reservoir completed in 1911 that is owned and operated by MID. It has a gross capacity of 28,000 acre-feet (AF) and serves as a regulating reservoir for irrigation and domestic water. It is also a recreational area operated by Stanislaus County.
New Don Pedro Reservoir	MID & TID	A raw water reservoir located 4 miles northeast of La Grange in the Sierra Nevada foothills, completed in 1971, and owned and operated by MID and TID. It provides recreation, water storage, power production for MID and TID, and flood control for the Army Corps of Engineers. It has a capacity of 2.03 million AF.
Modesto Regional Water Treatment Plant (MRWTP)	MID	The MRWTP and associated storage/delivery facilities were completed in 1995. It treats Tuolumne River water from MID's Modesto Reservoir, which is then conveyed to the City of Modesto's service area for use. Since 1995, it has provided the City of Modesto 30 million gallons per day (mgd) of treated water. Phase 2, to expand the plant by an additional 30 mgd, is under construction and anticipated to be completed in 2015.
La Grange Dam	MID & TID	The La Grange Dam diverts water for MID and TID. It was completed in 1894.

Water System Facility	Owner	Description
Groundwater wells	Cities of Modesto, Turlock, Ceres, Hughson, Oakdale;	The City of Modesto has 110 groundwater wells located throughout its entire water service area with a total production capacity of 110 mgd. The wells are located in the Modesto, Turlock, and Delta-Mendota subbasins of the San Joaquin Valley Groundwater Basin. The City of Turlock operates 24 active potable groundwater wells and a handful of non-potable wells used for irrigating landscape in City parks. The City of Ceres pumps groundwater from 15 active municipal supply wells which obtain water from the Turlock Subbasin, part of the San Joaquin Valley Groundwater Basin. The wells can produce a total of 14,500 gallons per minute (gpm), but the current firm groundwater pumping capacity is 12,700 gpm. The City of Ceres also has 3 inactive wells that are out of service due to water quality concerns. The City of Hughson's water supply source is derived from five groundwater wells scattered throughout the City. Each well has a capacity ranging from 1,000 to 1,200 gpm. The City of Oakdale operates seven deep groundwater supply wells while the City of Riverbank currently operates 10 municipal supply wells.
Transmission and Distribution Pipelines	Cities of Modesto, Turlock, Ceres and Hughson	The City of Modesto's contiguous water service area has about 940 miles of pipelines. A portion of the transmission pipelines within the City is owned by MID. The City of Turlock maintains over 270 miles of water lines to deliver water to users (17,382 water connections to its potable water system) in a single pressure zone. The City of Ceres' water distribution system consists of a single pressure zone with approximately 140 miles of water pipelines. The City of Hughson conveys water from the wells to consumers via the distribution system that has pipe sizes ranging from 2- to 16-inches in diameter. The City of Riverbank conveys water from the wells to its users via a 44 mile distribution system with pipe sizes ranging from 4 to 12 inches in diameter.

Water System Facility	Owner	Description
Storage Tanks	Cities of Modesto, Turlock, Ceres and Hughson	The City of Modesto has 8 at-grade storage tanks with a combined total storage capacity of 12.1 million gallons (MG). Each storage tank has a booster pump station to pump water from the tank to the distribution system. There are also two 5 MG MRWTP reservoirs that MID owns. The only outlying portion of the City of Modesto's service area that has a storage tank (0.22 MG capacity) is Grayson. The City of Turlock has two at grade reservoirs each with a capacity of one million gallons. East reservoir has a booster pump station to pump water to the water distribution system. A third at grade, one million gallon reservoir will be constructed in 2013. The City of Ceres has two at-grade reservoirs with a combined storage capacity of 3.5 MG. The reservoirs have a booster pump station to pump water to the water distribution system. The City of Hughson has a storage reservoir within the distribution system with a capacity of 750,000 gallons. The City of Riverbank maintains two above-grade reservoirs with a combined storage capacity of 2 MG. The City of Oakdale currently maintains one 0.5 MG reservoir but is planning the addition of a second, 0.6 MG tank.

Notes:
MID – Modesto Irrigation District
TID – Turlock Irrigation District

2.1.4 Wastewater and Recycled Water

Each of the four ESRWMP partner cities (Modesto, Turlock, Ceres, and Hughson) operates a wastewater treatment plant or plants, providing services to their respective service areas. Additionally, the Salida Sanitary District operates a wastewater treatment plant and provides wastewater collection, treatment, and disposal for the unincorporated community of Salida. The influent is currently one half of the plant design capacity (1.2 mgd of 2.4 mgd capacity).

The City of Turlock produces tertiary-treated recycled water, and the City of Modesto recently upgraded its secondary plant to tertiary treatment and is now also producing recycled water. The Cities of Hughson and Ceres treat wastewater to secondary standards and therefore do not produce recycled water meeting Title 22 standards for unrestricted reuse.

Recycled water is recognized as a beneficial water supply due to its many advantages – adding a reliable water source that is consistently available regardless of droughts or climate change, offsetting potable water for other uses, and diversifying agencies' and cities' water supply portfolios. Three of the four members of the ESRWMP have historically worked together to identify regional opportunities for wastewater treatment and recycled water production. An example of a recent cooperative project under consideration is the North Valley Regional Recycled Water

Program (NVRRWP), an effort to regionalize recycled water use in Stanislaus County. As presently envisioned, the NVRRWP could produce and deliver up to 30,600 acre-feet per year (AFY) of disinfected tertiary treated recycled water to western Stanislaus County by 2018. By 2045, NVRRWP could deliver up to 59,900 AFY of recycled water. The source of recycled water includes treated wastewater from the Cities of Turlock, Ceres, and Modesto. As part of the project, the City of Turlock would install an additional 5.7 miles of conveyance pipeline to convey water directly from its Regional Water Quality Control Facility's tertiary treatment plant to the Delta-Mendota Canal (DMC). The Canal would be used to convey the blended canal-recycled water to users in the west side of the County (City of Turlock, 2011). Funding from the USBR has been pursued for completion of feasibility studies related to the NVRRWP; however, no funding has been secured to date. Information regarding the NVRRWP can be found on the project website at http://www.nvr-recycledwater.org/.

City of Modesto

Treatment of the City of Modesto's raw wastewater occurs at the Sutter Avenue Primary Treatment Plant and Jennings Road Treatment Plant, located on two sites with the City of Modesto. The Sutter Avenue Primary Treatment Plant provides pumping, screening, grit removal, flow measurement, primary clarification and sludge digestion. The primary effluent is then conveyed to the secondary treatment plant, the Jennings Road Treatment Plant, where it is treated further and either discharged or stored until it can be discharged. The City currently disposes of the secondary treated effluent in two ways: through irrigation to land that it owns (namely, a 2,526 acre ranch), and through seasonal discharge to the San Joaquin River, both of which are pursuant to National Pollutant Discharge Elimination System (NPDES) Permit No. CA0079103. The Jennings Road Treatment Plant has recently been upgraded to a tertiary treatment system with the implementation of Phase 1A of its Tertiary Treatment Project, providing up to 2.3 mgd of tertiary-treated water. Phase 2 of the project is currently under construction and will add 12.6 mgd of tertiary treatment, allowing for compliance with the City's NPDES Permit and permitting year-round discharge to the San Joaquin River.

Solids handling at the Jennings Road Treatment Plant was analyzed in the *2008 Wastewater Treatment Master Plan Update* (Carollo, 2007e). The biological nutrient removal (BNR)/tertiary facilities constructed during Phase 1A produce waste activated sludge (WAS) that needs to be properly disposed of. The alternative to process the WAS in the recirculation channel and ponds was determined to be the most economical approach in the *Wastewater Treatment Master Plan Update*. It also has low energy requirements and does not require WAS thickening. The dried solids are then beneficially applied to the City's ranch lands (Carollo, 2008).

Historically, about 20 mgd of cannery wastewater with high concentrations of organic vegetable solids were sent to the primary treatment plant, causing the treatment plant to operate inefficiently. To address this problem, in the late 1990's, the Cannery Segregation Project was implemented such that now, up to 40 mgd of wastewater from seasonal canneries is segregated and bypasses treatment. These cannery discharges are applied directly to city-owned ranchlands as a soil supplement.

Current and projected wastewater flows for the City of Modesto are presented in Table 2-4. The wastewater treatment plants serve the City's sanitary service area and a small portion of Ceres, as described later in this section.

Table 2-4: City of Modesto Wastewater and Treatment, AFY

	2005	2010	2015	2020	2025	2030	2035
Wastewater Collected and Treated [a]	29,100	27,100	28,900	32,500	36,400	40,300	44,400

Source: West Yost, 2011b.

a. Wastewater collected and treated is equivalent to recycled water produced and available for beneficial reuse.

The City analyzed opportunities to reuse the tertiary recycled water with the completion of a feasibility study in 2005. The feasibility study assessed recycled water markets, reviewed regulatory requirements, and developed and evaluated alternatives for regional water recycling and wastewater treatment. As part of the study, stakeholder workshops were conducted to discuss and gain input on the recycled water opportunities. Seventeen local communities and agencies were invited to participate in the workshops and nine cities and agencies participated. This work has been refined, and the City is currently considering supplying tertiary treated recycled water to Del Puerto Water District (DPWD), as well as other potential users in western Stanislaus County, with the implementation of the NVRRWP. Although the NVRRWP would not provide a potable water offset directly to the City of Modesto service area, the treated wastewater would be used beneficially and would provide water supply reliability, public safety, enhanced property values and increased educational opportunities (West Yost Associates, 2011b).

City of Turlock

In 2006, the City of Turlock's Regional Water Quality Control Facility (WQCF) was upgraded to tertiary treatment, producing recycled water compliant with Title 22 requirements for unrestricted reuse. All existing and future treated wastewater flows will be treated to recycled water standards, potentially available for beneficial reuse. Table 2-5 presents the wastewater collected and treated in the City's service area. The City is currently permitted to use the recycled water for industrial cooling (2 mgd) and landscape irrigation at Pedretti Baseball Park (up to 20 MG/year) as part of the City's Recycled Water Program, which was approved by the California Department of Public Health (CDPH) in 2006. The recycled water for industrial cooling is delivered to Turlock Irrigation District for use at the Walnut Energy Center, a 250 megawatt (MW) natural gas power plant located in Turlock.

Table 2-5: City of Turlock Wastewater Collection and Treatment, AFY

	2005	2010	2015	2020	2025	2030	2035
Wastewater Collected and Treated[a]	14,482	12,935	14,636	16,557	18,733	21,194	23,980

Source: City of Turlock, 2011.

a. Wastewater collected and treated is equivalent to recycled water produced and available for beneficial reuse.

The City of Turlock currently discharges recycled water that is not used to the San Joaquin River via the Harding Drain, a man-made agricultural drain. The City plans to build a pipeline as part of the NVRRWP that will bypass Harding Drain to allow for recycled water delivery to DPWD, who provides irrigation water to about 11,000 acres of farmland in western Stanislaus County. The City's 2010 Urban Water Management Plan (UWMP) Update assumes the City would begin selling 4,000 MG/year of recycled water to DPWD in 2020. The City will continue to use 400 MG/year of recycled in its service area.

In the City's 2005 UWMP, the City predicted using a larger volume of recycled water in its service area than amounts actually delivered. Multiple factors explain why the use of recycled water has not met the previous projections:

- Regulatory Approval - the approval process required approval from three separate State agencies (State Water Resources Control Board (SWRCB), Regional Water Quality Control Board (RWQCB), and CDPH).
- Water Quality Requirements - at first, the newly constructed tertiary treatment processes at the City's WQCF did not meet all water quality standards required for recycled water use. The City has since modified the treatment processes to gain compliance.
- Infrastructure Construction - implementation and construction of a recycled water distribution system has taken longer than anticipated.
- Economic Downturn - the overall economic decline limited customer growth and dampened demand for recycled water.

In 2010, the City worked with ECO:LOGIC to complete a recycled water pricing analysis and develop a price for recycled water that would provide significant incentive to industrial customers to switch to recycled water. The cost of recycled water is cheaper than potable water, but the City lacks the necessary recycled water distribution facilities, and customers that are further from the one existing recycled water distribution line are faced with significant construction costs to extend recycled water distribution lines. The expansion of a recycled water distribution system within the City would allow for more recycled water use and potable water offsets (City of Turlock, 2011).

City of Ceres

The City of Ceres does not currently produce or deliver recycled water, but in recent years, it has evaluated the potential to develop recycled water to offset potable water use and assist with wastewater disposal. Presently, the City collects and treats wastewater for customers within city boundaries, except the northwest portion of the city. The City manages collection in the northwest portion of the city, but currently exports about 1.3 mgd of wastewater to the City of Modesto's trunk sewer system. The City also exports a significant portion of its treated wastewater from its wastewater treatment plant (WWTP) to the City of Turlock's WQCF.

The City of Ceres Wastewater Treatment Plant has been at its existing location since before 1970, and treats 3.1 mgd of wastewater on average. No treated wastewater is discharged to a surface water body; instead, treated effluent is either discharged into on-site ponds for evaporation and incidental groundwater recharge (up to 2.5 mgd) or exported to the Cities of Turlock or Modesto (up to 1 mgd to each location). Wastewater treatment and disposal at the City's WWTP is regulated by Waste Discharge Requirements (WDRs) Order no. 93-237. Current and projected wastewater flows are presented in Table 2-6 (West Yost Associates, 2011a).

Table 2-6: City of Ceres Wastewater Collection and Treatment, AFY

	2010	2015	2020	2025	2030	2035
Wastewater Collected and Treated	4,800	5,800	6,700	7,700	8,600	9,600

Source: West Yost, 2011a.

The City's wastewater flow projections, as shown in Table 2-6, exceed currently available disposal capacity, so the City has explored disposal options. Tertiary treatment and water recycling is currently not being considered due to significantly higher costs than other disposal options resulting from required upgrades. (Areas that could potentially use recycled water in the City's service area have been identified, but it was determined not to be cost effective to add tertiary treatment and install dual piping.) Other disposal options include increased exports to the City of Turlock and increased exports to the City of Modesto, both of which will be explored further. The City of Ceres is in the process of buying another 1 mgd of capacity of Turlock's WQCF in order to export up to 2 mgd of its wastewater flows. The Central Valley Regional Water Quality Control

Board (RWQCB) is reluctant to add another discharger to the San Joaquin River. Under current RWQCB policy, regionalization is preferred whenever feasible. Regionalizing the Cities of Modesto and Turlock wastewater treatment facilities would provide greater economies of scale than the City of Ceres constructing its own treatment and/or disposal facilities (West Yost, 2011a).

City of Hughson

The City of Hughson operates the Hughson Wastewater Treatment Plant (WWTP), located adjacent to the Tuolumne River, north of the city. Most of the flows to the WWTP come from residential users except for a creamery owned by the Dairy Farmers of America (DFA) which is permitted specific flows and wastewater characteristics. The City is approximately 70% built out within the City limits, with agricultural land use dominating the areas surrounding the City boundary. The City's original WWTP was constructed in 1947 by the Hughson Sanitary District. The City took over the function of the Sanitary District in 1972, and in 1983, constructed the existing WWTP which began operation in 1986. Over the years, the WWTP has had a number of improvements, at times necessitated by violations issued by the RWQCB and operational issues. In 2003, the City's Hatch Road Pump Station broke down, and the RWQCB issued a Notice of Violation calling for improvements. Although repairs were made, this critical lift station continues to experience more problems. The existing treatment processes at the WWTP include screening, grit removal, denitrification, extended aeration, secondary clarification, and chlorine disinfection, and the effluent is discharged to 10 evaporation and percolation ponds.

In 2004, a *Peer Review and Preliminary Design Report Technical Memorandum* was prepared which noted that the WWTP, as originally designed, was having difficulty meeting plant effluent and groundwater limits as stated in the City's WDR Order No. 5-00-024 and a Notice of Violation was issued in July 2003. More capacity at the plant was also required, so an interim upgrade project was designed and constructed in 2005 and 2006. The WWTP Interim Upgrades Project added two treatment ponds, a pump station and other peripherals. In December 2005, the RWQCB renewed its Notice of Violation for issues that were not addressed by the interim updates to the WWTP. In response to the Notice of Violation, the City prepared its 2007 *Wastewater Treatment Plant Master Plan* to develop an approach to upgrade the WWTP based on projected flows and loadings through the year 2025 while also meeting current and anticipated discharge requirements from the Central Valley RWCQB. The improvements identified in the Master Plan were analyzed in an Environmental Impact Report (EIR), prepared in 2007. The EIR included environmental review of new headworks at the existing WWTP, including course and fine screens, a Parshall flume, and biofilters for odor control, as well as two new trapezoidal oxidation ditches to the west of the plant, two 70-foot diameter secondary clarifiers and three percolation ponds. Other improvements analyzed were a RAS/WAS pump station, two new gravity belt filter presses for dewatering, upgrades to the operations center, and a supervisory control and data acquisition system. Additionally, the Hatch Road influent pump station and associated force main were to be removed and a new 36-inch gravity sewer and influent pump station added. Upon completion of the EIR, the improvements and upgrades were constructed at the City's WWTP. Overall plant capacity was increased from 1 mgd to 1.9 mgd (Quad Knopf, 2007).

Recycled water is not produced at the City's WWTP, as tertiary treatment has not been constructed. Therefore, no recycled water is delivered within City limits.

City of Riverbank

The City of Riverbank owns and operates its own wastewater collection and treatment system. The City's Wastewater Treatment Plant (WWTP) is located north of Riverbank across the Stanislaus River and borders the north side of Jacob Myers Park.

Recycled water is not produced at the City's WWTP, as tertiary treatment has not been constructed. Therefore, no recycled water is delivered within City limits.

City of Oakdale

The City of Oakdale owns and operates its own sewage collection system and Wastewater Treatment Plant (WWTP). The City's WWTP is designed to treat up to 2.4 mgd of domestic and industrial wastewater. The facility uses two aerated lagoons for primary treatment. Effluent from the lagoons flow by gravity to a single secondary clarifier, and treated effluent is discharged to one of 11 evaporation/percolation ponds. At present, the City is looking to upgrade its WWTP to add a second secondary clarifier, a new disinfection facility, and a new or expanded biosolids treatment facility

Recycled water is not produced at the City's WWTP, as tertiary treatment has not been constructed. Therefore, no recycled water is delivered within City limits.

2.1.5 Stormwater and Flooding

Stormwater Management

Flood management consists of flood prevention, response, and recovery, generally provided by flood control infrastructure, operation and maintenance (O&M) of that infrastructure, non-structural flood control such as land use decisions that do not place assets in areas with a high probability of flooding, and providing financial assistance, counseling, and assistance after flood events (ESA, 2013). Storm drainage systems are used to reduce the chance of flooding and to meet regulatory requirements regarding stormwater runoff. A Stormwater Management Plan (SWMP) was prepared for Stanislaus County in 2004. As an operator of a Small Municipal Storm Sewer Systems (MS4) that serves urbanized areas, the County filed a Notice of Intent to participate in the SWRCB General Permit. To comply with State and Federal requirements, also referred to as Phase II Stormwater Requirements, designated MS4s must develop a plan to implement measures to control stormwater quality, develop a 5-year plan for implementation and an associated budget. The SWMP for the County covers the County's unincorporated communities, including Empire, Keyes, Salida, Crow's Landing, Denair, Diablo Grande, Del Rio, Grayson, Hickman, Knight's Ferry, La Grange, Sunset Oaks Estates, Valley Home and Westley, as well as the industrial area known as Beard Tract between Modesto and Empire. The Cities of Modesto, Turlock, Ceres, Hughson, Oakdale, Patterson, and Riverbank are also subject to Phase II Stormwater Requirements. Ceres, Oakdale, Patterson, and Riverbank prepared a joint-Stormwater Management Program in 2003. The Cities of Modesto, Turlock, and Hughson have each prepared individual SWMPs.

In most rural parts of Stanislaus County, stormwater runoff is handled by field percolation or through roadside ditches which then drain to Dry Creek, Tuolumne River, Stanislaus River, or San Joaquin River. While the majority of agricultural lands on the valley floor do not require drainage, there are some lands in the rolling hills to the east which generate runoff. For example, runoff from Mustang Creek and Sand Creek drain to the TID canal system, and runoff from McDonald Creek eventually drains to Turlock Lake where flows are routed through the TID canal system to the river.

There are few storm drain facilities constructed in rural areas. The Beard Tract covers about 5,000 acres and the streets have curb/gutter storm drains that discharge to Tuolumne River. Unincorporated communities in the County typically have constructed storm drain facilities that are owned, operated, and maintained by the County (Stanislaus County, 2004). Some rural systems pump stormwater to the TID canal system which is used to convey runoff to the river system.

In 2008, the City of Modesto prepared Storm Drainage Master Plan (SDMP) to identify major storm drainage infrastructure improvements that are needed or would be needed in the future. The City also prepared a Stormwater Management Plan in August 2009 to comply with Phase II requirements. Historically, the City has used a rockwell system, a positive storm drainage system, or no system. The City's Public Works Department operates and maintains 77 miles of storm drain lines, 21 pump stations, 24 drainage basins, and about 10,500 rockwells. The rockwells are used to percolate stormwater runoff into the ground, but these can lead to groundwater quality concerns. In addition to potentially impacting water quality, the rockwells are expensive to maintain and overall, the City's system is deficient in its ability to drain stormwater runoff and minimize localized flooding in many areas. In some areas of the City, it uses a positive storm drainage conveyance system that discharges to the Tuolumne River, Dry Creek, detention basins, and irrigation facilities owned and operated by MID and TID. Some of these systems are in need of retrofit and repair to properly serve the areas (Stantec, 2008). In the areas of the City of Modesto where there are no permanent storm drain systems, the City uses the sanitary sewer to drain stormwater runoff and reduce flooding. There are a total of 52 storm drain cross-connections, most of which are located in the downtown area. These can cause a dramatic increase in Peak Wet Weather Flow at the City's wastewater treatment plant, so the City is interested in removing the cross-connections from the wastewater collection system (Carollo, 2007f).

In order for the City of Turlock to comply with the Waste Discharge Requirements for Stormwater Discharges from MS4s, in 2003, it prepared a Stormwater Management Plan (SWMP). The City of Turlock owns and operates its own stormwater system that includes 28 active storm lift stations, 66 storm ponds totaling 140 acres, 1,300 stormwater catch basins and 102 miles of storm drain pipe. Stormwater runoff is transferred through storm pipes to a storm basin where it either percolates to the groundwater basin or is pumped to a larger storm basin or canal. Stormwater runoff that reaches the larger storm basin percolates to and recharges the groundwater basin, If excess stormwater is pumped to a canal, it is discharged to the San Joaquin River. To protect water quality, the City of Turlock implements Best Management Practices (BMPs) as required by its MS4 permit (Turlock, 2003). Additionally, the City of Turlock implemented an environmental stewardship program called "Go Green" that has a stormwater pollution prevention component in it, and is also heavily related to water conservation (City of Turlock, 2011).

The City of Hughson provides positive storm drainage for its service area; the system includes pipelines, four stormwater pump stations, rockwells, and detention and retention basins. Stormwater is discharged to TID via three discharge points to its irrigation canal, and the Ceres Main Canal. Currently, stormwater is discharged from the detention basins to the TID canal once a significant portion is in the basin. Most of the stormwater runoff in the City goes through storm basins, while some is discharged directly to the canal. In 2007, the City of Hughson also completed a Storm Drainage Master Plan to help plan, develop, and finance the storm drainage system facilities. The report recommended a number of improvements to the existing system including upsizing many of the pipelines, constructing new pipelines, and constructing a new basin. Overall, the City's storm drainage system is in good condition. The City maintains, cleans and repairs lift stations and pipelines as needed. Some areas within the City have localized flooding problems due to the lack of positive drainage facilities; City crews typically eliminate any storm inlet plugging and street flooding/ponding within a half-day. During a major storm in 1997 (a 170-year storm event) the most significant issue was the high inflow of stormwater runoff into the sanitary sewer system which then caused problems at the wastewater treatment plant (Carollo, 2007b).

In 2003, the Cities of Ceres, Oakdale, Patterson, and Riverbank adopted a Memorandum of Understanding (MOU) to jointly apply for permit compliance. They prepared a Stormwater Management Program that described their positive storm drainage services they provide to their communities. The City of Ceres stormwater system includes 33 detention/retention basins, about 100 rockwells, 33 stormwater pump stations, pipelines, and 27 discharge points to receiving streams and canals. Stormwater is discharged to detention basins for percolation, to TID canals, or the Tuolumne River. Oakdale has 22 detention / retention basins, 8 stormwater pump stations, about 200 rockwells, pipelines, and 9 discharge points to streams and canals. Stormwater is disposed of by percolation, and/or discharged to the Stanislaus River and OID canal. Some of the stormwater is discharged directly to the river, while some enters a stormwater basin prior to discharge. Patterson has 14 detention/retention basins, 5 stormwater pump stations, pipelines, and multiple discharge points to Salado Creek, Patterson Irrigation District canals, and San Joaquin River. There is a portion of Stanislaus County development that discharges to Black Gulch, a tributary to Salado Creek above Patterson's service area. Runoff from the developed County area impacts stream hydrology in Salado Creek through Patterson. Storm drainage master plans were prepared in 1992 and 2001 to address the flooding along Salado Creek and Black Gulch. The study recommended $20 million of improvements to the storm drainage system be constructed. Some of the improvements have been constructed while other improvements have not as they require cooperation from other agencies such as the U.S. Army Corps of Engineers. In the past, Patterson's wastewater treatment plant received infiltration from stormwater runoff during storms, but the City has been eliminating infiltration through infrastructure improvements. Riverbank's storm drainage system consists of pipelines, 6 detention/retention basins, about 100 rockwells, 7 pump stations, and 8 discharge points to Stanislaus River and the MID Main Canal. The Cities of Ceres, Oakdale, Patterson, and Riverbank have a few stormwater quality incidents each year. Dumping of chemicals into storm drains may occur and a few illegal connections of house sewers to storm drains were found, but eliminated. The cities do not conduct routine stormwater quality monitoring and new storm drainage infrastructure will be constructed by developers as the City grows (Tulloch, 2003).

Flooding

During storms, there is occasional flooding in Stanislaus County because of a combination of factors: high groundwater, low percolation soils, and topography (Stanislaus County, 2004). The flood management system in the San Joaquin Valley includes reservoirs to regulate snowmelt from elevations greater than 5,000 feet, bypasses at lower elevations, and levees that line major rivers. Typically, snowmelt floods are more frequent in the San Joaquin Valley than rain floods, but rain floods do occur and generally have higher peak flows than snowmelt floods. The following table shows the discharge-frequency relationships for some of the rivers and creeks in the East Stanislaus Region as described by FEMA (ESA, 2013).

Table 2-7: Discharge Frequency Relationships for Rivers

		Peak Discharges (cubic feet per second)			
Location	Drainage Area (square miles)	10-year	50-year	100-year	500-year
Tuolumne River at Modesto	1,884	10,500	32,000	70,000	154,000
Tuolumne River at Waterford	1,640	9,000	10,000	42,000	225,000
Stanislaus River at Oakdale	1,020	7,600	8,000	8,000	41,300
Dry Creek at Modesto	192.3	4,730	9,300	11,800	18,100

Source: ESA, 2013

The San Joaquin River, upstream of the Tuolumne River and down to the Merced River confluence, has a design capacity of 45,000 cfs, but a current capacity estimated to be 22,000 cfs to 35,000 cfs. Downstream of Tuolumne River to Stanislaus River, the design capacity of the river is 46,000 cfs, while the current capacity is only 25,000 cfs. The lowest reaches of Stanislaus River have a design capacity of 12,000 cfs, but its current capacity is 23,000 cfs. The lowest 0.6 miles of the Tuolumne River have a design capacity of 15,000 cfs; the current capacity is not estimated, but landowners along the river report flood damages when flows exceed 8,200 cfs.

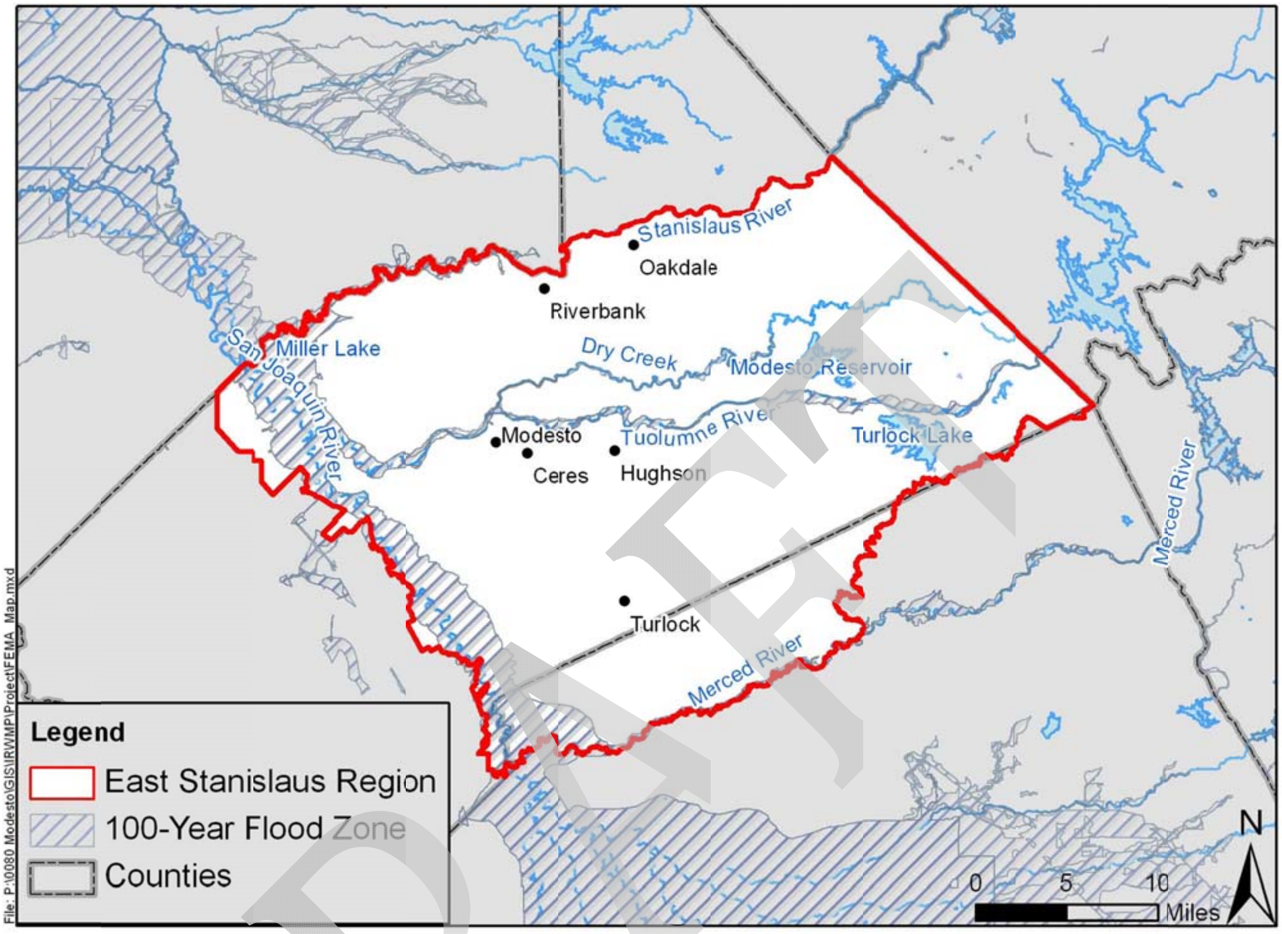
In 1983, four levees broke in the San Joaquin River Basin. One of the levees that broke was within the Mid-San Joaquin River Region, an area generally described as the floodplain corridor extending along the mainstem San Joaquin River, from its confluence with the Merced River to its confluence with the Stanislaus River, and the lower reaches of the Merced, Tuolumne and Stanislaus Rivers that are within the State Plan of Flood Control. This levee break occurred on March 5th of 1983 along the left bank of the San Joaquin River, just downstream of its confluence with the Tuolumne River and along the San Joaquin River National Wildlife Refuge. The break resulted in the inundation of 500 acres, causing $12 million of losses in agricultural damages in Stanislaus County. In 1986, there were a series of storms from February 11th to the 19th in which several precipitation records were set. Precipitation in a 300 mile wide band from San Francisco to Sacramento to Lake Tahoe ranged from 100 to 200% of normal. While this caused flooding and damage, there were no damages sustained in Stanislaus County. (ESA, 2013). Some older areas of Stanislaus County have problems with flooding during storms that exceed ½-inch per hour due to inadequate drainage.

During the 170-year storm of 1997, the County experienced flooding in some areas surrounding Tuolumne River due to the release of excess water from Don Pedro Dam and Reservoir into the Tuolumne River channel. The second wettest December on record in the Sierra Nevada occurred in 1997 which contributed to the flooding. Additionally, there were three tropical storms that hit Northern California on December 29, 30, and 31, 1996. Within three days, more than 30 inches of rain fell in the upper watersheds of the Sierra Nevada. Record flows were a result in the Sacramento and San Joaquin River Basins. In mid-December, a cold storm brought snow to the Sierra Nevada foothills which melted during the three warm storms at the end of December. Approximately 15% of the total runoff volume was from the snowmelt. Millerton Lake and Don Pedro Reservoir both exceed their design capacity. Flooding occurred along the Merced River

Tuolumne River, and San Joaquin River. Areas within Modesto, Ripon, Waterford, and La Grange were inundated. Multiple levees failed on the San Joaquin River, or were breached, leading to further flooding in nearby areas. Flooding did not occur in the Cities of Patterson, Newman or Turlock. Then in 1998, during 35 days of above average rainfall, upland areas of Stanislaus County experience sheet flooding in a number of new subdivisions near saturated rural areas (Stanislaus County, 2004). Some low-lying areas of the lower reaches of the Tuolumne River, some near the confluence with Dry Creek are subject to occasional flooding.

The Federal Emergency Management Agency (FEMA) delineates 100-year floodplains for FEMA Flood Insurance Rate Maps (FIRMs). A majority of the San Joaquin River's 100-year flood plain (in this stretch of the San Joaquin River) is within the Region, but overall, not much of the East Stanislaus Region is described as being within a 100-year floodplain (Figure 2-6). FEMA prepared the approximate floodplain mapping, but did not conduct detailed floodplain analysis. The City of Modesto performed detailed floodplain analyses to map the 100-year floodplain. According to the Stanislaus County Multi-Hazard Mitigation Plan prepared in 2010, an estimated 2,400 people live within the 100-year floodplain of the San Joaquin River within Stanislaus County. The estimated total property value, including private property, in that same area is approximately $150 million. Flood hazards in the region are areas that are naturally flood-prone, along major rivers, and potentially near levees that are in poor condition. The cities of Modesto, Newman, Patterson and the communities of Westley and Grayson are exposed to flood risk during large runoff events. Flooding occurs in Modesto at the confluence of the Tuolumne River and Dry Creek during intense storms and especially when releases from Don Pedro reservoir are high. Agricultural areas along the San Joaquin, Merced, Tuolumne, and Stanislaus Rivers are also exposed to flood risk, as well as lands managed to preserve habitat along the San Joaquin, Tuolumne, and Stanislaus Rivers (ESA, 2013). Some development in the region is planned within the 100-year floodplain, but development will be restricted by the City's floodplain zoning ordinance. If areas within the 100-year floodplain are to be developed, properties are usually constructed on fill (Stantec, 2008).

Figure 2-6: 100-Year Flood Plain Maps for Water Bodies within the East Stanislaus Region



The East Stanislaus Region, as part of its IRWM planning process, is currently participating in the development of a Regional Flood Management Plan for the Mid-San Joaquin Region to identify potential projects that may improve flood management. As part of FloodSAFE California, DWR initiated a comprehensive Statewide Flood Management Planning Program to assess flood risks statewide and inform development of the State's flood management policies and investment decisions over the next 10 to 15 years. DWR prepared the Central Valley Flood Protection Plan (CVFPP) in June 2012, which calls for DWR to work with local flood management agencies to prepare detailed Regional Flood Management Plans that, at a minimum, identify and articulate the following:

- Describe flood management challenges and deficiencies at the regional level including operations and maintenance practices, levee and channel inspection, and emergency response plans.
- Propose potential solutions/projects identified by local public agencies and interest groups for the region, projects' costs, and prioritization of the solutions/projects enhanced operations and maintenance, emergency response, and floodplain management.
- Propose financial strategies that identify benefits of the projects and sources of the funding for implementation of the projects.

The Mid-San Joaquin River Region planning area lies within the East Stanislaus IRWM Region, along its western boundary. Also, because flood concerns related to the San Joaquin River and its tributaries extend beyond the specific area, the geographic extent of the Mid-San Joaquin Region (the area covered in the Mid-San Joaquin River Regional Flood Management Plan) is the Reclamation Districts identified in the Draft Regional Atlas, as well as the Cities of Modesto, Ceres, Turlock, Patterson, and Newman; the communities of Grayson, West Stanislaus, and El Solyo; Del Puerto Water District; Modesto and Oakdale Irrigation Districts; Newman Drainage District; and all the areas between the Merced/San Joaquin River confluence and the Stanislaus/San Joaquin River confluence with a nexus to flood management. Preparation of the Mid-San Joaquin River Regional Flood Management Plan (RFMP) began in March 2013 and is expected to be complete in December 2014. It is one of six regional Central Valley RFMPs to be developed (ESA, 2013).

2.1.6 Natural Resources

The East Stanislaus Region, as with most of California, is rich with natural resources. Most land in Stanislaus County has been cultivated, and very limited mineral was found within its boundary. In the early 1900's, some quicksilver, manganese, and magnesite were found, as well as silica, sand and clays. Gravel from the Stanislaus River near Oakdale was used for roads. In La Grange, mining for gold was successful (Perazzo, 2011).

Stanislaus County is primarily agricultural, except for the urban areas. Up until about 1960, most of the County's population lived on farms. In the early 1990's, when Stanislaus County prepared its General Plan, the population of the nine incorporated cities was nearly three times that of the unincorporated area of the County. In its General Plan, the County applies agriculture land use to areas suitable for open space and recreational use.

Regional parks are valuable in preserving natural resources, such as river and riparian areas. River corridors and floodplains are some of the most ecologically valuable areas in the landscape, especially in an area like the Central Valley of California that has an arid climate. The rivers and floodplains are important for fish species, including anadromous species such as salmon and steelhead, and also provide wintering areas for migratory birds on the Pacific Flyway. The San Joaquin, Merced, Tuolumne, and Stanislaus Rivers are characterized as Critical Habitat for steelhead trout, as designated by the U.S. Fish and Wildlife Service. Other Critical Habitats in the Region include those for the vernal pool tadpole shrimp and vernal pool fairy shrimp. Riparian and wetland sensitive species within the San Joaquin River and the lower reaches of the Merced, Tuolumne, and Stanislaus Rivers include Delta button-celery, valley elderberry longhorn beetle, riparian woodrat, riparian brush rabbit, wading bird rookeries, least Bell's vireo, tricolored blackbirds, Swainson's hawk, pallid bat, and western red bat.

The Stanislaus River National Wildlife Refuge covers nearly 8,000 acres; approximately three-quarters of this area was specifically acquired to allow floodwater to temporarily move out onto the floodplain, now in flood-compatible land use. Extensive riparian vegetation is present within the Wildlife Area and there are small swaths of riparian vegetation along the San Joaquin River from the confluence with the Merced River to the confluence with the Stanislaus River. Similarly, the Dos Rios Ranch is a 1,600 acre area managed by the Tuolumne River Trust and River Partners located at the confluence of the Tuolumne and the San Joaquin Rivers provides six miles of river frontage and is managed for habitat and attenuation of flood flows (ESA, 2013).

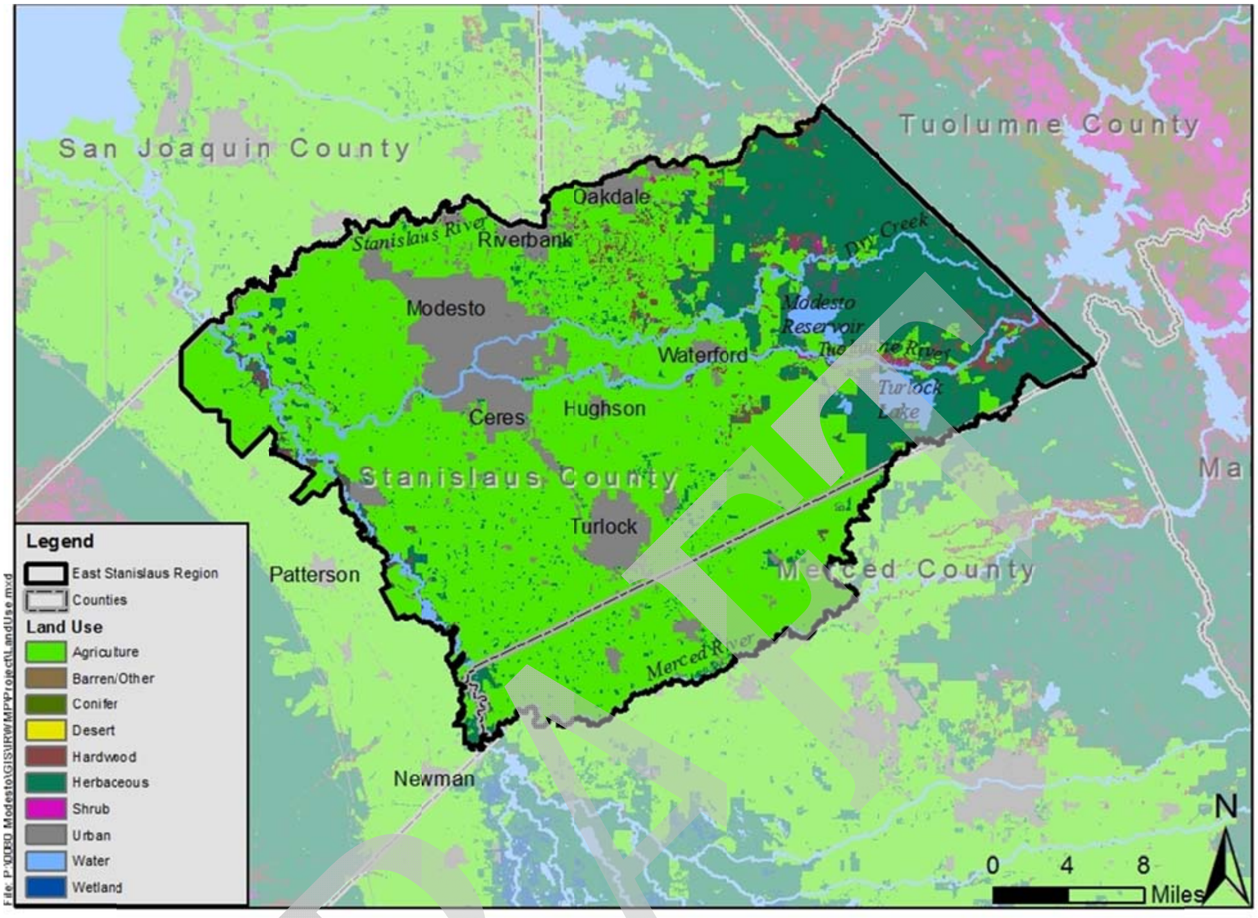
2.1.7 Social and Cultural Composition

The East Stanislaus County IRWM Region encompasses most of Stanislaus County and a portion of Merced County. Based on the 2010 Census data, Stanislaus County had a 2010 population of 514,453, an increase of 15.1% from 2000. The County's population is approximately 65% white, approximately 42% of which are of Hispanic or Latino origin. Asians provide the next largest demographic population, composing approximately 5% of the county's population. Native Americans compose approximately 1% of the county's population. Merced County is smaller than Stanislaus County (with a total population of 255,793 in 2010, a 21.5% increase from 2000); however, its population demographics are similar. Approximately 58% of Merced County's population is white, though unlike Stanislaus County, approximately 55% of this population is of Hispanic or Latino origin. Approximately 7.5% of the county's population is Asian, while Native Americans compose approximately 1.4% of the county's population.

The cities within the East Stanislaus Region had all been experiencing extremely rapid growth within the last decade, up until the most recent economic downturn. As previously noted, Stanislaus County's population increased by 15% between 2000 and 2010 while Merced County's population increased by 21.5% in that same period, as compared to a 10% growth rate for the State as a whole. This trend is also seen locally. For example, according to the 2000 U.S. Census, there were 3,980 people living in the City of Hughson in the year 2000, resulting in a 22% increase since 1990, equivalent to an average annual growth rate of 2.2%. In 2005, Hughson's population was estimated at 5,942, resulting in an annual growth of 10%. According to the 2010 U.S. Census, population in the City of Hughson in 2010 was 6,640 (a 67% increase in population between 2000 and 2010). Although the City continued to grow, growth slowed down as demonstrated by the 12% increase from 2005 to 2010, which equates to annual average growth rate of 2.4%, much lower than the previous 10% annual growth rate.

Agriculture is the primary industry in the East Stanislaus Region, except in urban centers (city limits). The region includes all or portions of five irrigation districts, providing water to over 300,000 acres. Figure 2-7 shows land uses in the East Stanislaus Region.

Figure 2-7: Land Use in the East Stanislaus Region



The East Stanislaus Region is also home to many disadvantaged communities, whose involvement in the IRWM process will be essential. A Disadvantaged Community (DAC), according to the State of California (California Water Code (CWC), Section 79505.5(a)), is a community with a Median Household Income (MHI) less than 80 percent of the California statewide MHI. DWR compiled the U.S. Census Bureau's American Community Survey (ACS) data for the period of 2006 to 2010. Based on this data, a community with an MHI of $48,706 or less is considered a DAC. Within the East Stanislaus Region, the communities of Keyes, Bret Harte, Bystrom, Empire, Grayson, Shackelford, West Modesto, Riverdale Park, Cowan, Parklawn, Rouse, and portions of Modesto, Turlock, Denair, Hughson, Oakdale, Waterford, and Ceres are DACs. Involvement and participation by representatives of these communities during the East Stanislaus IRWM planning process was solicited and encouraged to help understand the issues confronted by DACs and to better address the needs of minority and/or low-income communities. Figure 2-8 identifies the DACs based on the data defined at the census block group level. A census block group is a cluster of census blocks, generally containing between 600 and 3,000 people. Table 2-7 lists the DACs in the East Stanislaus Region and their associated MHIs.

Figure 2-8: Disadvantaged Communities Located in the East Stanislaus Region

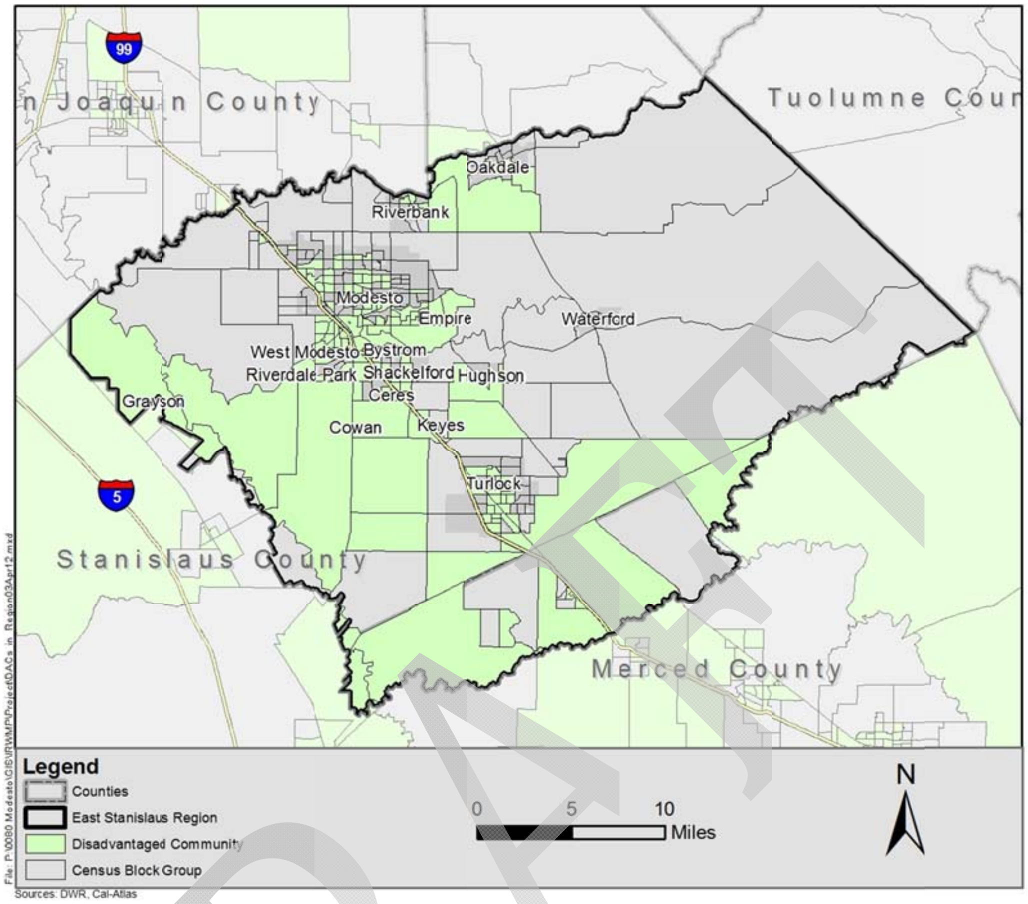


Table 2-8: DACs in the East Stanislaus Region

Community[1]	MHI
Bret Harte	$38,087
Bystrom	$34,464
Cowan	$31,063
Empire	$32,198
Grayson	$39,567
Keyes	$35,130
Parklawn	$32,902
Riverdale Park	$37,656
Rouse	$30,504
Shackelford	$19,302
West Modesto	$30,767

1. Based on the ACS data for Census Designated Places.
2. Source: DWR ACS data from 2006 to 2010, available here: http://www.water.ca.gov/irwm/grants/resourceslinks.cfm.

2.2 Water Resource Status

2.2.1 Water Supplies and Demands

The Cities of Modesto, Turlock, and Ceres have each prepared a 2010 Urban Water Management Plan (UWMP). The City of Hughson is not considered an urban water supplier (as they deliver less than 3,000 AFY) and therefore is not required to prepare an UWMP.

The 2010 UWMPs prepared were updates to each city's 2005 UWMP and were prepared in compliance with the Urban Water Management Planning Act, which was originally established by Assembly Bill 797 in 1983. The law requires water suppliers who provide water to more than 3,000 customers or supply more than 3,000 AFY to prepare and adopt an UWMP every five years. In 2009, Senate Bill x7-7 (SBx7-7), also referred to as the Water Conservation Act of 2009, was passed which required each urban water supplier to include in the 2010 UWMP per capita water use targets to be met by 2015 and 2020. The statewide objective of SBx7-7 is to reduce per capita water use by the year 2020 by 20%. The water demand projections each city developed for inclusion in its UWMP assume the 2020 urban water use targets will be met. Water supplies and demands for each city are described in the following sections. This section includes the demand information/projections that are currently available. Some water demands, such as the agricultural demands, are not currently publicly available and therefore are not included in this description.

City of Modesto

The City of Modesto is the largest retail water supplier in Stanislaus County and has been providing potable water service to its urban area since 1895 through the acquisition/purchase of multiple water companies. Until 1995, the sole water supply source was groundwater from the Modesto and Turlock Groundwater Subbasins.

In the early 1990s, the City of Modesto, MID, and the former Del Este Water Company formed a partnership to use a portion of MID's surface water supplies for municipal uses, resulting in the Modesto Domestic Water Project (MDWP). The MDWP includes a 30 mgd surface water treatment plant plus storage and delivery facilities. The surface water treatment plant, referred to as the Modesto Regional Water Treatment Plant (MRWTP), and the associated facilities were completed in January 1995 and the City started delivery of treated surface water in addition to groundwater. In July 1995, the City of Modesto acquired the Del Este Water Company.

The City of Modesto's service area includes one large contiguous area and several outlying, non-contiguous areas. The service area is shown in Figure 2-9. The contiguous portion of the service area consists of the City's current sphere of influence (SOI), Salida, North Ceres and some unincorporated Stanislaus County "islands." The non-contiguous portion of the service area includes Grayson, Hickman, Del Rio, Waterford, a part of north Ceres, and portions of Turlock.

Approximately 264,000 people within the service area received water services from the City of Modesto. Historically, the City has been among the fastest growing areas in the State of California. Beginning in 2007, growth began slowing at a significant rate due to the economic downturn. The service area population of 264,000 is approximately 20,000 less than what was projected for 2010 in the City's joint 2005 UWMP with MID. The 2010 Joint (Modesto and MID) UWMP assumes a growth rate of 1.9% with an estimated population of 375,000 in 2030. Projected water demand is presented in Table 2-9.

Table 2-9: City of Modesto Projected Water Demand, AFY [a]

2010 (actual)	2015	2020	2025	2030	2035
64,464	82,900	80,500	87,900	96,000	104,800

Source: West Yost, 2011b. Table ES-1.
Footnotes:
a. Includes unaccounted for water which is estimated to be about 15% of total production.

As previously noted, the City of Modesto relies on conjunctive use to meet demands with its water supplies from two sources – groundwater and Tuolumne River surface water that is purchased wholesale from MID. Groundwater and surface water will continue to be the primary sources of water for the City, and although the City is pursuing recycled water, it would be to provide a more reliable and cost-effective water supply for agricultural use rather than to act as a potable water offset. The MRWTP provides water to municipal customers within the City of Modesto city limits north of the Tuolumne River, including the communities of Salida and Empire, while the customers south of Tuolumne River in the Turlock Irrigation District (TID) service area are served by groundwater from both north and south of the river.

In 2010, the City of Modesto pumped 33,800 AFY with groundwater constituting 52% of the City's total water supply. In the future, groundwater pumping is expected to be reduced with the expansion of surface water supplies with the implementation of the MRWTP Phase 2 (anticipated to be completed in 2015). The City of Modesto currently has 33,602 AFY in available treated surface water supplies from MID. In 2010, the City purchased 30,647 AFY of additional surface water from MID. Once the MRWTP Phase 2 is operational, available treated surface water from MID will increase up to 67,204 AFY, adding to the City of Modesto's water supply and replacing some groundwater pumping. Anticipated future water supplies are shown in Table 2-10.

Table 2-10: City of Modesto Current and Future Water Supplies, AFY

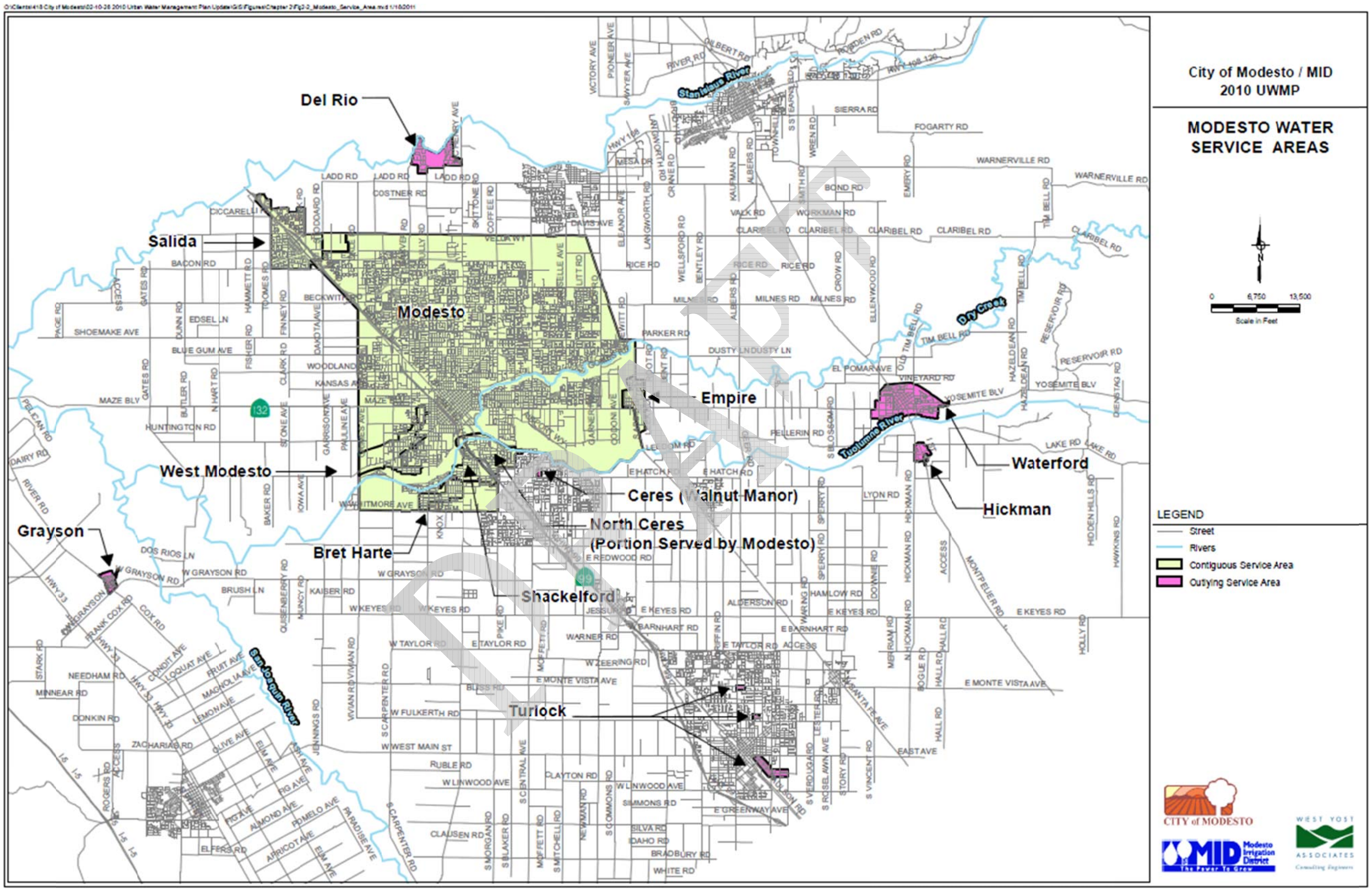
Supply	2010 (actual)	2015 [a]	2020	2025	2030	2035
Surface Water (Purchased from MID)	30,647	67,200	67,200	67,200	67,200	67,200
Groundwater	33,817	15,700	13,300	20,700	28,800	37,600
Total	64,464	82,900	80,500	87,900	96,000	104,800

Source: West Yost, 2011b. Table ES-2.
Footnotes:
a. In late 2015, when the MRWTP Phase 2 is completed, an additional 33,602 AFY of demand will be met with treated surface water supplies.
b. Build-out demand for the Modesto Water Service Area is 104,800 AFY which includes the anticipated reductions in water use to comply with SBx7-7.

The City of Modesto may also participate in a potential third phase of the MRWTP and/or the Regional Surface Water Supply Project (RSWSP), a proposed project to provide treated surface water for municipal use in South Modesto. Either project would result in greater supplies of treated surface water from MID and TID, respectively. The Stanislaus Regional Water Authority is pursuing the Regional Surface Water Supply Project. TID would provide raw surface water to the Authority to treat and sell to the three participating cities (Turlock, Modesto, and Ceres). Hughson may purchase treated water from the Authority, but that would be determined during a potential future phase of plant expansion.

The City of Modesto has adequate water supplies to meet projected water demands through 2035 during all hydrologic conditions. Other water supply options (such as desalination) for the City of Modesto are not necessary nor are they economical (West Yost, 2011b).

Figure 2-9: City of Modesto Water Service Area



Source: West Yost, 2011b.

Modesto Irrigation District

In 1887, MID was formed as the second irrigation district in California (after TID), and predominantly provides agricultural irrigation water from the Tuolumne River and the underlying groundwater basin. Surface water is diverted from the Tuolumne River at La Grange Dam, constructed in 1893 to divert water to MID north of the river and to TID south of the river. Don Pedro Reservoir is the District's primary water storage facility, while Modesto Reservoir is a small holding reservoir. The MID service area is shown in Figure 2-10.

MID is primarily an agricultural water supplier and provides irrigation water to 57,000 acres, typically between mid-March and late October each year. MID can also serve approximately 9,000 acres of additional lands based on customer demands. This water is used for dairy, chickens, turkeys, cattle, almonds, grapes, walnuts, tomatoes and peaches. In summary, MID serves approximately 3,000 irrigation accounts with an average of 20 acres per account. As previously noted, MID also provides treated surface water to the City of Modesto for domestic delivery, but it does not directly serve any domestic water users. In 1992, when MID, the City of Modesto, and the former Del Este Water Company formed a partnership, the agencies signed the *Treatment and Delivery Agreement Among the Modesto Irrigation District, City of Modesto, and Del Este Water Company* which controlled the delivery of domestic treated water from MID to the City of Modesto. This agreement obligated MID to deliver up to 33,602 AFY (30 mgd) to the City of Modesto each year (May 1st through April 30th), during normal years. The agreement contains a formula to determine reductions of water supplies during dry years. In September 2005, the SWRCB approved a long-term transfer of 67,204 AFY of water from MID to the City of Modesto through the year 2054. In October 2005, the original 1992 agreement was amended to include the second phase of the MRWTP (an additional 30 mgd) (West Yost, 2011b).

MID distributes a combination of Tuolumne River water and groundwater via a network of storage facilities, canals, pipelines, pumps, drainage facilities and control structures. The District operates approximately 90 groundwater wells with a combined pumping capacity of approximately 250 cubic feet per second (cfs) (MID, 2012). MID, in conjunction with TID, also operates the New Don Pedro Reservoir with a maximum storage capacity of 2,030,000 AF. Together, the Districts are responsible for maintaining regulated fish flows in the Tuolumne River to comply with FERC licensing requirements. MID's median annual diversion is 315,756 AF (MID, 2012). Of that amount, approximately 35,000 AF is diverted to the MRWTP for treatment and delivery to the City of Modesto (MID, 2012).

The MID on-farm water delivery system was originally designed to deliver irrigation water by gravity, with very large flows (10-20 cfs) on a predetermined rotation (typically every 10-20 days). However, as irrigators have converted their on-farm application practices from flood to pressurized systems, the requests for irrigation water have shifted from rotation to arranged-demand (MID, 2012). MID has an irrigation water allocation policy which established the allocation and cost of water to landowners. Factors affecting water allocation include land within the service area, reservoir storage, riparian rights, water year type, amount of land owned, and predicted runoff (MID, 2012). MID uses a variety of devices and methods to measure water within its delivery system (including orifices, propeller meters, weirs, flumes, venture meters and pumps), and it has a water rate schedule based on budget requirements and board policy. MID's water rates are an increasing block rate (tiered) pricing structure for water users who exceed the base amount of allocated water. The block rate structure is established annually, but typically contains two to three blocks of water with increasing price rates (MID, 2012).

As the developed areas of the City of Modesto and other communities within the MID service area expand, irrigated land is being replace by urban land uses. This continuing shift in land uses drives projected changes in water use. MID delivered 30,034 AF of treated water to the City of Modesto in 2009 (MID, 2012). The joint UWMP produced by MID and the City of Modesto projects that this supply will increase to 67,200 AFY by 2015 and remain constant until 2035. Future changes in agricultural water use will be driven by changes in cropping, irrigation practices, climate change and fluctuations in Tuolumne River hydrology. Although the irrigated area within the MID service area is expected to remain relatively stable, changes in the availability of surface water will continue to include the annual allocation of water (MID, 2012).

City of Turlock

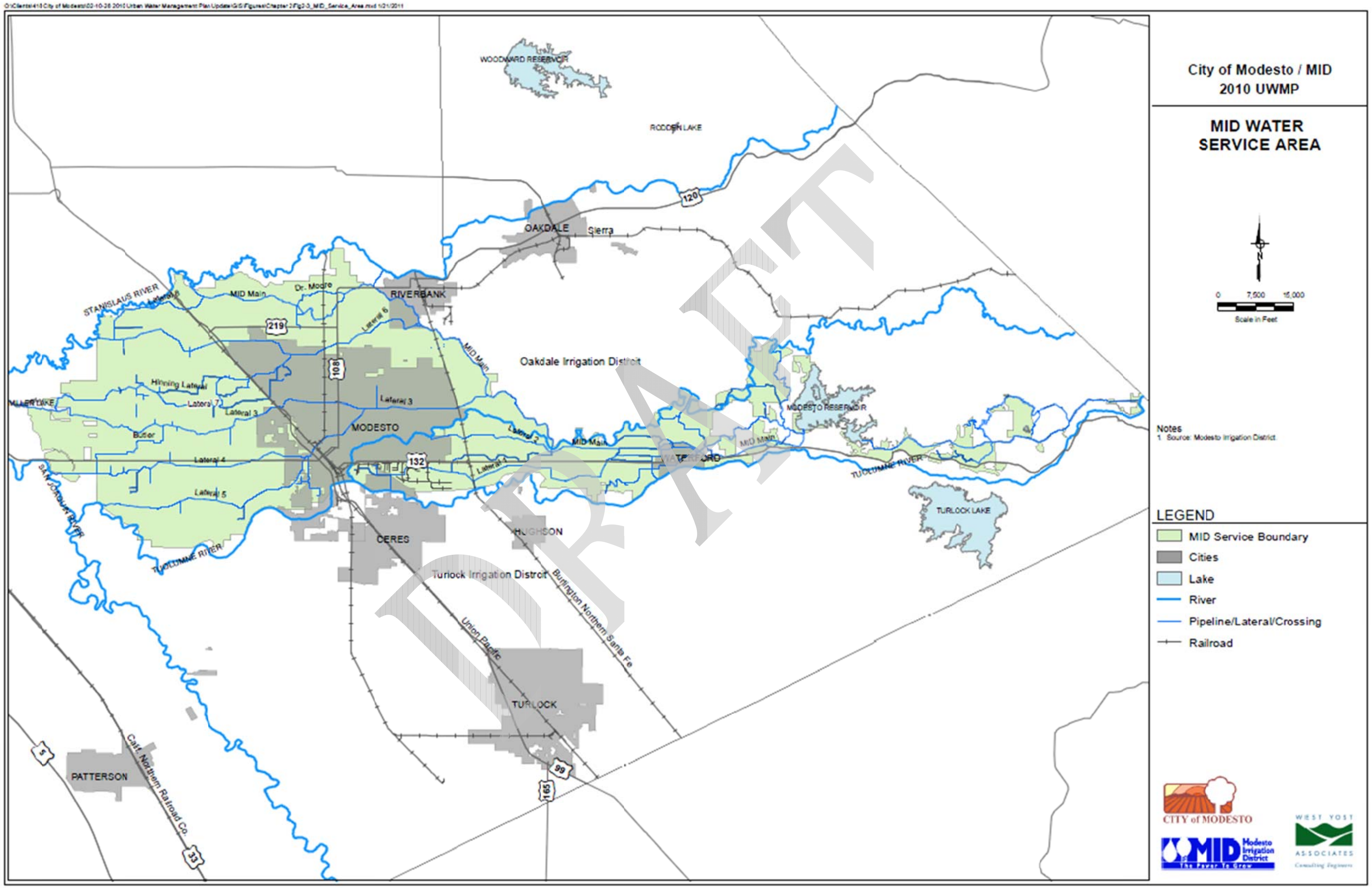
The City of Turlock is the second largest city in Stanislaus County, situated midway between Modesto (to the northwest) and Merced (to the southeast). The City of Turlock's population has grown steadily from 13,992 in 1970 to almost 70,000 in 2010. The City provides water to its service area through about 18,500 service connections. Turlock began installing water meters in 2007, and meter-based (i.e. volumetric) billing for all water users began on January 1, 2011. With the installation of water meters and volumetric billing, the recent drought, and the education/outreach efforts the City has implemented, there has been a significant reduction in water use. The City of Turlock's peak water use occurred in 2007 at 8,359 MG; in 2010 water use decreased to 7,093 MG.

The City of Turlock overlies the Turlock Groundwater Subbasin, a subbasin of the San Joaquin Valley Groundwater Basin. DWR's Bulletin 118 estimated a 160,000 AF increase of groundwater overdraft in this subbasin from 1990 to 1995, but from 1994 to 2000, groundwater water levels in the Turlock Subbasin rose about seven feet. The rising groundwater levels suggested that the groundwater basin had started to recover, but again, beginning in 2000, groundwater production increased, reaching its peak in 2007 when 8.359 billion gallons were pumped. Combined with below average rainfall, increased agricultural pumping and urbanization, groundwater pumping for urban water has adversely impacted groundwater levels. Conservation efforts and increase rainfall have helped the groundwater basin to begin recovering once again.

Groundwater is an unreliable water supply source for the City of Turlock in the long-term because the quantity that can be pumped depends on the amount available in the groundwater basin, the ability of the City's wells to pump, and pumping by other users. There is a significant cone of depression about five miles east of Turlock due to agricultural pumping; but even so, overdraft conditions have not occurred under the City of Turlock.

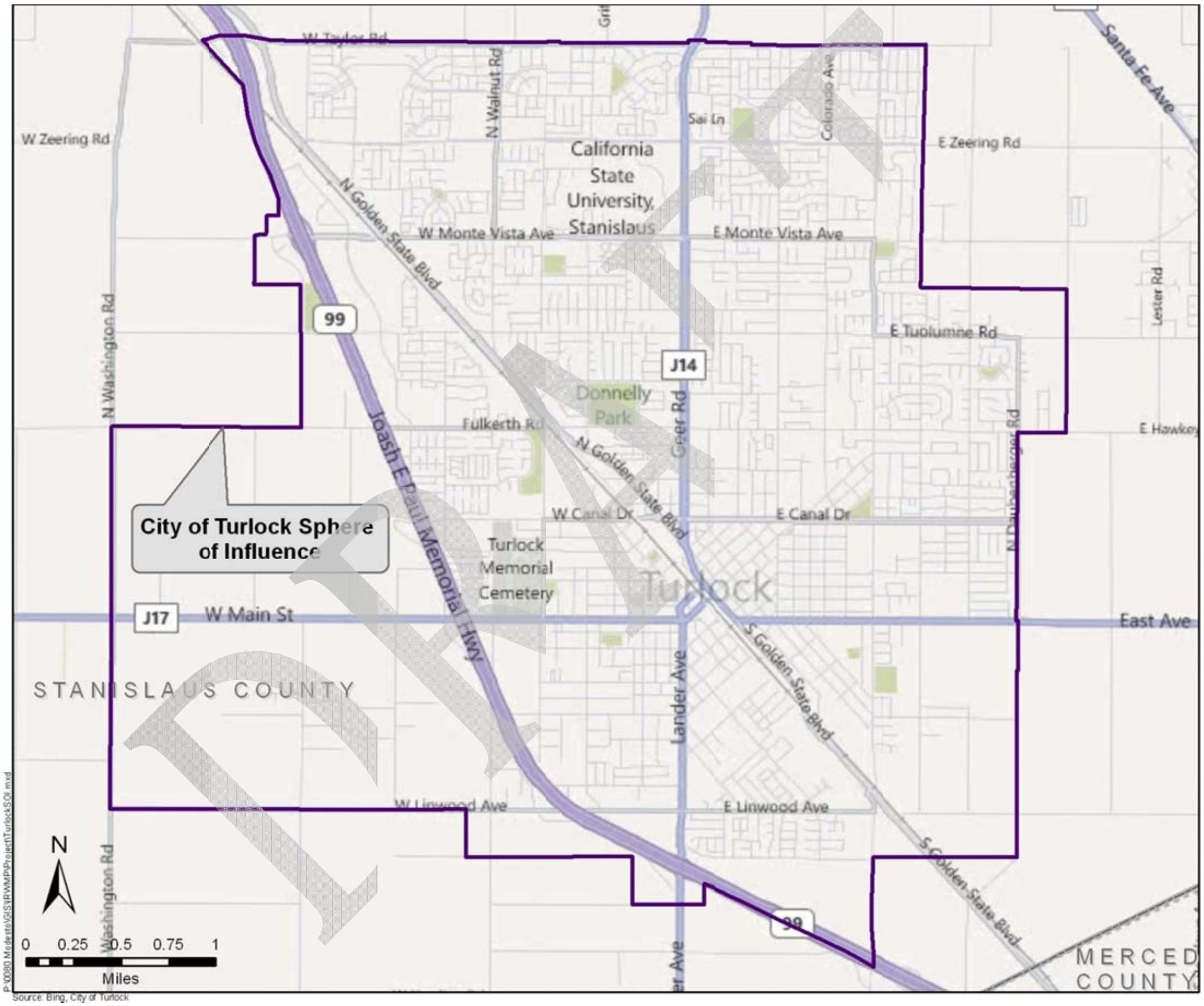
The City of Turlock's sole water supply is groundwater, and it anticipates meeting all water demands in its service area in the next five years with groundwater and supplementing supplies (recycled and non-potable water) as needed. As previously discussed, the City's wastewater treatment facility was recently upgraded to tertiary treatment, and the City is permitted to use the recycled water for industrial cooling and landscape irrigation at Pedretti Baseball Park. Water extracted from the shallow groundwater aquifer typically does not meet drinking water standards, but it can be used for landscape irrigation. Also, the City uses excess runoff from residential watering to supply irrigation water to Summerfaire Park. Potable water from the groundwater basin can support annual production of up to 8 billion gallons per year.

Figure 2-10: MID Service Area



Source: West Yost, 2011b.

Figure 2-11: City of Turlock Water Service Area



A population growth rate of 2.5% was used to estimate future water demand in the City of Turlock's service area in its 2010 UWMP. The demand projections are based on the preferred land use plan outlined in the Draft *2030 City of Turlock General Plan Update*. Table 2-11 presents current and projected future water demands for the City of Turlock.

Table 2-11: City of Turlock Water Demand, AFY [a]

2010 (actual)	2015	2020	2025	2030	2035
21,768	26,957	29,280	33,129	37,216	42,108

Source: City of Turlock, 2011. Tables 4 through 7.
Footnotes:
a. Does not include recycled water Turlock delivers to TID for industrial cooling or recycled water used for irrigation.

The City of Turlock intends to enter into an agreement with TID for delivery of 16,802 AFY of TID surface was to the City. TID has acknowledged that this volume of water is available and, for planning purposes, it expected to be available in 2020. Therefore, current and future water supplies for the City of Turlock are shown in Table 2-12.

Table 2-12: Current and Project Water Supplies, AFY

Water Supply Source	2010	2015	2020	2025	2030	2035
Water Purchased from TID [a]	0	0	16,802	16,802	16,802	16,802
Groundwater	21,771	26,957	12,478	16,327	20,414	25,306
Recycled Water	1,129	1,228	1,228	1,228	1,228	1,228
Total	22,900	28,185	30,508	34,357	38,444	43,336

Source: City of Turlock, 2011. Table 16.
Footnotes:
a. Assumes the TID's surface water treatment plant (the RSWSP) will be operational in 2020.

Turlock Irrigation District

Turlock Irrigation District (TID) was established in 1887 as the first publicly owned irrigation district in the State. Organized under the Wright Act, the District operates under provisions of the California Water Code as a special district. At present, TID covers a service area of 197,261 gross acres, with 157,800 acres that can currently be irrigated with surface water (TID, 2012). TID services over 4,900 irrigation customers, with irrigation water used to grow alfalfa, almonds, beans, corn, grapes, grain, oats, peaches, sweet potatoes and walnuts. The Tuolumne River is the District's primary source of water. Water for irrigation and hydroelectric power generation is kept at Don Pedro Reservoir, about 50 miles east of the Turlock.

The TID irrigation service area is generally bounded on the north by the Tuolumne River, on the south by the Merced River, and on the west by the San Joaquin River. The communities of Turlock, Ceres, Keyes, Denair, Hughson, Delhi, South Modesto, Hickman, and Hilmar are within the boundaries of the TID irrigation service area. As previously noted, the Tuolumne River is the principal water supply for TID, although the District does supplement surface water supplies with drainage wells and rented wells and jointly operates New Don Pedro Reservoir with MID. Rented wells are private or Improvement District wells that are rented by TID to supplement irrigation supplies, especially in dry years (TID, 2012).

In addition to La Grange Dam, the District's diversion dam, and Don Pedro Reservoir (its storage reservoir), TID owns and maintains more than 250 miles of canals and laterals, about 90% of which are concrete-lined to curb seepage and erosion. TID typically delivers irrigation water between mid-March and mid-October of each year. Customers irrigate their lands through a variety of means, including flood irrigation, drip and micro systems.

TID works cooperatively with other local agencies to promote the long-term sustainability of its water supplies. TID actively manages its groundwater supplies conjunctively with its surface water supplies, and participates in local groundwater management and planning. The District has a long-standing program of groundwater level monitoring and cooperates with other state and local entities to monitor the larger Turlock Subbasin area. TID is a member of the Turlock Groundwater Basin Association and has adopted the Turlock Groundwater Management Plan.

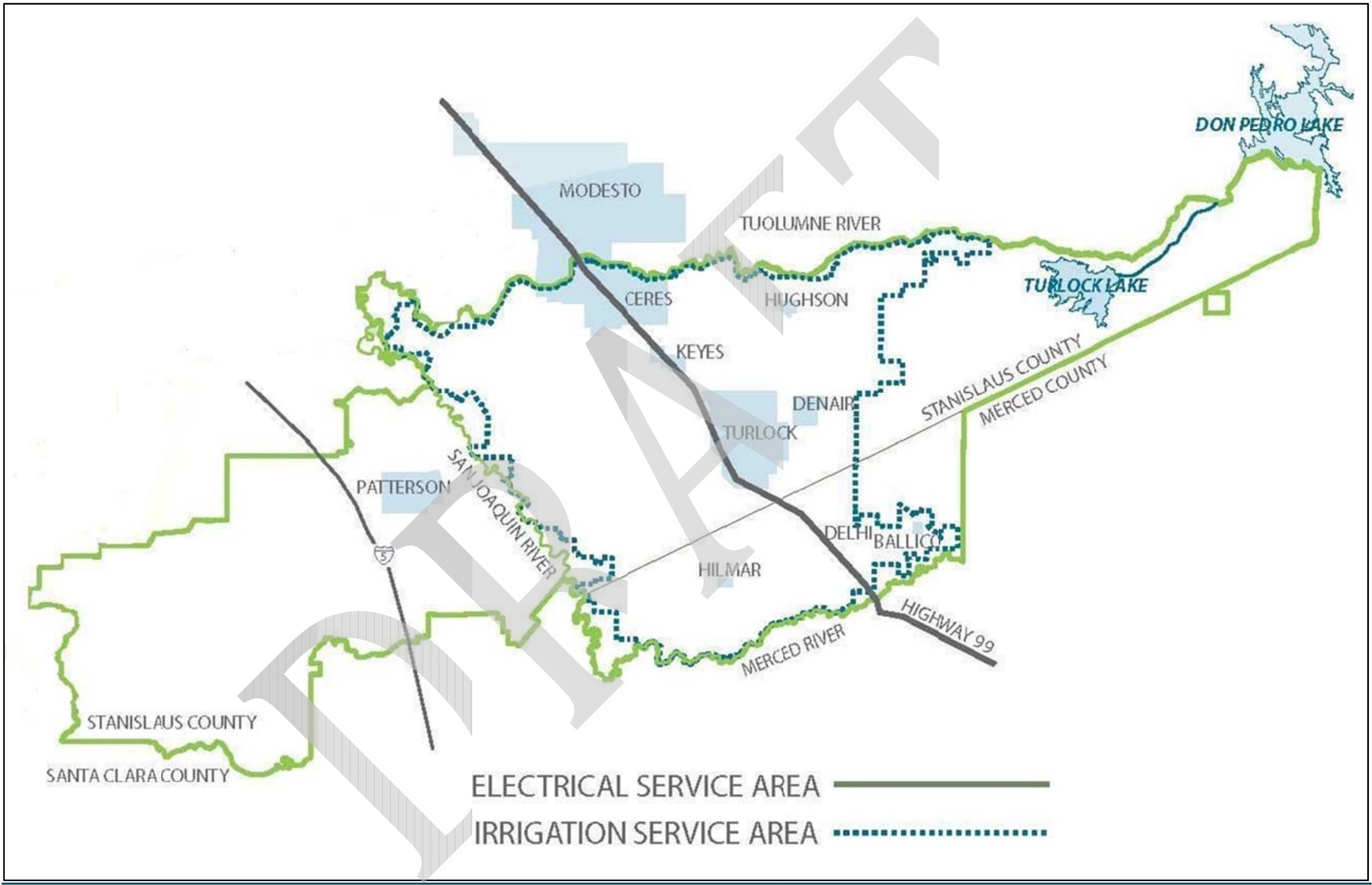
In 1996, TID was one of the first to develop an Agricultural Water Management Plan (AWMP) as a member of the Agricultural Water Management Council (AWMC), a non-profit organization consisting of water suppliers, public agencies, and members of the farming, academic and environmental communities. In compliance with new laws regarding Agricultural Water Management Planning, TID adopted an updated AWMP at the end of 2012 and remains committed to developing and implementing sound planning practices through its AWMP and to continue support agricultural irrigation efficiency.

TID uses a restricted arranged demand system of water ordering and delivery. Water deliveries are measured by a combination of SCADA, pressure transducers, sidegates, velocity meters, and electrical usage data. The TID Board of Directors establishes baseline water allotments each year, depending on projected runoff and including the possibility of the occurrence of consecutive dry years, carryover storage, flows required to be delivered to the lower Tuolumne River, and the availability of rented pumps. In addition, the TID Board of Directors has adopted a new volumetric pricing structure which utilizes a three-tiered increasing block rate structure combined with a fixed charge.

In recent years, several local community water systems, including those in Hughson, Ceres, Turlock and the southern portion of Modesto, have been studying the possibility of using TID surface water from the Tuolumne River to supplement urban groundwater supplies. While such a project would be within current irrigation boundaries, it would result in resumed water service to those areas (TID, 2012).

Over the last five years, total TID water supply averaged about 614,000 AF, approximately 82% from surface water, 16% from groundwater and 2% from other supplies such as subsurface drainage, tailwater, spill recovery, and recycled wastewater (TID, 2012).

Figure 2-12: TID Service Area



City of Ceres

The City of Ceres provides water to almost all residential, commercial, industrial and institutional (CII) users, and governmental water users within its city limits. The City of Ceres water service area is concurrent with the city limits, except in the northwest portion of the city where the City of Modesto serves water to approximately 1,200 customers. The City of Ceres also serves some customers outside its city limit, but within its primary sphere of influence (SOI). The City's water service area is shown in Figure 2-13.

Since 1992, the City of Ceres has been installing water meters on all new residential units. In 2012, the City completed installation of meters on pre-1992 residential connection, multi-family housing, and CII users, and established rates for volumetric billing. Additionally, the City installed an Advanced Metering Infrastructure (AMI) system which includes fixed infrastructure to collect meter information. A metered rate structure was implemented to encourage conservation of water. The City of Ceres' future water demands are driven by compliance with SBx7-7 and the associated urban water use reductions. The City's projected water demands are presented in Table 2-13.

Table 2-13: City of Ceres Projected Water Demands, AFY [a]

2010 (actual)	2015	2020	2025	2030	2035
8,284	10,700	12,300	14,800	17,300	19,800

Source: West Yost, 2011a. Table ES-1.
Footnotes:

a. Includes unaccounted for water, estimated to be 15% of total production in 2015; after 2015 it is assumed unaccounted for system losses decrease to 10%, accounting for improved leak detection and repair when the City is fully metered.

The City of Ceres' sole water supply source is groundwater pumped from the Turlock Subbasin. Since 1980, the City of Ceres' groundwater production has increased from 3,300 AFY to approximately 10,000 AFY. Anticipated future water supplies are presented in Table 2-14. Non-potable groundwater is also pumped from shallow wells and used to irrigate several parks within the City. The non-potable water that is pumped is not included in the groundwater estimates in Table 2-14.

The City of Ceres is a member of the Stanislaus Regional Water Authority and is working with TID to implement the Regional Surface Water Supply Project (RSWSP) and supplement its current water supply with surface water. The City of Ceres future water supplies, shown below, assume the RSWSP is completed in 2018 and will supply the City with an additional 6 mgd.

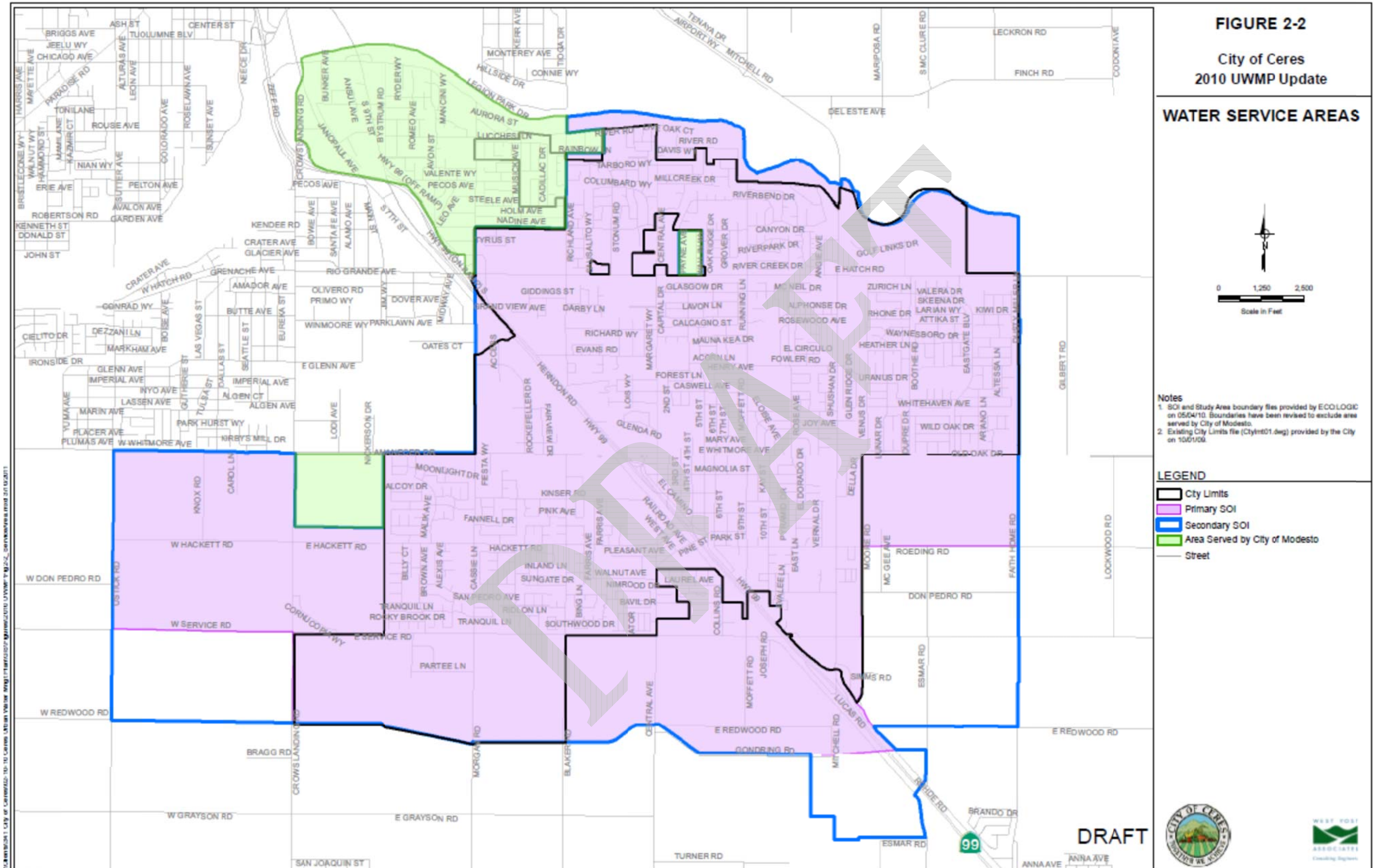
Table 2-14: City of Ceres Future Water Supplies, AFY

Supply Source	2010 (actual)	2015	2020	2025	2030	2035
Groundwater [a]	8,284	10,700	5,600	8,100	10,600	13,100
TID Surface Water [b]	0	0	6,700	6,700	6,700	6,700
Total	8,284	10,700	12,300	14,800	17,300	19,800

Source: West Yost, 2011a. Table ES-2.
Footnotes:

a. Groundwater quantity calculated by subtracting future water demand from surface water supply amount.
b. The RSWSP is anticipated to be operational in 2018. 6,700 AFY will be provided to the City of Ceres.

Figure 2-13: City of Ceres Water Service Area



Source: West Yost, 2011a.

Because the City of Ceres' sole source of water supply is groundwater, it is vulnerable to climatic variability and water quality. The primary sources of groundwater recharge in the Turlock Subbasin are infiltration from the Tuolumne River and incidental recharge from applied irrigation water. Drought conditions can reduce groundwater recharge and during a multi-year drought, groundwater levels can decline. By diversifying the City's water supply portfolio and adding a second source of water, surface water from the RSWSP, overall water supply reliability will increase. The addition of surface water to the City's supply portfolio will help protect the groundwater basin from overdraft and water quality degradation. Surface water is expected to be even more vulnerable to climatic variations than groundwater, so the City of Ceres' water supply projections presented in Table 2-14 assume groundwater will continue to be the primary source of water (West Yost, 2011a).

City of Hughson

The City of Hughson provides potable water services to residential and CII customers in its service area. Currently, the sole water supply source for the City is groundwater extracted from the Turlock Subbasin using five groundwater wells. The City's existing water distribution system and water facilities are shown in Figure 2-14. Water is distributed to its customers through 20 miles of pressurized pipe. The City's five wells each have a minimum capacity of 1,000 gpm, up to a maximum of 1,200 gpm. The combined well capacity is 8.1 mgd, which is adequate to meet estimated future water demands under most scenarios. In January 2007, the City of Hughson prepared a Water System Master Plan (Carollo, 2007a) with the purpose of effectively planning for future growth and identified Capital Improvement Program (CIP).

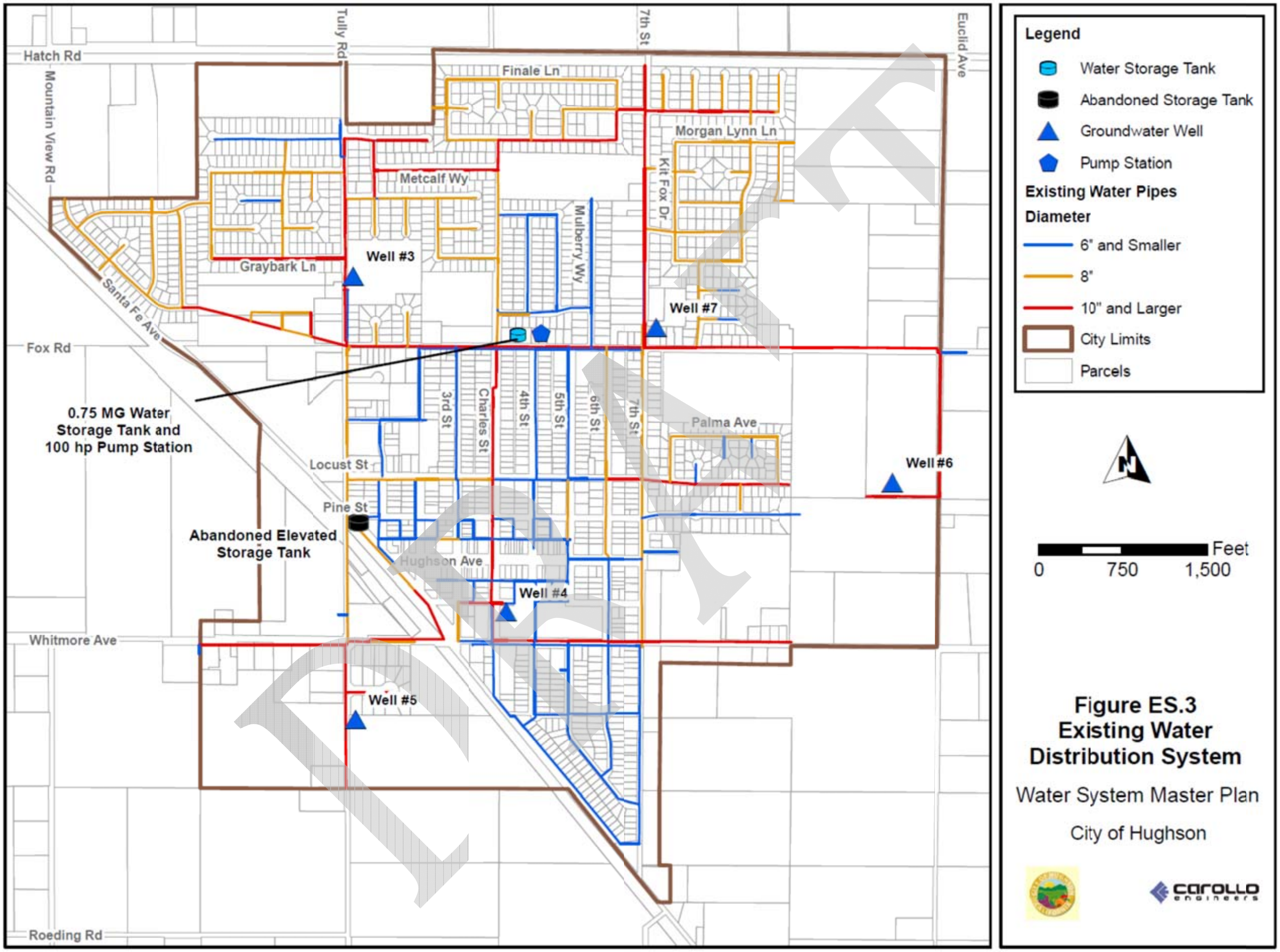
The annual average water production in 2005 for the City of Hughson service area was 541 MG or 1.5 mgd. This equates to an average daily per capita water use of about 250 gallons per capita per day (gpcd) (Carollo, 2007a). The City of Hughson's future water demands are shown below in Table 2-15. These demands are estimated based on the general plan land use and applied water demand factors. The City's updated General Plan was adopted in December 2005 and defines the City's land use plan at build out. Population is expected to increase from 5,942 (in 2005) to 15,074 (at build out in 2025), equating to an annual increase of 4.75%.

Table 2-15: City of Hughson Water Demand, AFY

2010	2015	2020	2025	2030
2,466	3,363	4,260	5,157	5,157

Source: Carollo, 2007a. Table ES.2.

Figure 2-14: City Hughson Water Service Area and Facilities



Source: Carollo, 2007a

Oakdale Irrigation District

Oakdale Irrigation District (OID) is located in Stanislaus and San Joaquin Counties, on the eastern side of the region. Approximately three-fifths of OID's service area lies south of the Stanislaus River and overlying the Modesto Groundwater Subbasin; this areas is within the East Stanislaus IRWM Region. The remaining two-fifths of the service area lies north of the Stanislaus River, overlying the Eastern San Joaquin Groundwater Subbasin.

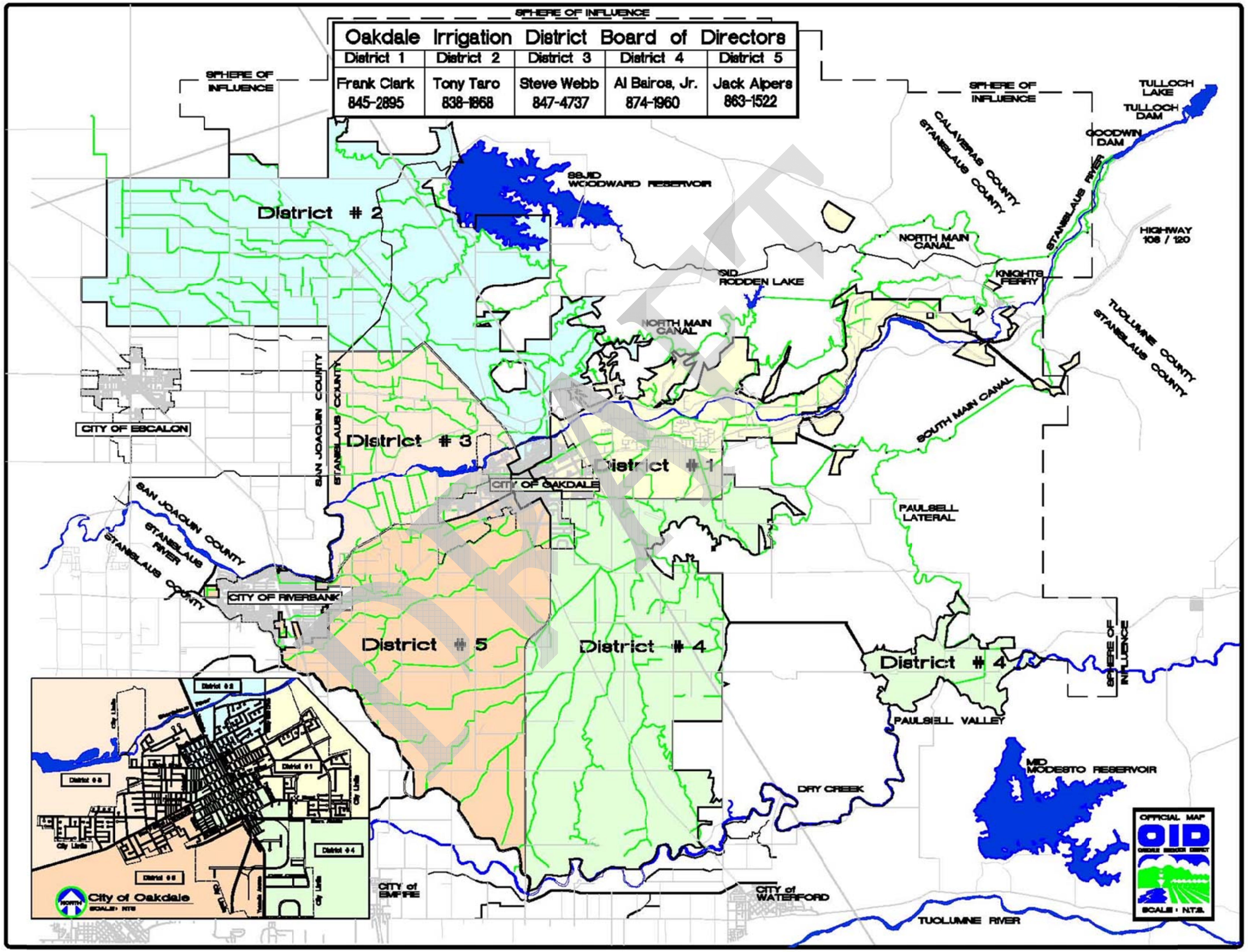
OID was formed in 1909, and in 1910, purchased certain Stanislaus River water rights and facilities from two existing water companies. Together with the South San Joaquin Irrigation District (SSJID), OID holds pre-1914 water rights for diversion of 1,817.7 cfs from the Stanislaus River at Goodwin Dam (Davids Engineering, 2012). In addition to Goodwin Dam, OID and SSJID also share a joint main canal, extending four miles from Goodwin Dam to the Joint Diversion Works. This canal carries 28% OID water and 72% SSJID water. OID's facilities also include main canals on each side of the river (the North Main Canal and the South Main Canal), plus approximately 250 miles of lateral and sublateral ditches.

Historically, OID shared Melones Reservoir (a storage reservoir) with SSJID, plus 25 deep wells used to augment water supply as needed. The Tri-Dam Project (jointly owned with SSJID and PG&E) was subsequently added. This project consists of three reservoirs with a combined storage capacity of 230,400 AF, plus combined power generation facilities capable of producing 81,000 KW of power. An additional 93,000 KW of generation capacity is provided by the Sand Bar Hydroelectric Powerhouse.

In 1979, New Melones Dam was completed, providing a reservoir capacity of 2.4 million AF and effectively submerging the original Melones project. New Melones Dam was constructed by the U.S. Army Corps of Engineers and transferred to the USBR; the dam and reservoir were subsequently incorporated into the Central Valley Project. Following completion, OID and SSJID entered into an operational agreement with the USBR allowing the District to divert a combined supply of 600,000 AF of water annually, subject to availability (OID, 2012). Releases from New Melones Dam are now the principal source of water for OID, along with groundwater from 25 operating wells. These wells produce an average of about 6,300 AFY. OID also operates 43 drainage and several reclamation pumps, used to discharge around 13,000 AFY. OID actively participates in groundwater management activities in the basins it overlies.

OID's service area currently encompasses approximately 72,345 acres of land supporting four major crop groups (irrigated pasture, oats/corn (double crop), rice, fruits/nuts) plus several rural communities (including the Cities of Oakdale and Riverbank, located within OID's service area). In addition, OID has short-term water transfers with the California American Water Company (Stockton District), and provides water to two rural water areas outside of the City of Oakdale. Water diverted from the Stanislaus River into the District's canals is measured by gauging stations operated by the Tri-Dam Authority. Releases from the canals to laterals are measured by various means, including pressure transducers, ultrasonic water level sensors, weir sticks, measuring tapes, Clausen rules and stilling wells with staff gauges. As with the other water districts, water rates are established annually by the Board of Directors, with water deliveries to OID customers on a flat rate, per-acre basis (OID, 2012).

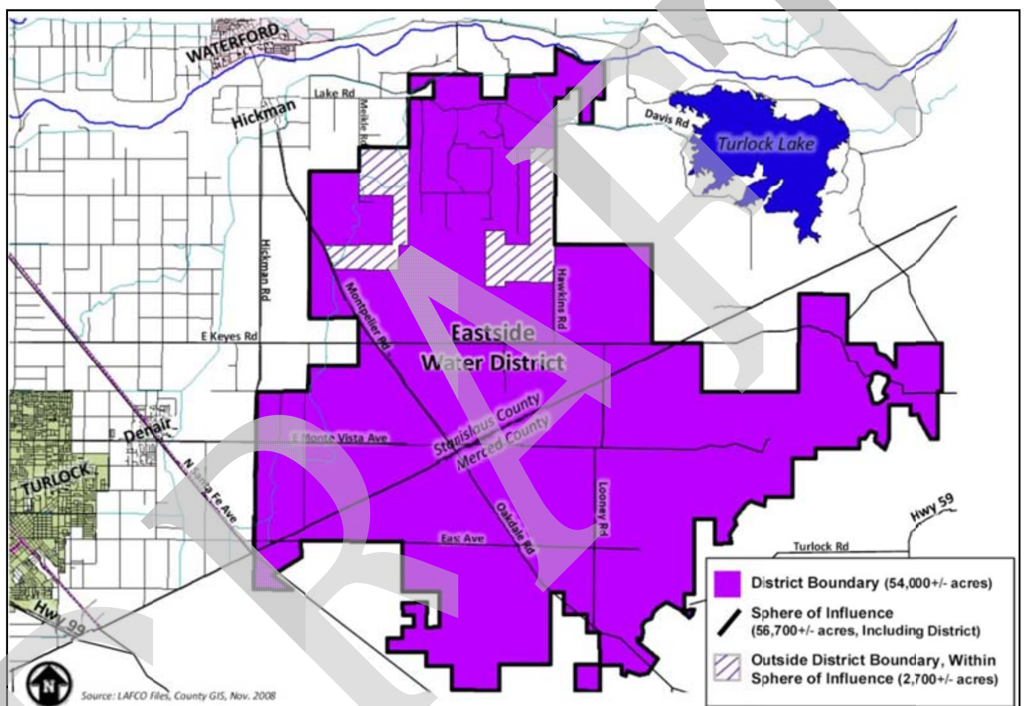
Figure 2-15: Oakdale Irrigation District Service Area and Facilities



Eastside Water District

Eastside Water District was formed in 1985 to address water needs in the area and encompasses approximately 54,000 acres in Merced and Stanislaus Counties. Most of the land within District is agricultural and is irrigated with groundwater; the District pumps on the order of 160,000 AFY. The only other source of supply is a very limited amount of surface water (~2,000 AFY) from purchases in wet years from the Turlock and Merced Irrigation District's canals lying adjacent to District and from riparian water rights along the Tuolumne and Merced Rivers. Groundwater within District appears to be declining at about two feet per year, creating an average annual deficit of about 80,000 acre-feet. The District participates in local groundwater management along with other users of the underlying Turlock Subbasin, and is actively working towards rectifying the basin overdrafts.

Figure 2-16: Eastside Water District



Demands and Supplies Outside Established Public Service Areas

There are areas within the East Stanislaus Region that are located outside the service areas of the afore-mentioned public water agencies. These areas are dependent primarily on groundwater for their water supplies. Privately-owned properties are managed by the individual property owner who also determines the water supply use, irrigation method, cropping patterns, and other issues related to their land. Unless a permit is acquired to install a building or well, modifications on the land are not part of a larger land use planning process. Privately-owned irrigation supply wells and domestic wells have been installed throughout the Modesto and Turlock Groundwater Subbasins to provide water for irrigation and supplies to rural homes and businesses. In addition to areas located outside of the local water agency boundaries that are using groundwater, there are also areas that have had significant conversions from non-irrigated lands to irrigated lands, further increasing reliance upon groundwater (TGBA, 2008).

Possible Future Changes to Water Supplies

In December of 2012, the SWRCB issued its *Public Draft, Substitute Environmental Document in Support of Potential Changes to the Water Quality Control Plan for the San Francisco Bay-Sacramento/San Joaquin Delta Estuary: San Joaquin River Flows and Southern Delta Water Quality*. In this document, the SWRCB evaluated potential impacts from proposed amendments to the 2006 *Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary* (2006 Bay-Delta Plan). The amendments would establish:

- New flow objectives on the Lower San Joaquin River and its three eastside tributaries, the Tuolumne, Stanislaus and Merced Rivers (all of which are located within the East Stanislaus IRWM Region), for the protection of fish and wildlife beneficial uses; and
- New water quality (salinity) objectives for the protection of agricultural beneficial uses in the southern portion of the Sacramento-San Joaquin Delta (Delta).

The San Joaquin River flow proposal would establish February through June flow requirements of 35% of unimpaired flow for the three salmon-bearing tributaries. (Unimpaired flow is the flow that would occur if all runoff from the watershed remained in the river, without storage in reservoirs or diversions.) Achieving this proposal would require increased flows of 21% and 20% in the Tuolumne and Merced Rivers, respectively, with the increased flows resulting from decreases in diversions of 132,000 AFY from the Tuolumne River and 67,000 AFY from the Merced River. Loss of these diversions would significantly impact water supplies in the East Stanislaus Region. The proposed amendments are currently under consideration.

Concurrently, expansion of the San Joaquin River National Wildlife Refuge is being considered. As described in the Draft Environmental Assessment, released in 2012, the proposed expansion would add up to 22,156 acres of land to the Refuge. This expansion may require additional water to establish and maintain riparian habitats.

2.2.2 Water Quality

Water quality within a watershed can be affected by a mix of point and nonpoint source discharges, and groundwater and surface water interactions. Water quality can affect water supplies for the East Stanislaus Region and overall water supply reliability. Much of the Region relies predominantly on groundwater and/or surface water. In California, the SWRCB and the RWQCBs are responsible for contributing to the development of a Strategic Plan for water resource protection. In December 2002, the Central Valley Regional Water Quality Control Board (CVRWQCB) prepared a Watershed Management Initiative (WMI) chapter for its watersheds to integrate surface and groundwater regulatory programs. It was then revised in October 2004. The CVRWQCB divided its region into the Sacramento River Basin, the San Joaquin River Basin, and the Tulare Lake Basin (CVRWQCB, 2004). As previously described in Chapter 2.1.2, the East Stanislaus Region is within the San Joaquin Basin which is then further divided into the Merced, Tuolumne, and Stanislaus watersheds.

Each RWQCB is also required to prepare a Basin Plan (also referred to as a Water Quality Control Plan) to be used as a basis for regulatory actions to protect water quality. The Basin Plans describe beneficial uses, identify water quality objectives, and define an implementation program consisting of actions to be taken to meet those objectives. Region 5, the Central Valley Region, has two Basin Plans, one for Tulare Lake Basin and one for the Sacramento and San Joaquin River Basins. The latter Basin Plan is pertinent to the East Stanislaus Region and was originally adopted in 1975, then updated and revised in 1984, 1989, 1994, 1998 and 2011 (CVRWQCB, 2011).

Beneficial uses of water resources as identified in the Basin Plan are critical in water quality management. The existing and potential beneficial uses of the surface waters within the East Stanislaus Region include:

- Municipal and Domestic Supply
- Cold Freshwater Habitat
- Migration of Aquatic Organisms
- Spawning, Reproduction, and/or Early Development
- Hydropower Generation
- Recreation
- Freshwater habitat
- Wildlife Habitat
- Agricultural Supply

Beneficial uses of groundwater identified in the Basin Plan for groundwater in groundwater basins underlying the East Stanislaus Region include:

- Municipal and Domestic Supply
- Agricultural Supply
- Industrial Service Supply (e.g. cooling water supply)
- Industrial Process Supply (CVRWQCB, 2011)

Surface Water Quality

Pesticides have been found within the San Joaquin River at concentrations that are toxic to sensitive aquatic organisms. Two multi-year studies were conducted; one study in the early 1990's found a 43-mile reach of the San Joaquin River, between the confluence of the Merced and Stanislaus River, to be toxic about half of the time to invertebrate components of the U.S. Environmental Protection Agency (USEPA) three species test. This portion of the river is the portion within the East Stanislaus Region as the Stanislaus River coincides with the northern regional boundary and the Merced River coincides with the southern regional boundary. The toxicity in the river was caused by pesticides, specifically diazinon and chlorpyrifos, in storm and irrigation runoff from crops. A year later, follow-up testing was conducted that found that water in the San Joaquin River was toxic to invertebrate species about 6% of the time. As with the first study, diazinon and chlorpyrifos in winter storm runoff from crops and summer irrigation return flows were identified as the primary source of the toxins. Urban runoff has also been identified as a significant source in and around the City of Modesto. The SWRCB has also found elevated levels of Group A Pesticides in fish in the Tuolumne, Merced, and Stanislaus Rivers and the main stem of the San Joaquin River. Group A Pesticides include chlordane, toxaphene, endosulfan, and other pesticides, many of which are no longer used or are heavily regulated. These chemicals tend to bind to sediment and move into water systems as sediment moves off site (CVRWQCB, 2004). The San Joaquin, Merced, Tuolumne, and Stanislaus Rivers are on the Clean Water Act 303(d) list for Group A pesticides and various other constituents.

Water quality objectives were identified in the Basin Plan for inland surface waters and groundwater in the San Joaquin Basin. Examples of these objectives are as follows:

- Bacteria – In waters designated for contact recreation, the fecal coliform concentration shall not exceed a geometric mean of 200/100 milliliter (mL) from five samples over a 30-day period, nor shall more than 10% of the total number of samples taken during the 30-day period exceed 400/100 mL.

- Chemical Constituents – Water shall not contain chemical constituents in concentrations that adversely affect beneficial uses. For domestic and municipal water supply, the concentrations of chemical constituents must not be in excess of the maximum contaminant levels (MCLs) specified in the California Code of Regulations, and state and federal drinking water regulations.
- Color – Water shall be free of discoloration that adversely affects beneficial uses.
- Floating Materials, Oil and Grease – Water shall not contain floating materials, oils, greases, waxes or other materials that cause nuisance or affect beneficial uses.

Other water quality objectives were identified in the categories of biostimulatory substances, dissolved oxygen, mercury, methylmercury, pH, pesticides, radioactivity, salinity, sediment, settleable material, suspended material, tastes and odors, temperature, toxicity, and turbidity. A more comprehensive description of the water quality objectives is included in the Basin Plan. (CVRWQCB, 2011).

The SWRCB is also in the process of updating the *Water Quality Plan for the San Francisco Bay-Sacramento/San Joaquin Delta Estuary* (Bay-Delta Plan). The Bay-Delta Plan was developed in 2006 to protect water quality in the region and includes water quality objectives to protect municipal and industrial, agricultural, and fish and wildlife beneficial uses. The Delta Stewardship Council (DSC), as part of the Bay-Delta Plan, directed the SWRCB to adopt and implement updated flow objectives for the Sacramento–San Joaquin Delta (Delta) to achieve the coequal goals of ecosystem protection and a reliable water supply by June 2, 2014. To implement this policy, the Bay-Delta Plan is being updated by the SWRCB through a phased process. As part of Phase 1, a draft Substitute Environmental Document (SED) was prepared in December 2012 in support of potential changes to San Joaquin River flow and southern Delta water quality objectives and an implementation program to be included in the Bay-Delta Plan. The SED proposes to balance the use of water for fishery protection against competing uses of water such as municipal, agricultural, and hydropower. Amendments to the 2006 Bay-Delta Plan will establish the following:

- **Flow Objectives** – New flow objectives on the Lower San Joaquin River (LSJR) and its three eastside tributaries (the Stanislaus, Tuolumne and Merced Rivers) for the protection of fish and wildlife beneficial uses.
- **Water Quality Objectives –** New water quality (salinity) objectives for the protection of agricultural beneficial uses in the southern portion of the Delta.
- **Implementation Program –** An implementation program to achieve those objectives

The amendments have the potential to impact the East Stanislaus Region, predominantly through reduced diversions from the Tuolumne River. As the SED and amendments progress forward, the East Stanislaus Region will track the flow objectives and water quality objectives that may be relevant to the region, and will plan response actions needed to adjust regional water use.

Groundwater Quality

Groundwater quality in the Region is variable and has been impacted by overlying land uses in many locations. The Basin Plan identified water quality objectives for groundwater in the San Joaquin River Basin, over which the East Stanislaus Region lies. Objectives for bacteria, chemical constituents, tastes and odors, toxicity, and radioactivity are defined in the Basin Plan for groundwater. Extracted groundwater from both the Modesto and Turlock Subbasins has contained concentrations of multiple constituents in excess of drinking water regulatory requirements, including arsenic, uranium, PCE, TCE, DBCP and nitrate. As a result, many of the Region's groundwater wells have been taken out of service (for example, the City of Modesto has had 21 wells removed from service in recent years due to groundwater quality impacts) and several disadvantaged communities within Stanislaus County have been identified as having small community water systems with known violations of the arsenic and/or nitrate drinking water standards (CDPH, 2013).

High salinity, nitrates, iron, manganese, boron, arsenic, radionuclides, bacteria, pesticides, trichloroethylene and other trace organics have been detected in groundwater in the Turlock Subbasin. In the last 20 years, the City of Turlock has had to discontinue use of five wells due to contamination. Two of the well closures were a result of nitrate contamination, which is a major threat to wells in the City of Turlock. Average nitrate levels have increase from 12 parts per million (ppm) to 21 ppm (as NO_3) over the last 20 years. Arsenic has also been a problem for some wells. Some of the contaminants found in the groundwater occur naturally while others have been introduced by manmade sources, such as from industrial solvents, septic tanks, pesticides and herbicides. The City of Ceres too has had water quality concerns related to specific contaminants in the groundwater. These include many of the same that concern the City of Turlock and Modesto (such as nitrate, uranium, arsenic, and manganese) and nearly all of the City's active wells are impacted by a combination of inorganic contaminants. Wellhead treatment and blending are used to reduce levels of contaminants and in the future, the City of Ceres may replace older wells and/or install new wells and in such a way that the need for wellhead treatment is minimized (West Yost, 2011a).

Groundwater Management Plans (GWMPs) have been prepared for both the Modesto and Turlock Subbasins. The *Integrated Regional Groundwater Management Plan for the Modesto Subbasin* was prepared in 1994 by six agencies forming the Stanislaus and Tuolumne Rivers Groundwater Basin Association (STRGBA). The final draft of the Modesto Subbasin GWMP was completed in June 2005 and was adopted by all member agencies. The *Turlock Groundwater Basin Groundwater Management Plan* was drafted in 2008 by the Turlock Groundwater Basin Association (TGBA). Similarly, this plan was adopted by the member agencies comprising the TGBA. Both GWMPs outlined methods for groundwater monitoring both for groundwater levels and groundwater quality. Local cities and small community water systems conduct water quality monitoring using drinking water supply wells. The data collected are then made available to the public in each municipal water supplier's Consumer Confidence Report (CCR). CDPH regulates the type of monitoring and frequency of data collection to ensure the water meets required standards.

During development of the Turlock Basin GWMP, the TGBA developed Basin Management Objectives, one of which is monitoring groundwater extraction to reduce the potential for land subsidence, indicating how important it is for the TGBA to monitor groundwater quality and levels. Other groundwater monitoring is conducted by other agencies. For example, DWR has a network of wells throughout the valley that are used to monitor groundwater level on an annual or semi-annual basis. Local agencies have a similar program to monitor groundwater levels at local supply wells. The Stanislaus County Department of Environmental Resources (DER) also monitors water quality very closely. There are 61 contamination sites within the Stanislaus County portion of the Turlock Subbasin; the County monitors groundwater quality at these sites quarterly. Most of the water quality data collected from the contaminated sites can be viewed on the SWRCB Geotracker-GAMA website, http://geotracker.waterboards.ca.gov. The TBGA has also participated in the GAMA study, conducted by U.S. Geological Survey (USGS), SWRCB, CDPH, DWR, and Lawrence Livermore Laboratory. The GAMA study has yielded baseline water quality conditions and has allowed for early detection of contamination (TGBA, 2008).

In the Modesto Subbasin, groundwater levels have been measured in about 230 wells by DWR and others. USGS has also partnered with member agencies of the Stanislaus and Tuolumne Rivers GBA to monitor 17 wells in the area for the National Water Quality Assessment Program.

The Stanislaus and Tuolumne Rivers GBA plans to expand the network of monitoring wells in partnership with the USGS. If detections occur in the monitoring wells, the GBA will facilitate meetings between responsible parties and impacted agencies to determine strategies to minimize spread of contaminants. Groundwater monitoring for levels and quality will continue in order to ensure a balanced state of the groundwater basin (Bookman-Edmonston, 2005).

Table 2-16: Monitoring by Member Agencies of Stanislaus and Tuolumne Rivers GBA

Member Agency	Total Number of Wells	No. of Wells Groundwater Levels are Measured	No. of Wells where Samples are Analyzed for Groundwater Quality
Modesto Irrigation District	104	96	104
Oakdale Irrigation District	17	17	
City of Modesto	110[a]		14
Ceres	4		
Walnut Manor	1		
Salida	7		
Del Rio	3		1
Waterford	7		
Hickman	2		1
City of Oakdale	7		
City of Riverbank	7		
Total	**221**	**113**	**135**

Source: Bookman-Edmonston, 2005. Table 5-1.

a. Total number of wells provided by City of Modesto staff.