Mission statement

The City of Bakersfield is dedicated to providing the following services:

- A firm, reliable water supply to meet customer demands for high quality drinking water at a competitive price;

- Preservation and augmentation of the underground water supply in the metropolitan area; increase of local instream flows to Kern River channel;

- Proper distribution of Kern River water rights and delivery of water from Isabella Reservoir to canal headgates and agricultural customers;

- Flood control management and operation of Kern River and local drainage basins;

- Expand and maintain a viable Kern River Parkway through Bakersfield; and

- Planning for future growth and meeting increased water demands.

Study purpose

Wide open space, a seasonable climate, and an affordable cost of living are drawing new residents and businesses to the City of Bakersfield. These new members of the community will seek to share the water resources of the area with the existing population. This study provides a review of the historical balance of water supply and demand within the City. This review serves as the basis for determining how much additional water demand can occur without taxing the available water resources. This will allow the City to pursue its mission goal of providing a safe and dependable water supply in sufficient quantities to meet customer demands into the 21st Century.
Water supply agencies

The physical supply of water to residents and businesses throughout metropolitan Bakersfield is provided by a series of water districts and private water supply companies. The service boundaries of these agencies/companies are shown on the map on the opposite page. The description below provides specific information about wholesale and retail agencies that provide water to users within the City of Bakersfield.

wholesale

Kern County Water Agency Improvement District No. 4 (ID4)

ID4 was formed to treat and convey State Water Project flows to retail suppliers in Metropolitan Bakersfield. The District owns and operates the Henry Garnett Water Treatment Plant. This facility has the ability to treat Kern River and Central Valley Project water in addition to the State Water Project supply. ID4 also operates two transmission lines to convey treated water to four participating retail suppliers. Only one of these suppliers, the California Water Service Company, distributes a significant amount of ID4 surface water within City boundaries.

retail

California Water Service Company

The California Water Service Company (CWSC) is currently the largest municipal water supplier in the metropolitan Bakersfield area. CWSC supplies groundwater through 187 wells in combination with surface water. Approximately 20% of the water used by CWSC is surface water purchased from ID4.

City of Bakersfield Service Area

The City of Bakersfield purchased both Kern River water rights and the physical water distribution systems for the Ashe Service Area from Tenneco West in 1977. The City subsequently added service areas in the Fairhaven and Riverlakes areas. These service areas are the only portion of the City which directly receives water service from the City of Bakersfield. Water supply to the system is pumped from 47 groundwater wells. Additional wells are continually in development. The California Water Service Company operates the City’s water system under contract for the City of Bakersfield.

The City of Bakersfield also owns and operates 2,800 acres of recharge ponds along the Kern River on the west side of the City. This banking system is an important reliability feature in the City’s water supply system.

Vaughn Mutual Water Company

The Vaughn Mutual Water Company provides water to portions of northwest Bakersfield. This agency obtains all of its water from wells. The Vaughn Mutual Water Company owns and operates 11 wells.

Agricultural Districts

This document focuses on municipal water supply. However, the City of Bakersfield has also contracted to provide Kern River water for irrigation to five nearby agricultural water districts. The majority of this water is transported to the Districts through a series of earthen canals spanning the City. Percolation through these canals plays a key role in replenishing the City’s groundwater supply.
Bakersfield is partially surrounded by a rim of mountains with an open side to the northwest. The Sierra Nevada Mountains are located northeast of Bakersfield. These mountains catch and store snow which can be used as a water supply. The southern boundary is formed by the Tehachapi Mountains. These mountains often have high wind velocities and heavy precipitation.

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*Year begins on July 1st for recording purposes

The City of Bakersfield is located in the southern San Joaquin Valley in Kern County approximately 100 miles north of Los Angeles and 290 miles southeast of San Francisco. The current population is over 230,000 with an acreage of 71,009 and area of 110.95 square miles.

The Coast Ranges are located approximately 75 miles to the west. There are large climatic variations in this area because of the nature of the surrounding valleys, mountains, and desert areas. The overall climate of Bakersfield is warm and semi-arid. The normal wet season is from October through April. Approximately 90 percent of the precipitation falls during this period. The annual average rainfall is 5.72 inches. A monthly summary of the average rainfall is shown above. Annual precipitation for 1977-1998 is presented in the sidebar table.

Winters are mild and semi-arid. The growing season averages 265 days. Cotton, potatoes, grapes, and cattle are the main agricultural products in the valley. Severe freezes seldom occur and in some years no frost occurs at all. Snow rarely falls in the valley. Tule fog frequents the valley in December and January. This fog occurs when marine air is trapped in the valley by a high pressure system. Extreme fog can last continuously for two or three weeks.

Summers in Bakersfield are hot and dry with minimal breezes.
Water supply

Water supply for the City of Bakersfield is provided through both groundwater and surface water. Each type of water supply has several sources.

**Groundwater**
- Natural Recharge
- Canal Seepage
- Spreading Basins
- Reclaimed Water

**Surface Water**
- Kern River
- Central Valley Project
- State Water Project

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**groundwater**

The City of Bakersfield rests above a series of water bearing aquifers. These water bearing aquifers are part of the larger groundwater basin called the Southern San Joaquin Groundwater Basin.

The primary groundwater aquifer below Bakersfield is made up of unconsolidated sediments. These sediments are bordered by faults or mountain ridges to the east, west, and south. These geologic features serve as effective barriers to groundwater movement to or from these directions.

The goal for water resource management is to reach a condition of "safe yield" for the groundwater basin. "Safe yield" occurs when the amount of water pumped from the basin is less than or equal to recharge into the basin.

Sources of recharge include:
- Kern River channel
- runoff,
- canal seepage,
- spreading/banking and
- wastewater reclamation.
Natural recharge is provided by precipitation runoff, which is defined as the amount of melted snow and rainwater measured after evaporation, evapotranspiration, and percolation. Runoff from the Sierra Nevada Mountains feeds the Kern River. Precipitation falling within the City of Bakersfield may not reach the Kern River. The City operates a series of drainage basins or "sumps". Stormwater collected in these basins percolates to the groundwater or evapotranspirates. An average of about 24,000 acre-feet of this runoff occurs yearly. This contributes about 12% to the City of Bakersfield's total water supply.

Canal seepage is defined as the amount of water that percolates into the ground from earthen canals. When added with seepage from the Kern River channel, it contributes more than half the City's water supply at an average of 54%, or about 106,000 acre-feet each year.

Current and anticipated water shortages in the Southwestern United States have caused recycled wastewater, or reclaimed water, to be viewed as a valuable resource in water supply. Effluent produced from the City's two wastewater treatment plants is used in land application. Land application of reclaimed water to non-edible crops for irrigation is considered one of its most beneficial uses, providing both water and nutrients to enhance plant growth. The City of Bakersfield obtains about 10% of its total water supply from reclaimed water, at an average of 20,000 acre-feet per year.
spreading and banking

Percolation of water spread in open basins has been historically used in Kern County as a means of banking groundwater. The City owns and operates the 2800 Acre recharge facility used to replenish water to the groundwater aquifers. It was included with the acquisition of Kern River water rights by the City. This site is 6 miles long and includes old river channels, overflow lands, and constructed spreading basins. It is located in and along the Kern River Channel approximately 8 miles west of Highway 99. The facility receives surface water supplies during years when surpluses exist. Sources include the Kern River, the Central Valley Project, and the State Water Project.

Depth to Water (ft)

20-Year Operation 1977-1997

The groundwater is recharged in this facility by using spreading basins, which look like small lakes surrounded by levees. The city began spreading water into the “2800 Acres” in 1978 through the use of one basin and a number of temporary embankments. Additional basins have since been constructed, increasing the number of acres available for water spreading and recharge. More than 1,000,000 acre-feet of water has been spread within the facility since its inception.

The 2800 Acre recharge facility improves groundwater quality by recharging low salinity Kern River water into the aquifers. This dilutes the more saline irrigation water that percolates underground from adjacent farming operations. The underground reservoir can be pumped in dry years for agricultural and domestic use. In wet years, the reservoir can be built up. This allows water to be used without causing a groundwater overdraft problem.

The facility is a valuable resource to the City in providing a reliable water supply during dry years. An average of 22,000 acre-feet of water is banked annually in the facility, which provides about 11% to the City’s total water supply.
Groundwater and surface water supplies

Water sources are usually categorized as either groundwater or surface water. However, recharge of groundwater supplies is very dependent on surface water as shown below.

The wet year/dry year cycle can have a significant impact on recharge. The category which may be most noticeably impacted is groundwater banking.

Surface water

Three surface water supplies are available to the City of Bakersfield:

- Kern River,
- State Water Project, and
- Central Valley Project
The Kern River originates in the vicinity of Mount Whitney. The river drains a 2,420 square mile area in the Sierra Nevada Mountains. River water has been sharply managed since the 1954 Army Corps of Engineers construction of the Isabella Dam. The primary purpose for the dam is flood control; however, the reservoir behind the dam provides a key reserve. The usable capacity of the reservoir is 568,075 acre-feet. The Kern River enters the San Joaquin Valley through the Kern River Canyon. With the exception of very wet years, there is no flow in the river past Bakersfield due to upstream canal diversions. During very wet years, water flows in the river southwest to Buena Vista Lake Bed and then north to Tulare Lake or into the California Aqueduct Intertie near Tupman.

As a result of the purchase of water rights from Tenneco West, Inc., the City owns an average annual entitlement to more than 140,000 acre-feet of Kern River water.

supplemental surface water supplies

The California State Water Project (SWP) is an extensive network of reservoirs, aqueducts, power plants and pump stations. The main function of the SWP is to manage water supply, storing surplus water during wet periods and distributing it to service areas throughout California.

The Federal Central Valley Water Project provides irrigation water to the Central Valley through the Friant-Kern Canal System. It also contributes to urban water supply, water quality, flood control, power, recreation, and fish and wildlife enhancement throughout central and northern California. Many of its facilities were developed to be used jointly with the California State Water Project.

Existing SWP facilities can supply approximately 2.4 million acre-feet of water each year. This system could ultimately be expanded to provide 4.2 million acre-feet per year.
The bar graph and pie chart below present historical water supply over the past twenty years. The "treatment plant" category represents the metered water supplies from the Kern County Water Agency (KCWA) and the California Water Service Co. treatment plants. "Reclaimed water" and "banking" values are similarly based on metered flows. "Canal and river seepage" and "runoff" are calculated based on historical gauge readings and precipitation records respectively.

These historical values show trends of steadily increasing development of the treated water supply and reclaimed water spreading. The figure below also shows the impact of a drought period on the available supply.
Water demand and outflow

Water demand can be calculated by a water utility in several different ways: meters for individual residents or businesses, meters for subdivisions and other subregions or meters on the delivery system. This latter approach includes flow metering on pumps or gravity pipelines into the service area. This is the approach which has been used to calculate demand for this analysis.

There are three types of metered delivery systems in the City of Bakersfield which have been used to calculate water demand:

- Groundwater wells
- 2800 Acre Wells
- Surface Water Treatment Plant

These demand points are shown in the graphic at left.

Well production

Well production is the total amount of water pumped from municipal, purveyor, commercial, and individual wells within the City. The City is currently provided water by the City’s own Ashe Water Company, the Vaughn Mutual Water Company, and the California Water Service Company. Well production data is not available for Ashe Water before 1983. Therefore, for the years 1977 through 1982, the well production for the Ashe Water Company was estimated using an average acre-foot per customer. Also, the Vaughn Mutual Water Company only had two wells producing in the City which began in 1994. Before this time, the Vaughn Mutual Water Company had no wells within the city limits. The average well production is 58,138 acre-feet per year. Well production in 1995 was 75,789 acre-feet. The current well production is increasing an average of 2,200 acre-feet per year.

2800 acre extractions

The City has first priority to spread its water in the 2800 Acre Recharge Facility. However, the City permits other water districts and agencies having surplus water to spread, percolate, and later recover their own water in the 2800 Acres. At this time, the City has spreading and extraction agreements with many districts and agencies. These extractions must be used in the San Joaquin Valley for irrigation, light commercial or industrial, and municipal or domestic purposes. These extractions account for an average of 12,947 acre-feet per year.
surface water production

Surface water from the Kern River, California State Water Project or Central Valley Water Projects must be treated prior to distribution. There are currently two surface water treatment plants in the metropolitan Bakersfield area:

- **Henry Garnett Water Treatment Plant:**
  This facility is owned and operated by the Kern County Water Agency ID4. The plant treats combinations of Kern River, California Water Project and Central Valley Project supplies. The facility has a nominal peak capacity of 37.5 mgd. Treated water is distributed to customers inside and outside the City of Bakersfield boundaries.

- **California Water Service Co. Filtration Plant:**
  This 1.5 mgd water treatment plant is now owned and operated by the California Water Service Co. The plant was built and operated by Olcese Water District with California Water Service Co. assuming ownership in 1999. The facility treats only Kern River water.

Each plant uses a combination of chemical addition, settling, filtration and disinfection to produce water of acceptable quality. The plants have produced an average of 24,000 acre-feet of water annually, a portion of which accounts for 12% of the City’s total water supply.

The location of these two facilities is shown on the map above.

A third water treatment plant is planned for the next five years. This new water treatment plant will be constructed and operated by the California Water Service Company. This facility will treat Kern River water and distribute it to City of Bakersfield residents in the growing northeast area of the City.

The pie chart and the bar graph at left present historical water demand over the past twenty years. The "treatment plant" category represents the metered water supplies from the Kern County Water Agency (KCWA) and the former Olcese Water District treatment plants. "Well production" and "2800 Acre extractions" values are based on recorded pumping rates.
Water balance

historical water balance

The table at right compares the inflow (water supply) and outflow (water demand) for the City of Bakersfield from 1977 through 1995. This data shows that the inflow exceeded the outflow for all but the three years during the drought period during the early 1990's. The impacts of this drought period were buffered by the City's surface water storage behind Isabella Dam and the introduction of banked water to the groundwater distribution system.

Conservation of water supply through the City's long term program for banking excess water through the 2800 Acres Recharge Facility is a key in maintaining the water balance. The chart below compares average use (demand) with the available supply. On average, there is an excess supply of 95 thousand acre-feet per year. The 2800 Acre program allows the City to retain a portion of that water for future system reliability.

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Note: All values in acre-feet.

effect of groundwater migration

The Southern San Joaquin Groundwater Basin in the vicinity of Bakersfield is essentially contained by geologic boundaries on three different sides. However, it is possible that groundwater can migrate in a northwesterly direction. This migration has never been quantified. The graph at left shows the impact of approximately 50,000 acre-feet per year of migration. Although the actual amount of migration is uncertain it should be noted that the inflow into the groundwater basin has exceeded the outflow. This is evidenced by the rise in groundwater levels (see graph on page 7).
This Water Balance Report has shown that the available water supply has historically been able to meet the water demand in the City of Bakersfield. The City Water Resources Department has also evaluated the ability of the water supply system to meet future water demands as the City grows. Water demands are generally projected as a function of increasing population. The 1998 population of the City of Bakersfield is in excess of 220,000; the City’s Planning Department has projected the 2020 population at 365,600.

Forecasting future water demand typically considers other factors in addition to population growth. Overall water use tends to decrease over time as increased emphasis is placed on both conservation and on recycling. The City has developed a conservative water demand projection based on current usage patterns. The projected water demand shown below is based on the current annual average water consumption rate of 325 gallons per capita day.

This graph shows that the projected water demand in the year 2020 is significantly less than the average annual water supply which has been available over the past 20 years. This graph also indicates that that the projected water demand will be greater than the imported water supply if the dry year conditions of 1977 occur again. The City has planned for this event through the development of its groundwater banking program.
drought planning

water balance
during drought conditions

Tables presented in this report have shown that during the dry years from 1990 to 1992 the water outflow for the City of Bakersfield exceeded the water inflow. These conditions are typical for communities throughout the southwestern United States. The graph below shows the annual average fluctuation in flow conditions for the Kern River.

This graph identifies the cycles of wet/dry years which Bakersfield has experienced over the past century.

Most water utilities in the arid Southwest have developed “Drought Management Plans”. These tools may include water usage restrictions, distribution of water conservation devices such as low flow shower heads, and stringent price controls. The City of Bakersfield's own planning includes such measures for prolonged drought conditions. However, the primary element of the City’s “drought management” plan is the banked groundwater. The graph below shows the relative accumulation of banked groundwater from 1977 through 1997.

This graph shows that the current "banked" groundwater is over three times as great as the collective shortfall from 1990 to 1992.

* This does not reflect the net water loss due to groundwater migration
The City of Bakersfield requires adequate, dependable and high quality water for the future of the urban area. Acquisition of water properties and water rights from Tenneco West was a major step for the City of Bakersfield in tending to long term water supply for its citizens. The development of the 2800 Acres Recharge Facility has been another important feature of the City's long term program. The City is continuing to be proactive in water supply planning. Recent achievements include the following:

- Completion of a 10 million gallon storage tank that links high quality Kern River water into the drinking system.
- Created a public/private partnership to construct and operate a new water treatment plant in northeast Bakersfield to serve Kern River water to new and existing urban developments.
- Implemented a Water Management Plan to increase flows in the river channel through the Kern River Parkway to complement Parkway activities and increase groundwater aquifer recharge.
- Enhanced the Reclaimed Water Program with the acquisition of additional farm land for the use of recycled water for irrigation of crops, decreasing the reliance of those lands on the shared groundwater basin.

- Started a phased program to upgrade and replace mechanical and electronic components of drinking water delivery systems to assure reliable water pressures and flows are available to consumers under all conditions.

Established in 1890, Kern County Canal & Water Company was the parent company representing 16 incorporated and 9 private canal companies. At its peak, K.C.C. & W. Co. operated over 800 miles of canals delivering Kern River water to more than 300,000 acres surrounding the original Bakersfield Townsite.

1870's → 1890 → 1906 → 1967 → 1976
J.B. Haggin K.C.C. & W KERN COUNTY TENNECO CITY OF
& Associates Company Land Company West, Inc. BAKERSFIELD

"This plaque hangs in the hallway of the City of Bakersfield Water Resources building as a tribute to the succession of ownership of the Kern River water rights the City owns and uses today"
CITY OF BAKERSFIELD,
California

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Alan E. Tandy

CITY ATTORNEY
Bart Thiltgen

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