Section 2 | Region Description

This section presents a regional description for the Antelope Valley Region, including location, climate, hydrologic features, land uses, water quality, population and demographic information, regional growth projections, and climate change information. The Antelope Valley Region Description emphasizes the combination of increasing population growth, the lack of adequate water-related infrastructure, the need to maintain existing water levels in the groundwater basin, and the opportunity to create a proactive growth strategy for the developing Antelope Valley Region. This description sets the stage for the issues and needs discussed subsequently in Section 3.

2.1 Region Overview

The 2,400 square miles of the Antelope Valley Region lie in the southwestern part of the Mojave Desert in southern California. Most of the Antelope Valley Region is in Los Angeles County and Kern County, and a small part of the eastern Antelope Valley Region is in San Bernardino County. Figure 2-1 provides an overview of the Antelope Valley Region. For the purposes of this IRWM Plan, the Region is defined by the Antelope Valley's key hydrologic features; bounded by the San Gabriel Mountains to the south and southwest, the Tehachapi Mountains to the northwest, and a series of hills and buttes that generally follow the San Bernardino County Line to the east, forming a well-defined triangular point at the Antelope Valley Region's western edge. The drainage basin (or watershed) was originally chosen as the boundary for the IRWM Plan because it has been used in several older studies such as "Land Use and Water Use in the Antelope Valley" by the United States Geological Survey (USGS) and "The Antelope Valley Water Resource Study" by the Antelope Valley Water Group. The area within the boundary also included key agencies dealing with similar water management issues such as increasing population, limited infrastructure, and increasing pumping costs with shared water resources and, therefore, it was an appropriate boundary to define the Antelope Valley Region for this IRWM Plan.

On November 23, 2009, the Antelope Valley Region successfully completed the Region Acceptance Process (RAP) with DWR. The RAP was the first step in becoming eligible for Prop. 84 grant funding and the process helped to further define certain aspects of the Region. Specifically, the RAP provides documentation of contact information, governing structure, RWMG composition, stakeholder participation, DAC participation, outreach, stakeholder decision-making, geographical boundaries and other features, water management issues, water-related components, and relationships with adjacent Regions. The Region boundary shown in Figure 2-1 was determined during the RAP and represents the Antelope Valley watershed. Water demands within the Antelope Valley Region are supplied by a variety of water purveyors, including large wholesale agencies, irrigation districts, special districts providing water primarily for M&I uses, investor-owned water companies, mutual water companies, and private well owners. Water supply for the Antelope Valley Region comes from five sources: the SWP, local surface water runoff that is stored in Little Rock Reservoir, the Antelope Valley Groundwater Basin, recycled water, and captured stormwater. Development demands on water availability and quality, coupled with the potential curtailments of SWP deliveries due to prolonged drought periods and other factors, have intensified the competition for available water supplies. Consensus is needed to maintain a water resource management plan and strategy that addresses the needs of the M&I purveyors to reliably provide the quantity and quality of water necessary to serve the continually expanding Antelope Valley Region, while concurrently addressing the needs of agricultural users to have adequate supplies of reasonably-priced irrigation water.

Highway 14 connects Los Angeles to the expanding communities of the Antelope Valley.

2.2 Location

As discussed above, the Antelope Valley Region encompasses most of the northern portion of Los Angeles County and the southern region of Kern County. The Region is located within the Lahontan DWR Funding Area. Bordered by mountain ranges to the north, south, and west and the hills and buttes along the east, the Antelope Valley Region is composed of the following major communities: California City, EAFB, Lancaster, Mojave, Palmdale, and Rosamond. Smaller communities include Boron, Lake Los Angeles, North Edwards, Littlerock and Quartz Hill. The communities are predominantly located in the eastern portions of the Antelope Valley Region.

The Lahontan Funding Area is bordered by the Tulare/Kern, Los Angeles-Ventura, Santa Ana, and Colorado River Funding Areas. Other Regions within the Lahontan Funding Area and adjacent Funding Areas are currently represented by, or are in the process of developing, IRWM Plans. These consist of the Mojave Water Agency IRWM Plan in the Lahontan Funding Area; the Fremont Basin IRWM Plan in the Lahontan Funding Area; the Upper Santa Clara River IRWM Plan in the Los Angeles-Ventura Funding Area; the Los Angeles IRWM Plan in the Los Angeles-Ventura Funding Area; and the Watersheds Coalition of Ventura County IRWM Plan, which includes the Ventura River, lower Santa Clara River and Calleguas Creek watersheds, also within the Los Angeles-Ventura Funding Area. These areas are shown in Figure 2-1 and Figure 2-2. “Funding areas” are large areas across the State that are designated by DWR; they are made up of smaller self-defined “Regions”.

The relatively small portions of the Antelope Valley that are located in San Bernardino County are served by the Mojave Water Agency (MWA) and were included in the MWA IRWM Plan. Thus demands from these areas and any proposed projects serving these areas were not accounted for in this IRWM Plan to avoid significant overlap with the MWA IRWM Plan. The MWA has submitted a letter of support for the Region boundary. Additionally the AVRWMG submitted a letter of agreement which acknowledges both the AV IRWM and Kern IRWM regional boundary overlap and the respective RWMG's for the IRWM regions will work collaboratively to address any issues of common interest in this area. Letters of Support and Agreement may be found at the www.avwaterplan.org website (under "Grants"). These IRWM Regions nearly surround the Antelope Valley Region, which means that the Antelope Valley IRWM Plan will play an integral role in completing watershed analyses for the Lahontan Funding Area and provide an important link to the neighboring Los Angeles-Ventura Funding Area. The collective efforts of these interconnected IRWM Plans will not only benefit their respective regions, but the watersheds of Southern California as a whole.

Figure 2-1: Neighboring IRWM Regions

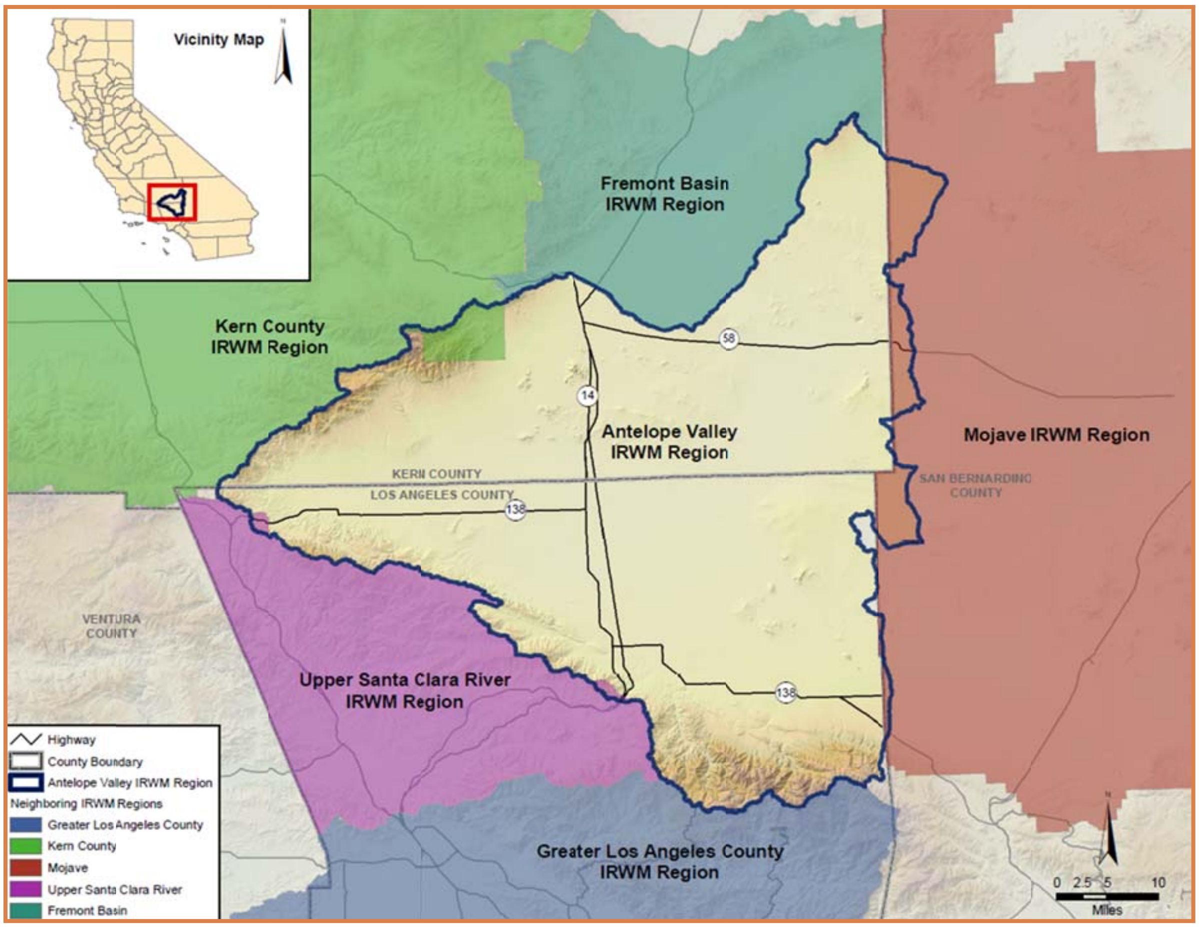
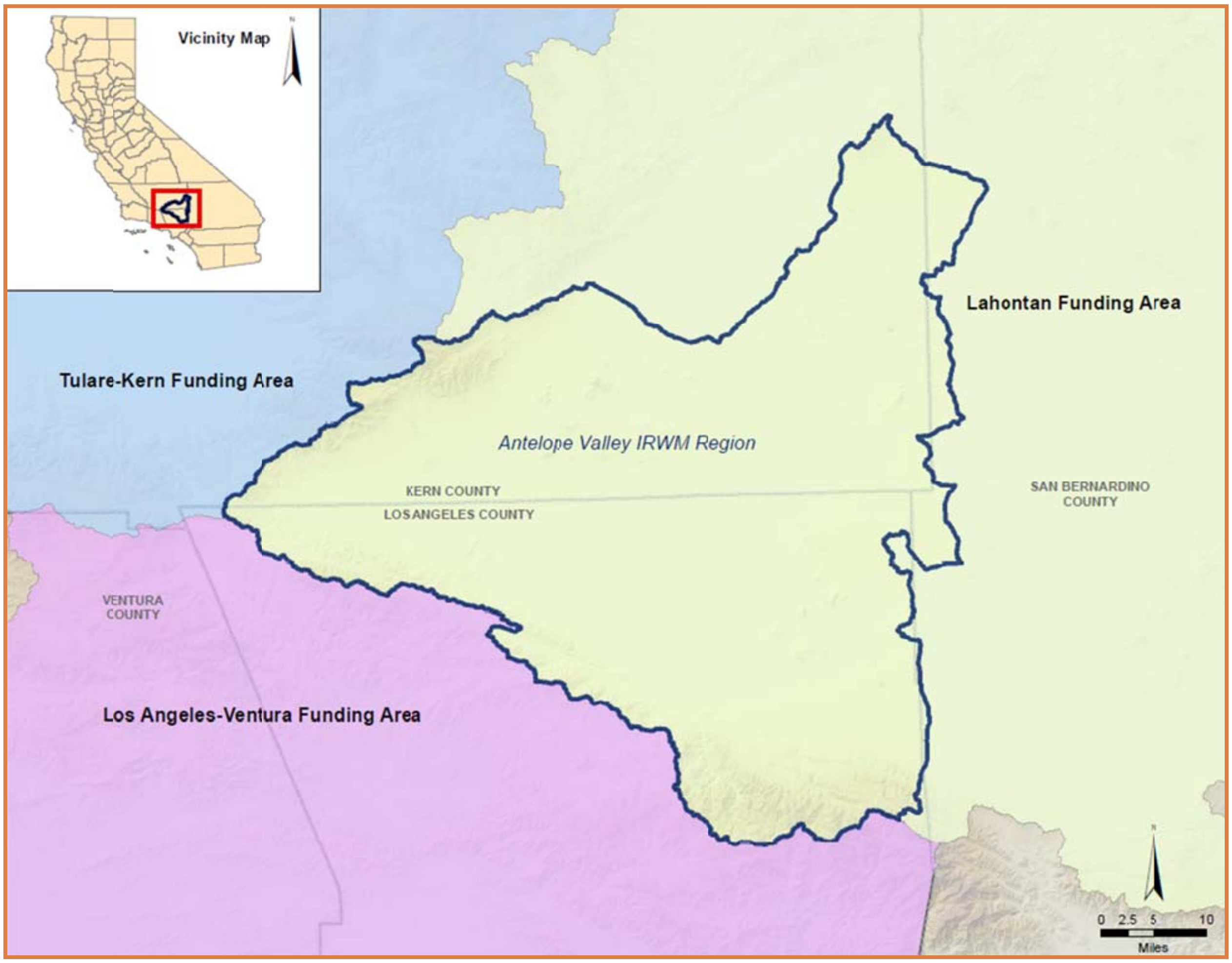


Figure 2-2: DWR IRWM Funding Areas



Four major roadways traverse the Antelope Valley Region. The Antelope Valley Freeway (State Route 14) and Sierra Highway both bisect the Antelope Valley Region from north to south. The Pearblossom Highway (Highway 138) traverses the southeastern and central-western portions of the Antelope Valley Region in an east-west direction. Highway 58 traverses the northern portion of the Antelope Valley Region in an east-west direction. Figure 2-3 shows the main Antelope Valley Service Districts, including counties, AVEK, EAFB, LACWD 40, LCID, PWD, Boron CSD, Mojave Public Utilities District, North Edwards Water District, West Valley County Water District, QHWD, RCSD, and mutual water companies. Figure 2-4 shows the Antelope Valley city boundaries, towns, flood control districts and sanitation districts. Both figures include the locations of the major roads, county lines, city lines, and Antelope Valley Region boundary.

2.3 Climate Statistics

Located in the southwestern portion of the Mojave Desert, the Antelope Valley Region ranges in elevation from approximately 2,300 feet to 3,500 feet above sea level. Vegetation native to the Antelope Valley Region is typical of the high desert and includes Joshua trees, saltbush, mesquite, sagebrush, and creosote bush. The climate is characterized by hot summer days, cool summer nights, cool winter days, and cool winter nights. Typical of a semiarid region, mean daily summer temperatures range from 63 degrees Fahrenheit (◦F) to 93◦F, and mean daily winter temperatures range from 34◦F to 57◦F. The growing season is primarily from April to October, though vegetation may begin to grow as early as January as the ground temperature increases.

Native vegetation includes the regal joshua tree.

Precipitation ranges from less than 4 inches on the valley floor to 20 inches in the mountains, running off the surrounding mountains through a number of canyons and watersheds. Most rainfall occurs between October and April, with little to no precipitation falling in summer months, meaning cultivated crops and non-native plants must rely heavily on irrigation. Annual variations in precipitation are important to the annual variations in applied water required for crop production and landscape maintenance. Rainfall records indicate that some runoff may be available for artificial groundwater recharge use (USGS 1995).

Figure 2-5, Annual Precipitation, summarizes the historical annual precipitation for the Antelope Valley Region, based on the data from EAFB. Table 2-1 and the following charts provide a summary of the Antelope Valley Region's climate. Climatic data is based on data collected from 1903 to 2012. Figure 2-6 and Figure 2-7 present the average maximum and minimum temperature and the average rainfall and monthly evapotranspiration (ETo) in the Antelope Valley Region, while Figure 2-4 presents average rainfall throughout the valley.

Table 2-1: Climate in the Antelope Valley Region

	Jan	Feb	Mar	Apr	May	Jun
Standard Monthly Average ETo (inches)[a]	2.02	2.61	4.55	6.19	7.30	8.85
Average Rainfall (inches)[b]	1.46	1.53	1.24	0.48	0.14	0.03
Average Max Temperature(ºF)[b]	58.5	62.1	67.4	74.0	81.9	90.2
Average Min Temperature (ºF)[b]	32.4	35.6	39.2	44.0	51.0	58.0

	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Standard Monthly Average ETo (inches)[b]	9.77	8.99	6.52	4.66	2.68	2.05	66.19
Average Rainfall (inches)[b]	0.05	0.15	0.19	0.33	0.67	1.36	7.62
Average Max Temperature(ºF)[b]	97.6	96.9	91.4	80.2	67.3	58.7	77.2
Average Min Temperature (ºF)[b]	65.3	63.9	57.6	48.1	38.1	32.7	47.2

Sources:
(a) CIMIS Data for Palmdale No. 197 Station since April 2005.
(b) Western Regional Climate Center, Palmdale Station (046624) for the Years 1903 to 2012.

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Figure 2-3: Antelope Valley Service Districts

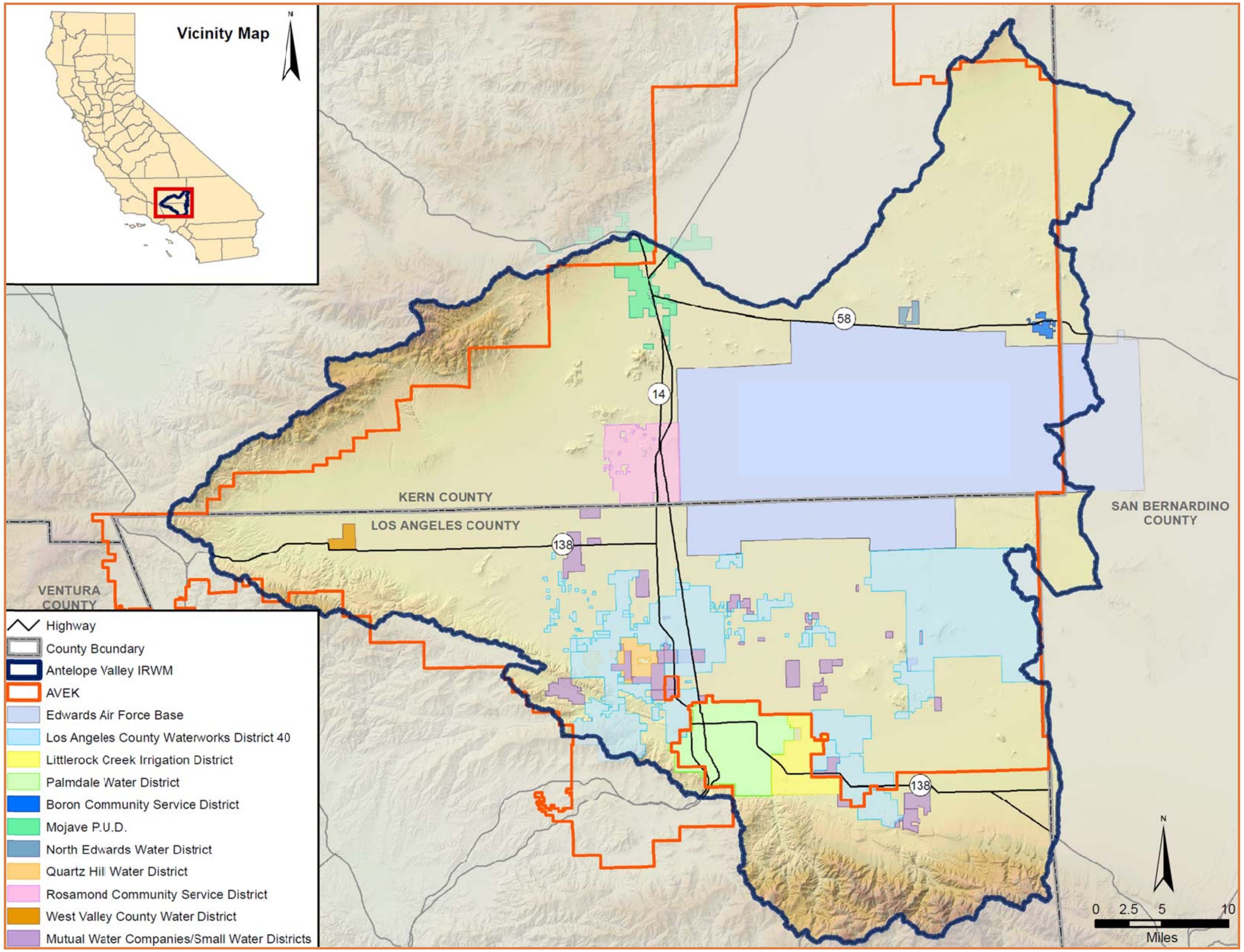


Figure 2-4: Antelope Valley City Boundaries and Special Districts

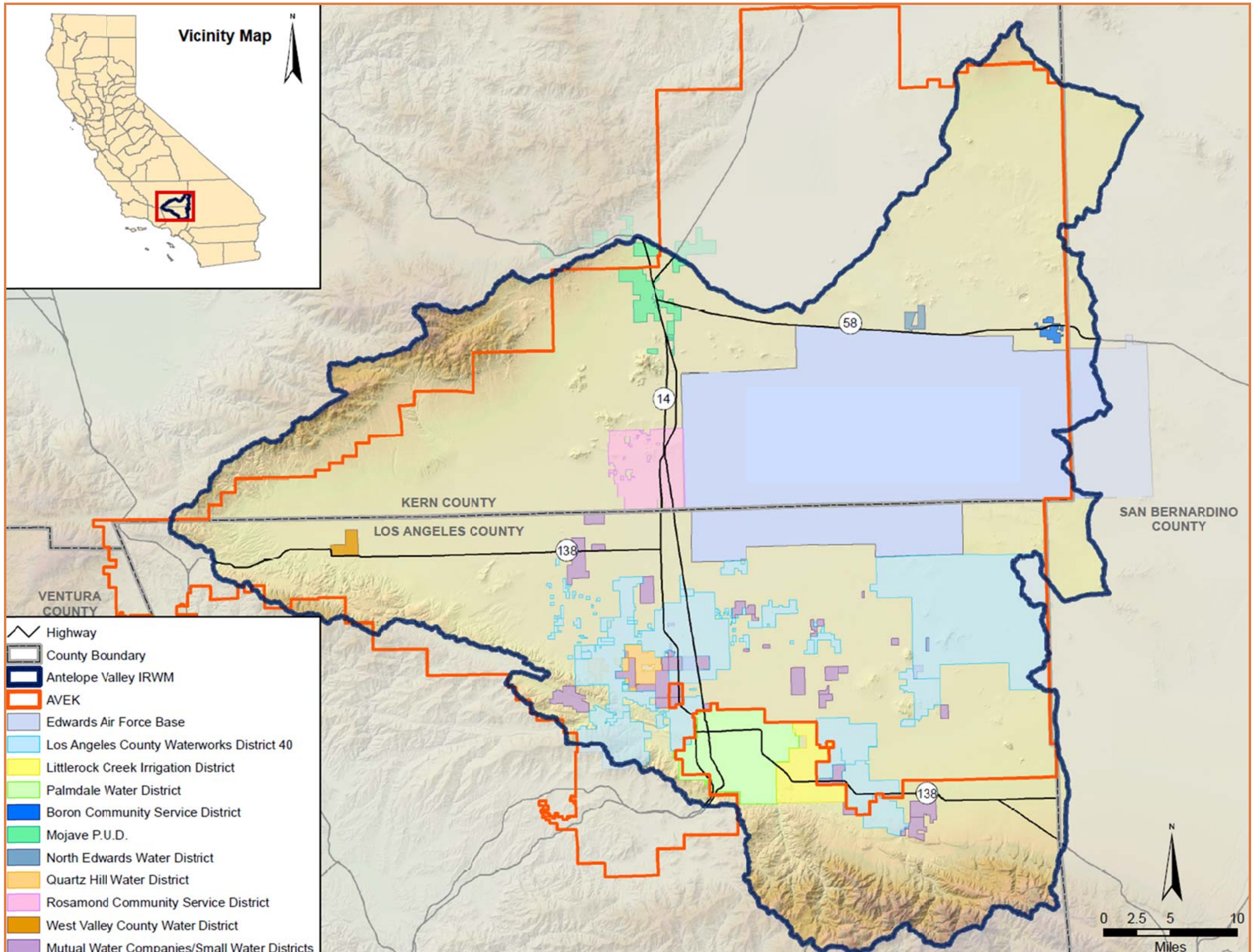
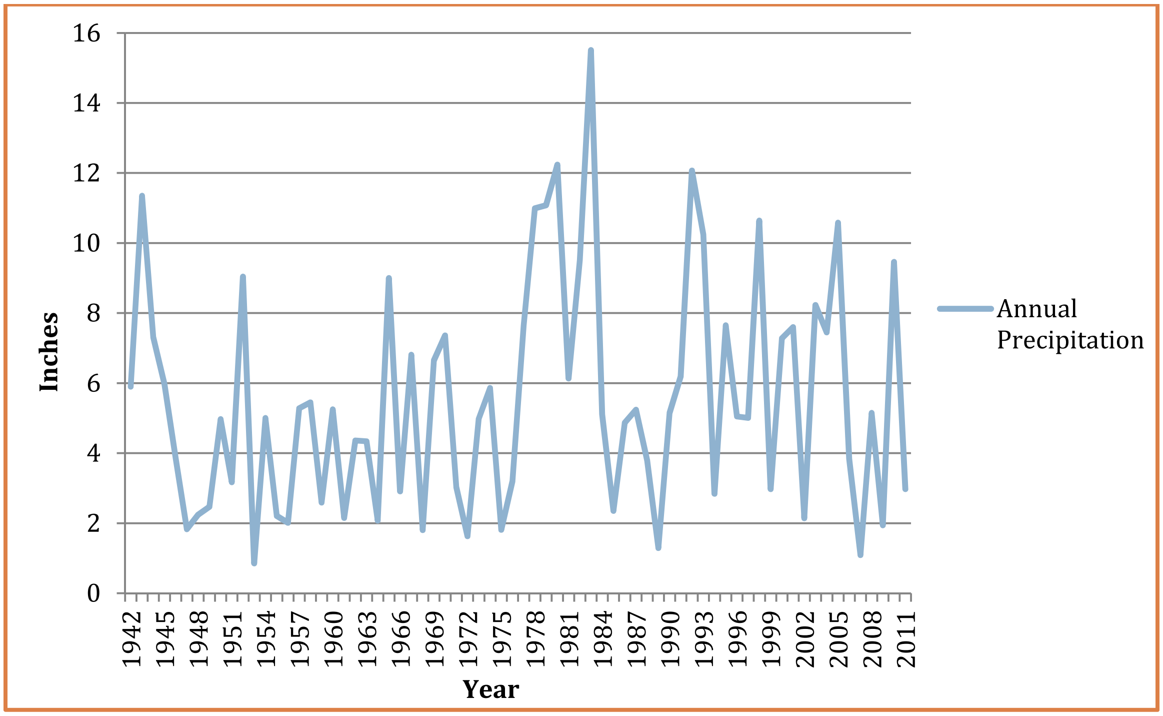
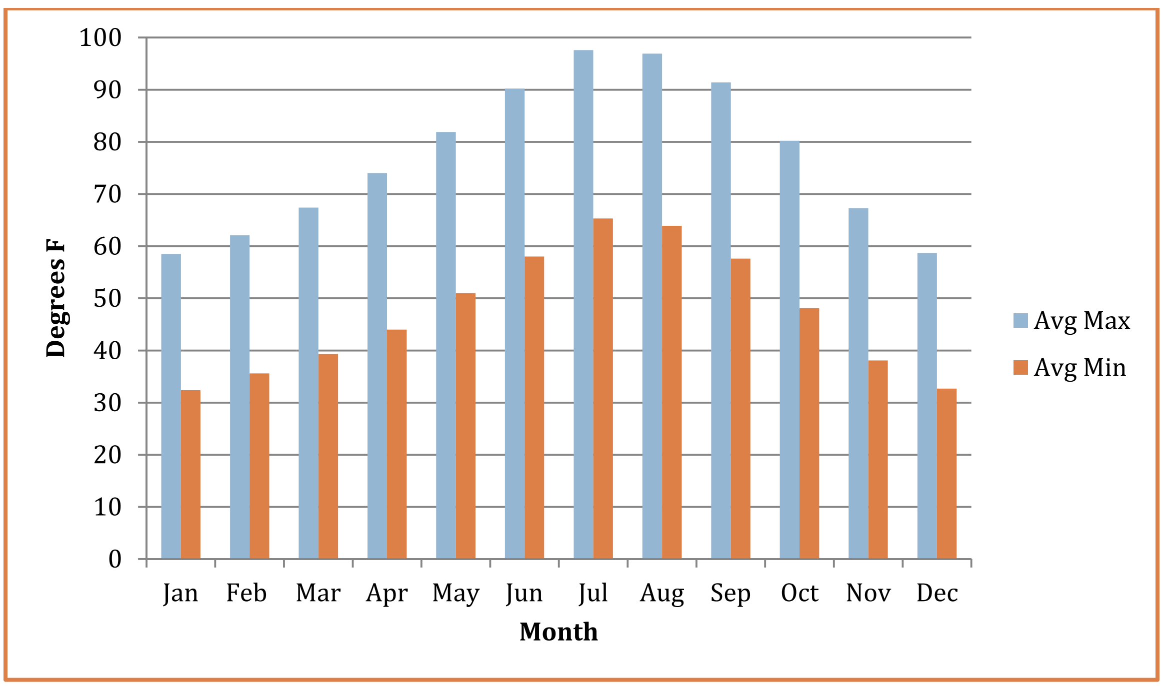


Figure 2-5: Annual Precipitation



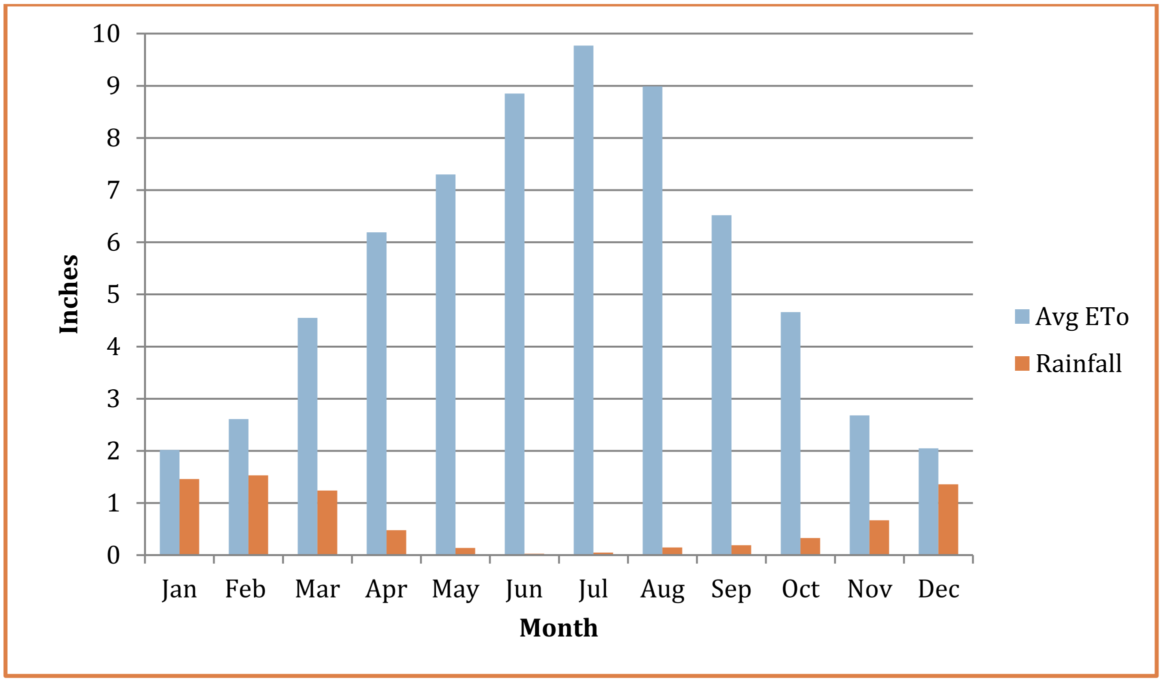
Source: 1942-2011 EAFB

Figure 2-6: Average Maximum and Minimum Temperature in the Antelope Valley Region



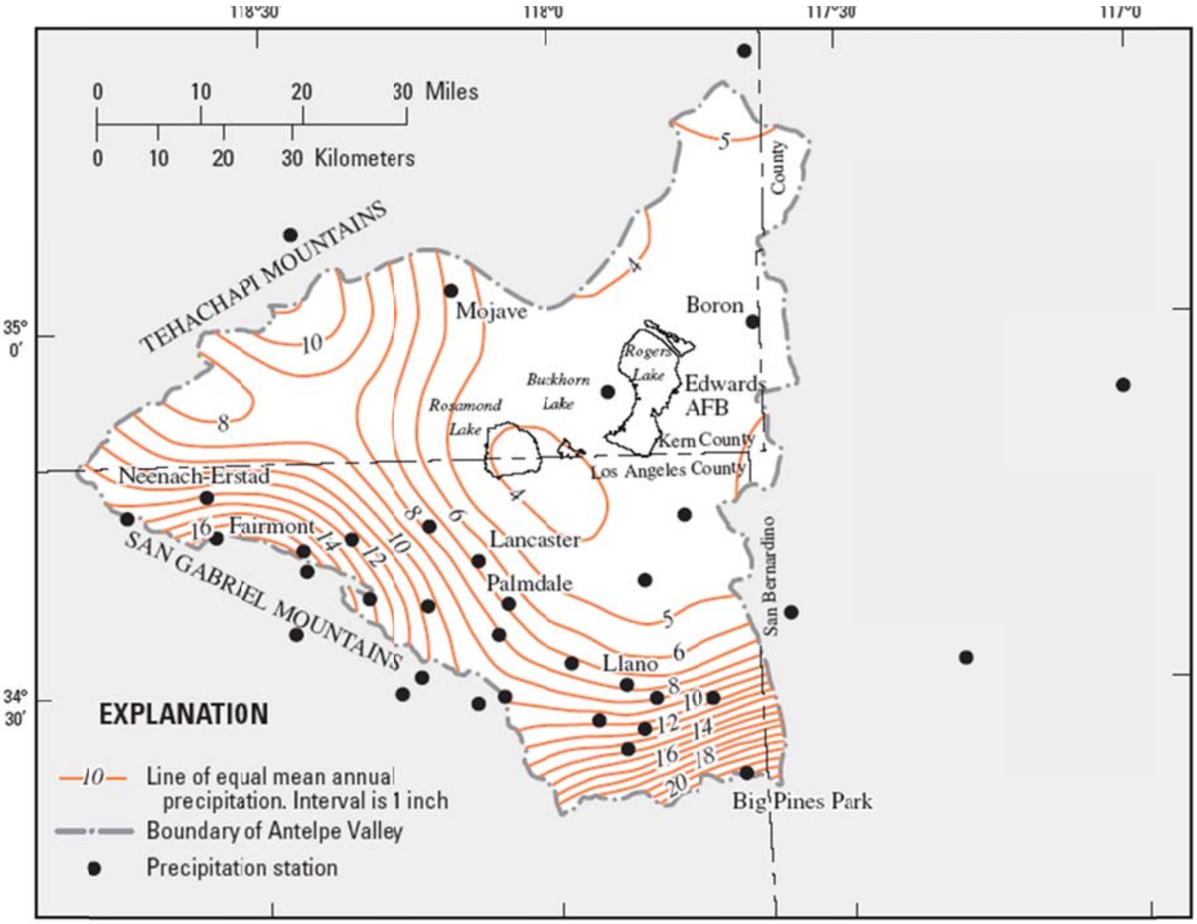
Source: Western Regional Climate Center, Palmdale Station (046624) for the Years 1903 to 2012.

Figure 2-7: Average Rainfall and Monthly Evapotranspiration (ETo) in the Antelope Valley Region



Source: CIMIS Data for Palmdale No. 197 Station since April 2005 and Western Regional Climate Center, Palmdale Station (046624) for the Years 1903 to 2012.

Figure 2-8: Map of Annual Precipitation for the Antelope Valley Region



Source: "Precipitation depth-duration and frequency characteristics for Antelope Valley, Mojave Desert, California" Author(s): Blodgett, J. C., Los Angeles County (Calif.), Geological Survey (U.S.) Sacramento, Calif. : U.S. Geological Survey ; Denver, CO : Earth Science Information Center, Open-File Report Section [distributor], 1996.

2.4 Hydrologic Features

The Antelope Valley Region is a closed topographic basin with no outlet to the ocean. All water that enters the Valley Region either infiltrates into the groundwater basin, evaporates, or flows toward the three dry lakes on EAFB: Rosamond Lake, Buckhorn Lake, and Rogers Lake. In general, groundwater flows northeasterly from the mountain ranges to the dry lakes. Due to the relatively impervious nature of the dry lake soil and high evaporation rates, water that collects on the dry lakes eventually evaporates rather than infiltrating into the groundwater (LACSD 2005). The surface water and some groundwater features of the Antelope Valley Region are discussed in more detail below and are depicted in Figure 2-9.

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Figure 2-9: Antelope Valley Hydrologic Features

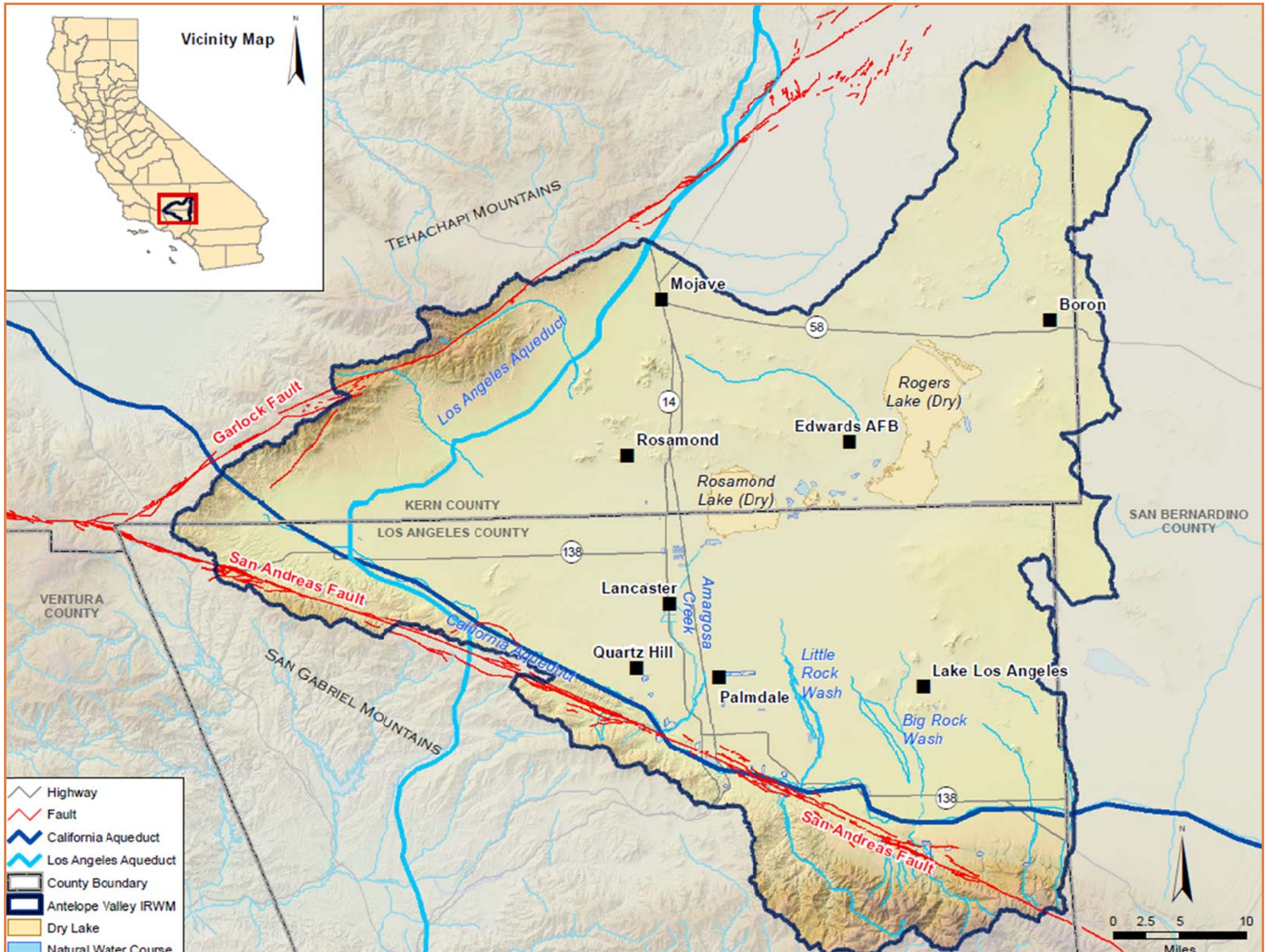
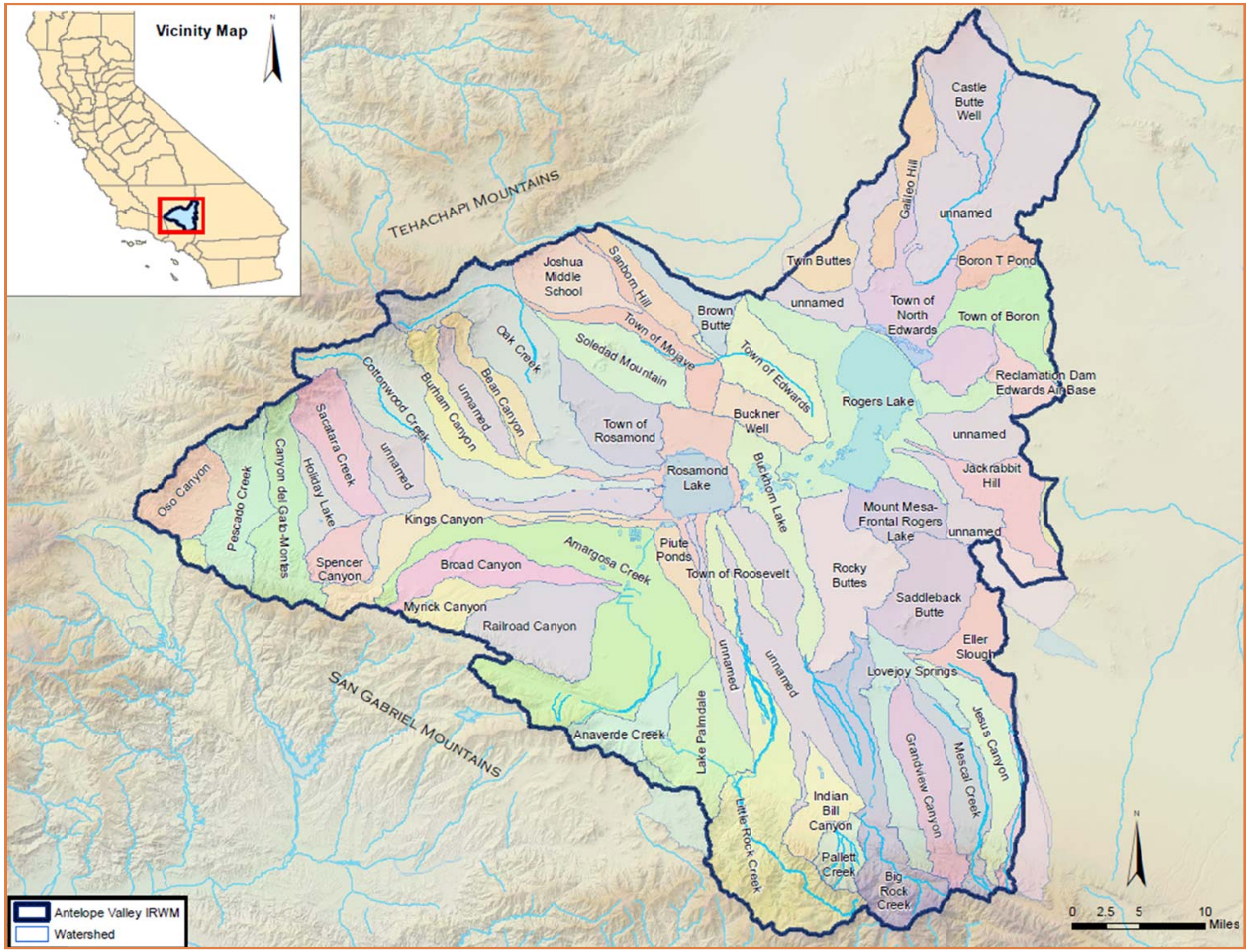


Figure 2-10: Antelope Valley Watersheds



2.4.1 Surface Water

Surface water flows are carried by ephemeral streams. The most hydrologically significant streams begin in the San Gabriel Mountains on the southwestern edge of the Antelope Valley Region and include Big Rock Creek, Little Rock Creek and Amargosa Creek from the San Gabriel Mountains; and Oak Creek and Cottonwood Creek from the Tehachapi Mountains. In addition, the fault lines surrounding the Valley form the Region's groundwater basin. These hydrologic features are shown on Figure 2-9.

2.4.1.1 Watersheds

The Antelope Valley's watersheds feed numerous ephemeral streams that originate in the surrounding mountains and meander across the alluvial fans that make up the valley floor. Stormwater runoff that doesn't percolate into the ground eventually ponds and evaporates in the dry lake beds on the Valley floor. There are a number of canyons and watersheds in the Valley, including Osos Canyon, Pescado Creek, Canyon del Gato-Montes, Sacatara Creek, Spencer Canyon, Kings Canyon, Cottonwood Creek, Burham Canyon, Bean Canyon, Oak Creek, Amargosa Creek, Railroad Canyon, Anaverde Creek, Little Rock Creek, Indian Bill Canyon, Pallett Creek, Big Rock Creek, Grandview Canyon, Mescal Creek, and Jesus Canyon. The most significant streams in the Valley begin in the San Gabriel Mountains on the southwestern edge of the Valley, and include Big Rock Creek, Little Rock Creek, and Amargosa Creek. Together, these streams drain an area of approximately 330 square miles. Surface water flows in Little Rock Creek are captured at Little Rock Reservoir, which is discussed further below. Big Rock Creek and Amargosa Creek are not diverted for supply at this time. The two major watersheds that begin in the Tehachapi Mountains, Oak Creek and Cottonwood Creek, drain an area of about 160 square miles. The Valley's watersheds are shown in Figure 2-10 and collectively drain the entire 2,400 square miles of the Region.

2.4.1.2 Little Rock Reservoir

Little Rock Creek is the only developed surface water supply in the Antelope Valley Region. The Little Rock Reservoir, jointly owned by PWD and LCID, collects runoff from the San Gabriel Mountains. As of 2005, the reservoir's useable storage capacity was estimated at 3,500 AF of water, reduced from its original design capacity of 4,300 AF due to the deposition of sediment. It is assumed that on average, 54,000 cubic yards of sediment are deposited in the reservoir per year (Aspen Environmental Group, 2005.) One of the priority projects in the 2013 IRWM Plan proposes to remove accumulated sediment from behind the dam (see Section 7).

Historically, water stored in the Little Rock Reservoir has been used directly for agricultural uses within LCID's service area and for M&I uses within PWD's service area following treatment at PWD's water purification plant. PWD and LCID jointly hold long-standing water rights to divert 5,500 AFY from Littlerock Creek flows per an agreement between the two districts. LCID has not exercised its right to surface water diversions since 1994 and has made those rights available to PWD by agreement for a 50-year period.[1]

2.4.1.3 Dry Lakes and Percolation

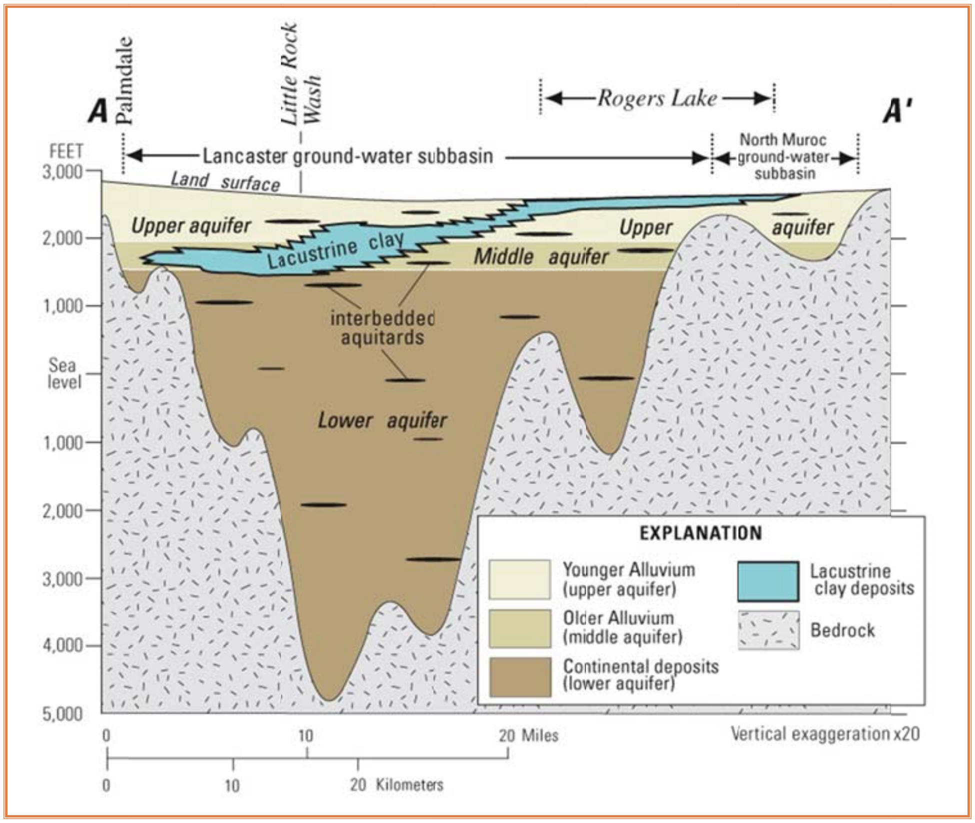
Surface water from the surrounding hills and from the Antelope Valley Region floor flows primarily toward the three dry lakes on EAFB. Except during the largest rainfall events of a season, surface water flows toward the Antelope Valley Region from the surrounding mountains, quickly percolates into the stream bed, and recharges the groundwater basin. Surface water flows that reach the dry lakes are either used by the natural vegetation on the lake beds, or are lost to evaporation. It

[1] *2010 Urban Water Management Plan,* PWD, June 2011.

appears that little percolation occurs in the Antelope Valley Region other than near the base of the surrounding mountains due to impermeable layers of clay overlying the groundwater basin, though further investigations would be necessary to confirm the locations of impermeable areas. See Figure 2-11 for a sample cross-sectional illustration of the clay layer as it is positioned between the upper and lower aquifers in the Antelope Valley Region.

Previous USGS estimates indicate that approximately 5 percent of the precipitation that falls in the Antelope-Fremont Valley each year percolates to the groundwater basins, while the remaining water is lost to evaporation (USGS, 1987).

Figure 2-11: Cross Sectional View of the Clay Layer Between the Upper and Lower Aquifers in the Antelope Valley Region



Source: USGS 2000b

2.4.1.4 Geology and Soils

The Antelope Valley represents a large topographic area and groundwater basin in the western part of the Mojave Desert in southern California. It is a prime example of a single, undrained, closed basin, and it is located at an approximate elevation of 2,300 to 2,400 feet above mean sea level. These elevations represent the surface areas overlying the groundwater basin only and do not include the larger area overlying the entire watershed (i.e., Region). In other words, the watershed has a larger "footprint" than the groundwater basin. The Antelope Valley Region occupies part of a structural depression that has been downfaulted between the Garlock, Cottonwood-Rosamond, and San Andreas Fault Zones. The Antelope Valley Region is bounded on the southwest by the San Andreas Fault and San Gabriel Mountains, the Garlock Fault and Tehachapi Mountains to the northwest, and San Bernardino County to the east. Consolidated rocks that yield virtually no water underlie the basin and crop out in the highlands that surround the basin. They consist of igneous and metamorphic rocks of pre-Tertiary age that are overlain by indurated continental rocks of Tertiary age interbedded with lava flows (USGS 1995).

Alluvium and interbedded lacustrine deposits of Quaternary age are the important aquifers within the closed basin and have accumulated to a thickness of as much as 1,600 feet. The alluvium is unconsolidated to moderately consolidated, poorly sorted gravel, sand, silt, and clay. Older units of the alluvium are somewhat coarser grained, and are more compact and consolidated, weathered, and poorly sorted than the younger units. The rate at which water moves through the alluvium, also known as the hydraulic conductivity of the alluvium, decreases with increasing depth.

During the depositional history of the Antelope Valley Region, a large intermittent lake occupied the central part of the basin and was the site of accumulation of fine-grained material. The rates of deposition varied with the rates of precipitation. During periods of relatively heavy precipitation, massive beds of blue clay formed in a deep perennial lake. During periods of light precipitation, thin beds of clay and evaporative salt deposits formed in playas or in shallow intermittent lakes. Individual beds of the massive blue clay can be as much as 100 feet thick and are interbedded with lenses of coarser material as much as 20 feet thick. The clay yields virtually no water to wells, but the interbedded, coarser material can yield considerable volumes of water.

Soils within the area are derived from downslope migration of loess and alluvial materials, mainly from granitic rock sources originating along the eastern slopes of the Tehachapi and San Gabriel Mountains. Additional detailed information on soil types and their distribution can be found in the Lancaster Water Reclamation Plant (WRP) 2020 Plan Final Environmental Impact Report (EIR). Figure 2-12 provides a soil map of the Antelope Valley Region.

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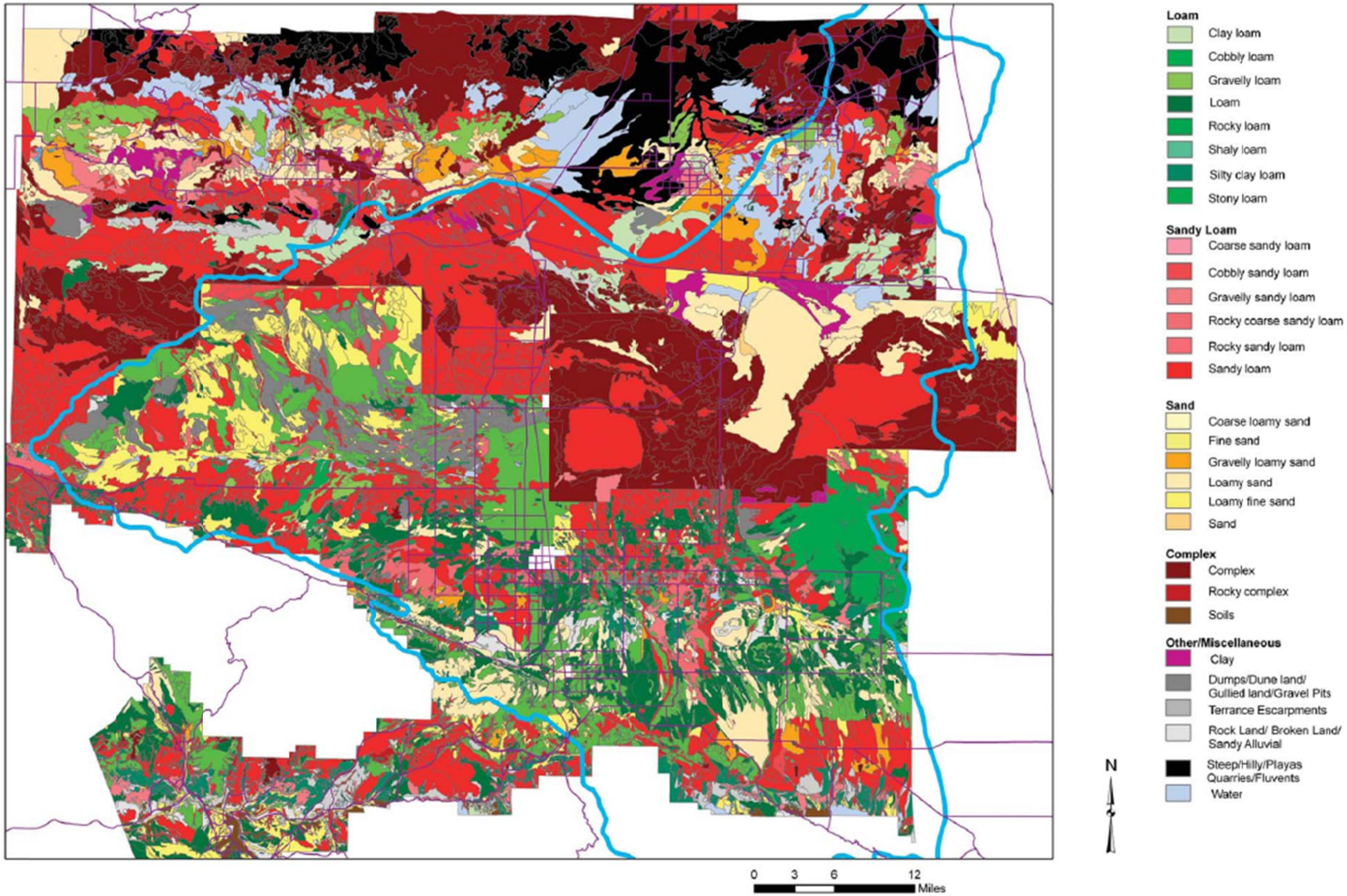
Figure 2-12: Antelope Valley Soils Map



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2.4.2 Groundwater

The Antelope Valley Groundwater Basin is comprised of two primary aquifers: (1) the upper (principal) aquifer and (2) the lower (deep) aquifer. The principal aquifer is an unconfined aquifer and historically had provided artesian flows due to perched water tables in some areas. These artesian conditions are currently absent due to extensive pumping of groundwater. Separated from the principal aquifer by clay layers, the deep aquifer is generally considered to be confined. In general, the principal aquifer is thickest in the southern portion of the Antelope Valley Region near the San Gabriel Mountains, while the deep aquifer is thickest in the vicinity of the dry lakes on EAFB.

Groundwater has been, and continues to be, an important resource within the Antelope Valley Region. Prior to 1972, groundwater provided more than 90 percent of the total water supply in the Antelope Valley Region; since 1972, it has provided between 50 and 90 percent (USGS 2003). Groundwater pumping in the Antelope Valley Region peaked in the 1950s (USGS 2000a), and it decreased in the 1960s and 1970s when agricultural pumping declined due to increased pumping costs from greater pumping lifts and higher electric power costs (USGS 2000a). The rapid increase in urban growth in the 1980s resulted in an increase in the demand for M&I water and an increase in groundwater use. Projected urban growth and limits on the available local and imported water supply are likely to continue to increase the reliance on groundwater.

Although the groundwater basin is not currently adjudicated, an adjudication process is underway. There are no existing restrictions on groundwater pumping, but pumping may be altered or reduced as part of the adjudication process. The adjudication process is discussed in more detail in Section 3 of this IRWM Plan.

2.4.2.1 Groundwater Subunits

The complex Antelope Valley Groundwater Basin is divided by the USGS into twelve subunits as shown on Figure 2-13. Groundwater basins are generally divided based upon differential groundflow patterns, recharge characteristics, and geographic location, as well as controlling geologic structures. The Antelope Valley Groundwater Basin's subunits are: Finger Buttes, West Antelope, Neenach, Willow Springs, Gloster, Chaffee, Oak Creek, Pearland, Buttes, Lancaster, North Muroc, and Peerless. The USGS mentions that groundwater levels in these subunits have improved in some areas due to the importation of SWP water to the Antelope Valley Region, and declined in others due to increased groundwater pumping. Each subunit has varying characteristics, and the current conditions in each subunit are briefly summarized below (USGS 1987).

Subunit Characteristics, listed generally from north to south and west to east (USGS 1987):

Finger Buttes: A large part of this subunit is in range and forest lands. Flow is generally from southwest to southeast. Depth to water varies, but is commonly more than 300 feet.

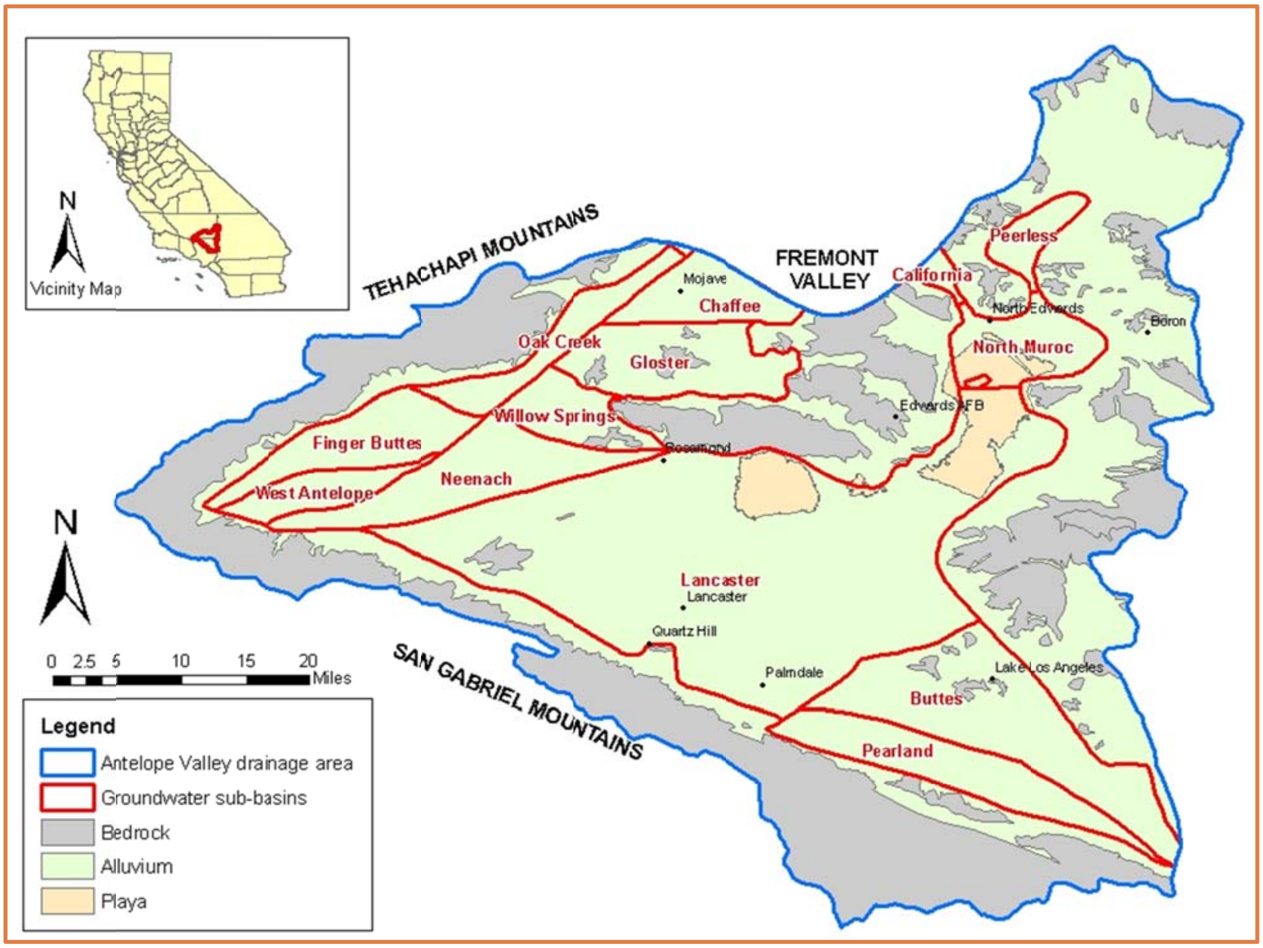
West Antelope: Groundwater flows southeasterly to become outflow into the Neenach subunit. Depth to water ranges from 250 to 300 feet.

Neenach: Groundwater flow is mainly eastward into the "principal" and "deep" aquifers of the Lancaster subunit. Depth to water ranges from 150 to 350 feet.

Willow Springs: Groundwater flows southeast and ultimately enters the Lancaster subunit. This subunit receives recharge for intermittent surface flows from the surrounding Tehachapi Mountain area. Depth to water ranges from 100 to 300 feet.

Gloster:	Groundwater flows to the east and southeast as outflow to the Chaffee subunit. Depth to water levels for the southeast area of the subunit are 50 and 100 feet; other water level data is sparse.
Chaffee:	Groundwater moves into this subunit from Cache Creek, adjacent alluvial fans to the west and, in lesser amounts, from the Gloster subunit. Water moves eastward in the western part of the subunit, and northward in the southern part, generally toward the City of Mojave. Water levels range from 50 to 300 feet.
Oak Creek:	This unit is recharged by flows from the Tehachapi Mountains. Groundwater flows are generally to the southeast, with some southward flows toward the Koehn Lake area. Data for depth to water is not available.
Pearland:	Substantial recharge to this subunit comes from Littlerock and Big Rock Creeks. Groundwater generally moves from southeast to northwest, with outflow to the Lancaster subunit. Water levels range from 100 to 250 feet.
Buttes:	Groundwater generally moves from southeast to northwest, with outflow to the Lancaster subunit. Depth to water ranges from 50 to 250 feet.
Lancaster:	This is the largest and most economically important subunit, in both size and water use. Due to the use of this subunit, depths to water levels vary widely, being generally greater in the south and west. Pumping depressions can be observed in various locations. There are two major aquifers in the subunit, the “principal” and “deep” aquifers, separated by clay layers. As noted above, groundwater moves into the subunit from the Neenach, West Antelope and Finger Buttes subunits. Groundwater also moves into the principal aquifer from the Buttes and Pearland subunits. The Lancaster subunit underlies Lancaster, Palmdale, Quartz Hill, Rosamond, Antelope Acres and other smaller communities.
North Muroc:	This unit underlies part of the Rogers Lake and EAFB area. Groundwater moves north and west, then north again and possibly into the Peerless subunit. Data on depth to groundwater is not available.
Peerless:	Little information is available on this subunit, which cannot be clearly delineated, but represents the eastern limit of highly developed water-bearing deposits. As of the date of the USGS report, water levels had declined by as much as 150 feet and flow was toward a pumping depression.

Figure 2-13: Antelope Valley Groundwater Sub-Basin Boundary Map



Source: Draft Salt and Nutrient Management Plan for the Antelope Valley June 2013

2.4.2.2. Groundwater Quality

Groundwater quality is excellent within the principal aquifer but degrades toward the northern portion of the dry lake areas. Considered to be generally suitable for domestic, agricultural, and industrial uses, the water in the principal aquifer has a total dissolved solids (TDS) concentration ranging from 200 to 800 milligrams per liter (mg/L). The deeper aquifers typically have higher TDS levels. Hardness levels range from 50 to 200 mg/L and high fluoride, boron, and nitrates are problematic in some areas of the basin. Identification and characterization of salts and nutrients is necessary for assessing constituent loads and analyzing impacts on groundwater quality. Sources of salts and nutrients in the basin include imported water, recycled water, and several others. The following provides a brief description of some of the significant salts and nutrients in the Antelope Valley Watershed. Refer to Appendix G for a more detailed description of the constituents in the Antelope Valley Salt and Nutrient Plan.

Total Dissolved Solids: Salts in groundwater are typically measured by TDS, which is the overall mineral content. Most TDS sources are anthropogenic in nature and include agricultural runoff, point source water pollution, and industrial and sewage discharge. Inorganic sources include minerals commonly found in nature through the weathering and dissolution of rocks and organic material from decaying organisms, plants, and animals.

There are no known health effects associated with the ingestion of TDS in drinking water. However, high TDS concentrations can negatively impact sensitive crops and cause corrosion and scaling in pipes.

Chlorides: Chlorides are widely distributed in nature as salts of sodium (NaCl), potassium (KCl), and calcium ($CaCl_2$). Chlorides in groundwater are naturally occurring from weathering of rocks, negligible atmospheric deposition, and as result of human use and wastes. Sources of chloride from human use include food condiments and preservatives, potash fertilizers, animal feed additives, production of industrial chemicals, dissolution of de-icing salts, and treatment of drinking water and wastewater. Release of brines from industry processes, leaching from landfills and fertilized soils, discharge of wastewater from treatment facilities or septic systems affect chloride in groundwater.

As with TDS, there are no known health effects associated with the ingestion of chloride in drinking water. Chloride concentrations in excess of approximately 250 mg/L can affect taste. Also, elevated chloride concentrations have substantial negative impacts on sensitive crops and cause corrosion in pipes.

Nitrogen: Nitrogen is ubiquitous in the environment and an essential nutrient for crops. Nitrate is the primary form of nitrogen found in groundwater and is a principal by-product of fertilizers. Other sources of nitrate include land use activities such as irrigation farming of crops, high density animal operations, wastewater treatment, food processing facilities and septic tank systems.

Nitrogen in the nitrate/nitrite form poses health hazards for infants and pregnant women. High nitrate levels in drinking water can result in methemoglobinemia, commonly known as "blue baby syndrome" which is a condition characterized by a reduced ability of the blood to carry oxygen to organs and tissue.

Arsenic: Arsenic is an odorless and tasteless semi-metal element that occurs naturally in rocks and soil, water, air, and plants and animals. It enters drinking water supplies from natural deposits in the earth or from agricultural and industrial practices. Higher levels of arsenic tend to be found more in groundwater sources than in surface water sources. The demand on groundwater from municipal systems and private drinking water wells may cause water levels to drop and release arsenic from rock formations.

Arsenic is a concern in the Antelope Valley Region and has been observed in LACWD 40, PWD, and QHWD wells. Research conducted by the LACWD 40 and the USGS has shown the problem to reside primarily in the deep aquifer, and it is not anticipated that the existing arsenic problem will lead to future loss of groundwater as a water supply resource for the Antelope Valley Region.

Arsenic has been linked to cancer of the bladder, lungs, skin, kidney, nasal passages, liver, and prostate. Non-cancer effects of arsenic can include thickening and discoloration of the skin, stomach pain, nausea, vomiting; diarrhea; numbness in hands and feet; partial paralysis; and blindness.

Chromium: Chromium is an odorless and tasteless metallic element found naturally in rocks, plants, soil and volcanic dust, and animals. The most common forms of chromium that occur in natural waters in the environment are trivalent chromium (chromium-3) and hexavalent chromium (chromium-6).

Chromium-3 is an essential human dietary element and is found in many vegetables, fruits, meats, grains and yeast. Chromium-6 occurs naturally in the environment from the erosion of natural chromium deposits, and it can also be produced by industrial processes. There are demonstrated instances of chromium being released to the environment by leakage, poor storage or inadequate industrial waste disposal practices.

Drinking water standards have been set to protect consumers served by public water systems from the effects of exposure to chromium. On August 23, 2013, the California Department of Public Health (CDPH) proposed a maximum contaminant level (MCL) for chromium-6 of 10 ug/L (parts per billion). Completion of the rulemaking process may take up to 12 months after the proposal.

Fluoride: Fluoride compounds are salts that form when the element, fluorine, combines with minerals in soil or rocks. Some fluoride compounds, such as sodium fluoride and fluorosilicates, dissolve easily into ground water as it moves through gaps and pore spaces between rocks. Most water supplies contain some naturally occurring fluoride. Fluoride also enters drinking water in discharge from fertilizer or aluminum factories. Also, many communities add fluoride to their drinking water to promote dental health.

Exposure to excessive consumption of fluoride over a lifetime may lead to increased likelihood of bone fractures in adults, and may result in effects on bone leading to pain and tenderness. Children aged 8 years and younger exposed to excessive amounts of fluoride have an increased chance of developing pits in the tooth enamel, along with a range of cosmetic effects to teeth.

Boron: Naturally-occurring boron is usually found in sediments and sedimentary rock formations and rarely exists in elemental form. Other forms of boron include boric acid, borax, borax pentahydrate, anhydrous borax, and boron oxide. The principal uses for boron compounds in the United States include glass and ceramics, soaps and detergents, algicides in water treatment, fertilizers, pesticides, flame retardants, and reagents for production of other boron compounds. The major sources of free boron in the environment are exposed minerals containing boron, boric acid volatilization from seawater, and volcanic material. Anthropogenic inputs of boron to the environment are considered smaller than inputs from natural processes and may include: agriculture, waste and wood burning, power generation using coal and oil, glass product manufacture, use of borates/perborates in the home and industry, borate mining/processing, leaching of treated wood, and sewage/sludge disposal. Contamination of water can come directly from industrial wastewater and municipal sewage, as well as indirectly from air deposition and soil runoff. Borates in detergents, soaps, and personal care products can also contribute to the presence of boron in water.

The available data for boron support its ubiquitous presence in the ambient environment. Based on the concentrations of boron in the groundwater compared to the health risk level, boron does not present a health risk (US EPA 2008).

2.4.2.3 Groundwater Storage Capacity and Recharge

The total storage capacity of the Antelope Valley Groundwater Basin has been reported at 68 million acre-feet (MAF) (Planert and Williams 1995 as cited in DWR 2004) to 70 MAF (DWR 1975 as cited in DWR 2004). The groundwater basin is principally recharged by deep percolation of precipitation and runoff from the surrounding mountains and hills (see Figure 2-13 for a depiction of groundwater basin boundaries). Other sources of recharge to the basin include artificial recharge and return flows from agricultural irrigation, urban irrigation, and wastewater management activities. Depending on the thickness and characteristics of the unsaturated zone of the aquifer, these sources may or may not contribute to recharge of the groundwater. As previously stated, precipitation over the Antelope Valley Region floor is generally less than 10 inches per year and ETo rates (along with soil requirements) are high; therefore, recharge from direct infiltration of precipitation on the Valley floor is considered negligible (Snyder 1955; Durbin 1978 as cited in USGS 2003). Estimates of the amount of recharge to the basin attributable to the types of recharge (other than mountain-front or precipitation infiltration) could not be found. As part of the current adjudication proceedings, the total sustainable yield (TSY) of the basin has been determined to be

110,000 AFY (i.e., natural recharge and return flows). A list of documents that reference estimates for TSY, natural recharge, and return flows are included in Appendix I. [2]

The basin has historically shown large fluctuations in groundwater levels. Data from 1975 to 1998 show that groundwater level changes over this period ranged from an increase of 84 feet to a decrease of 66 feet (Carlson and Phillips 1998 as cited in DWR 2004).

In general, data collected by the USGS (2003) indicate that groundwater levels appear to be falling in the southern and eastern areas of the Antelope Valley Region and rising in the rural western and far northeastern areas of the Antelope Valley Region. This pattern of falling and rising groundwater levels correlates directly to changes in land use over the past 40 to 50 years. Falling groundwater levels are generally associated with areas that are developed and rising groundwater levels are generally associated with areas that were historically farmed, but have been largely fallowed during the last 40 years. However, recent increases in agricultural production, primarily carrots, in the northeastern and western portions of the Antelope Valley Region may have reduced rising groundwater trends in these areas (LACSD 2005).

Though general trends exist, USGS data compiled by the City of Lancaster indicate that changes in groundwater levels have varied in different parts of the Antelope Valley between 1975 and 2011, with some areas experiencing decreases of over 30 feet and other areas experiencing increases of over 30 feet (Lancaster, 2011; USGS, 2013).

2.4.2.4 Groundwater Extraction

According to the USGS (2003), groundwater extractions have exceeded the estimated natural recharge of the basin during some periods since the 1920's. This overdraft has caused water levels to decline by more than 200 feet in some areas and by at least 100 feet in most of the Antelope Valley Region (USGS, 2003). Extractions in excess of the groundwater recharge can cause groundwater levels to drop and associated environmental damage (e.g., land subsidence). The Statement of Decisions for Phase Three Trial for the adjudication process has also determined that the groundwater basin is in overdraft and that overall, current extractions exceed recharge, though it also acknowledges that groundwater levels are increasing in some areas (Antelope Valley Groundwater Litigation (Consolidated Cases), Los Angeles Superior Court, Lead Case No. BC 325 201 (2011)).

Groundwater extractions are reported to have increased from about 29,000 AF in 1919 to about 400,000 AF in the 1950's, when groundwater use in the Antelope Valley Region was at its highest (USGS, 1995). Use of SWP water has since stabilized groundwater levels in some areas of the Antelope Valley Region. In recent years, groundwater pumping has resulted in subsidence and earth fissures in the Lancaster and EAFB areas, which has permanently reduced storage by 50,000 AF (DWR, 2004). Although an exact groundwater budget for the basin is not available, data estimates pertaining to groundwater production are available from the early 1900's through 1995. The most recent estimates from the adjudication process indicate that extractions are between 130,000 and 150,000 AFY based on the period between 1951 and 2005 (Antelope Valley Groundwater Litigation (Consolidated Cases), Los Angeles Superior Court, Lead Case No. BC 325 201 (2011)).

In the Lancaster basin, the groundwater generally moves northeasterly from the San Gabriel and Sierra Pelona Mountains to Rosamond and Rogers dry lakes. Heavy pumping has caused large groundwater depressions that disrupt this movement (LACSD 2005).

[2] The number for total sustainable yield (a portion of which is natural recharge) used in this 2013 IRWMP Update is selected strictly for long-term planning purposes and is not intended to answer the questions being addressed within the adjudication process.

2.5 Land Use

Figure 2-14 presents a map of major existing land use categories within the Antelope Valley Region, characterized and grouped together according to broad water use sectors. Land use is determined by the Region's counties and cities. The map was created with Los Angeles County and Kern County Planning Department Geographic Information System (GIS) parcel level data. Each major land use category is identified, below, including the types of "like water uses" assigned to each category.

- Residential: Residential uses include a mix of housing developed at varying densities and types. Residential uses in the Antelope Valley Region include single-family, multiple-family, condominium, mobile home, low-density "ranchettes," and senior housing.
- Commercial/Office: This category includes commercial uses that offer goods for sale to the public (retail) and service and professional businesses housed in offices (doctors, accountants, architects, etc.). Retail and commercial businesses include those that serve local needs, such as restaurants, neighborhood markets and dry cleaners, and those that serve community or regional needs, such as entertainment complexes, auto dealers, and furniture stores. Also included in this category are government offices that have similar water duty requirements as a typical commercial/office use.
- Industrial: The industrial category includes heavy manufacturing and light industrial uses found in business, research, and development parks. Light industrial activities include some types of assembly work, utility infrastructure and work yards, wholesaling, and warehousing.
- Public and Semi-Public Facilities: Libraries, schools, and other public institutions are found in this category. Uses in this category support the civic, cultural, and educational needs of residents.
- Resources: This category encompasses land used for private and public recreational open spaces, and local and regional parks. Recreational use areas also include golf courses, cemeteries, water bodies and water storage. Also included in this category are mineral extraction sites.
- Agriculture: Agricultural lands are those in current crop, orchard or greenhouse production, as well as any fallow lands that continue to be maintained in agricultural designations or participating in tax incentive agricultural programs.
- Vacant: Vacant lands are undeveloped lands that are not preserved in perpetuity as open space or for other public purposes.

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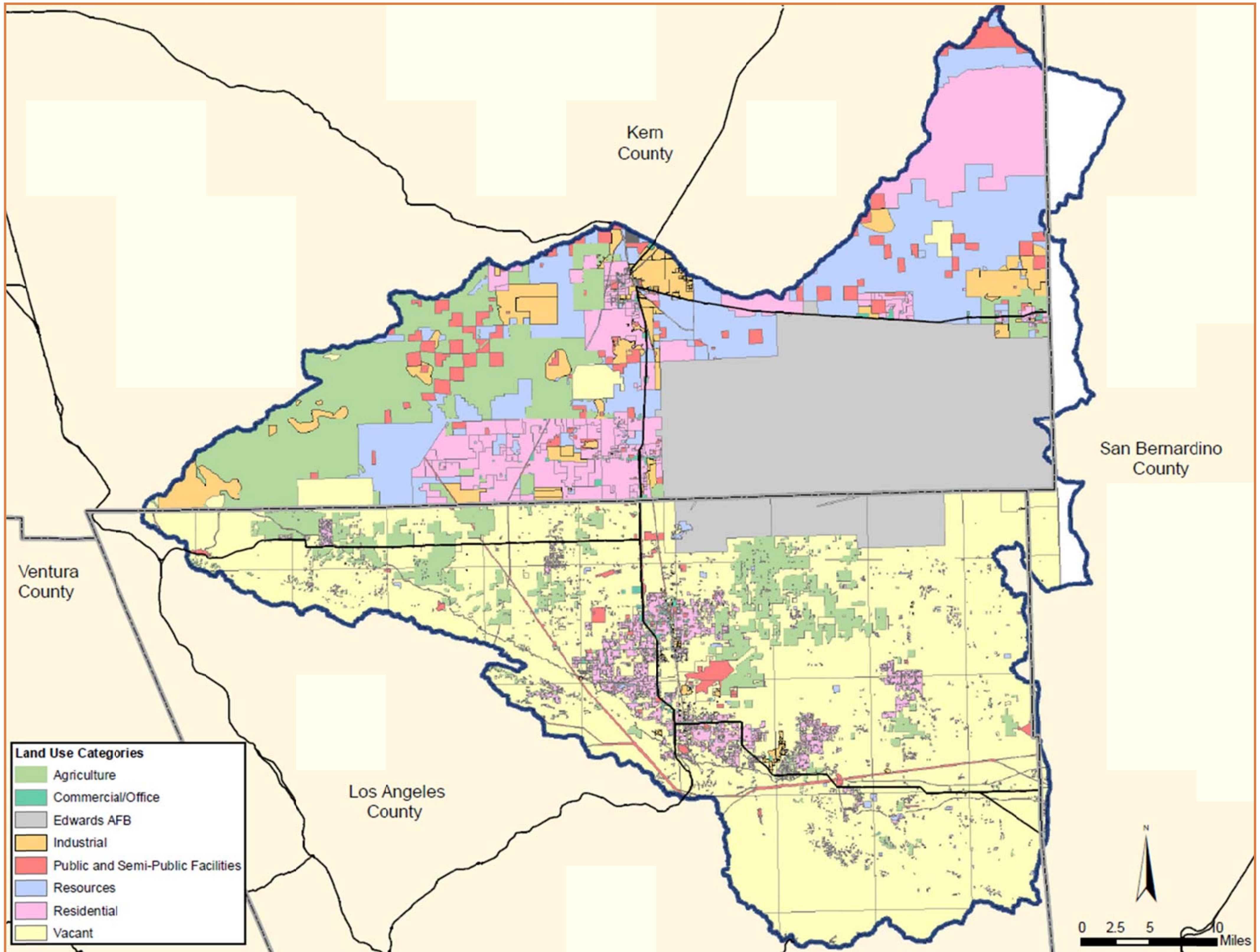
Figure 2-14: Current Land Use Designations for the Antelope Valley Region



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2.6 Flood Control

Flood control in the Region is managed at both the county level by Los Angeles County and Kern County, and at the municipal level by the cities. It should be noted that the Los Angeles County Flood Control District Boundary only extends as far north as Avenue S, as shown in Figure 2-4. Regional flood control facilities are limited and generally located in urban areas. The valley floor is essentially an alluvial fan, making much of it subject to inundation and shallow flooding with unpredictable flow paths. Additionally, "flashy" storms tend to occur in the area, leading to high stream flow volumes over short periods of time. Urban drainage facilities have limited hydraulic capacity which at times causes localized flooding problems. Urban drainage facilities generally consist of local detention basins, street drainage inlets, underground storm drain pipes, and culverts. There are no regional flood management facilities maintained in the Antelope Valley; however, a number of flood studies have been performed to assess the need for a more integrated, regional approach:

- Hydrologic Investigation for Feasibility Studies of the Los Angeles County Department of Public Works Master Drainage Plan, USACE, 1986.
- Antelope Valley Final Report on the Comprehensive Plan of Flood Control and Water Conservation, LACDPW, 1987.
- City of Palmdale General Plan, City of Palmdale, 1993.
- Flood Assessment for Rosamond Dry Lake, EAFB, 2004.
- Engineer's Report Relative to the Revised Master Plan of Drainage, City of Lancaster, 2005.
- Antelope Valley Integrated Regional Water Management Plan, AVSWCA, 2007.
- City of Lancaster General Plan 2030, City of Lancaster, 2009.
- General Plan Kern County, Kern County, 2009.
- Flood Assessment for Rosamond Dry Lake (Revision), EAFB, 2009.
- Surface Flow Study, Pre-Acquisition Report, EAFB, 2010.
- Quartz Hill Infrastructure Improvements Drain Alignment, LACDPW, 2011.
- Surface Flow Study, Technical Report, EAFB, 2012.
- Los Angeles County Revised Draft General Plan 2035, LACDPW, 2012.

Looking forward, flood management in the Region should incorporate urban needs as well as habitat needs and dry lake bed management needs to remain consistent with IRWM Objectives. For example, Amargosa Creek does not drain directly to Rosamond Dry Lake, but flows through Piute Ponds. Piute Ponds stores a portion of the runoff volume if capacity is available and traps a portion of the sediment delivered. The wetlands also provide habitat for a number of species. EAFB relies on stormwater reaching the Valley's dry

The Piute Ponds provide over 300 acres of wetlands and provide habitat for waterfowl.

lake beds to maintain the surface of the lakes for operational and emergency landing use, to maintain habitat, and to provide dust mitigation. An Integrated Flood Management Summary Document was developed during the 2013 IRWMP Updates and is included in Appendix F.

2.7 Wastewater and Recycled Water

Wastewater and recycled water in the southern portion of the Valley is managed primarily by LACSD, while in the northern portion of the valley wastewater and recycled water systems are managed by various local agencies including the RCSD. Wastewater service is primarily limited to urban areas, while rural areas of the Valley rely on septic systems.

The LACSD owns and operates the Lancaster WRP and Palmdale WRP which collect wastewater from the Cities of Palmdale and Lancaster, treating to tertiary levels that are suitable for non-potable uses and groundwater recharge. The RCSD treats wastewater at its Rosamond Community Services District Wastewater Treatment Facility, and also produces tertiary-treated water.

2.8 Social and Cultural Values

The story of the Antelope Valley Region's development helps to unveil the range of local cultural values that characterize the area. The continuing tradition of its historically rural character, combined with the emergent influence of the aerospace industry and metropolitan Los Angeles, give meaning to the diverse and, in some cases divergent, lifestyles and values that define the Antelope Valley Region's collective goals and challenges for the future.

2.8.1 Agriculture

Historically, agriculture was the predominant land use in the Antelope Valley.

Historically, agriculture was the Antelope Valley Region's predominant land use, characterized by dry wheat farming in the west, alfalfa on the Antelope Valley floor, and orchards on its southern fringes. The City of Palmdale was settled over 100 years ago as a residential community by Swiss and German migrants from the Midwest. At the time, land in the Antelope Valley Region sold for fifty cents an acre. The development of the Southern Pacific Railroad connected the Antelope Valley Region to Los Angeles and the Central Valley and spurred the first large influx of white settlers to the Antelope Valley Region. Most of the Antelope Valley Region's smaller communities emerged around this same time as agricultural settlements or local farm trade centers. Agriculture remains a significant industry in the Valley with approximately 19,000 acres actively farmed in the Region.

2.8.2 U.S. Military

In 1933, the U.S. Department of Defense established EAFB, (then called Muroc Army Air Field) east of Rosamond and roughly 60 kilometers northeast of Palmdale's current city limits. Because of the vast landing area provided by EAFB's dry lake beds, it was the original site of NASA space shuttle landings, as well as the site of other important aeronautical events. To this day U.S. military flight testing is a large and important part of EAFB operations.

As a result of increased governmental defense spending in the 1950's, the Antelope Valley Region underwent a dramatic change in character. In 1952, the aerospace industry officially took hold at U.S. Air Force Plant 42. Plant 42 in northeast Palmdale is home to Lockheed Martin, Boeing, and Northrop Grumman, among other significant aeronautical companies.

2.8.3 Housing Development

Increases in population and development bring more demand for cultural amenities.

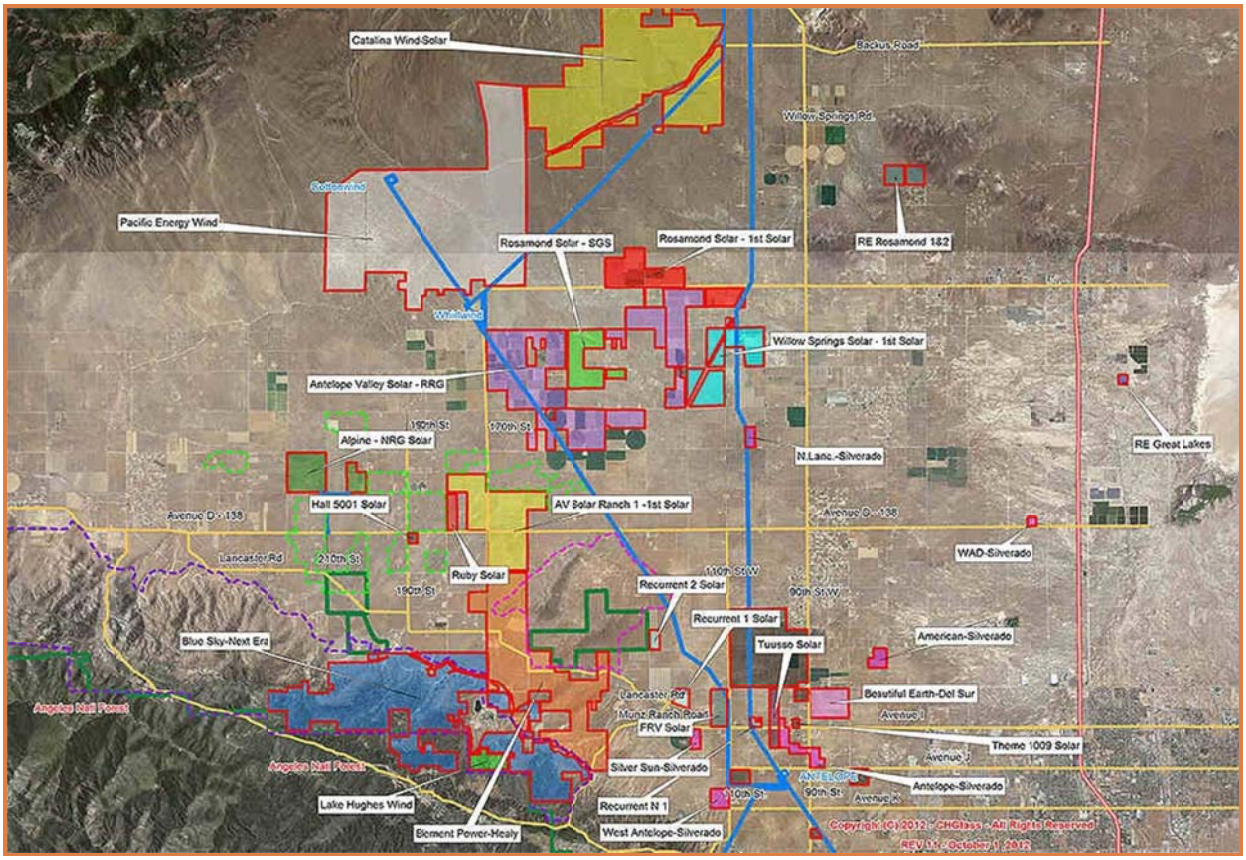
Increasing development pressures in the 1980's were in part driven by the continuing appeal of the Antelope Valley Region's high desert climate as well as land values lower than those in the Los Angeles metropolitan area. As the Los Angeles population rapidly expanded into the Antelope Valley Region, the desire for more cultural amenities and new skills and resources increased and the Antelope Valley Region became more metropolitan in character. The increase in population and the development of tract housing, retail centers and business parks has altered the formerly low density, rural and agrarian character of many local communities.

Today, competing demands are placed on limited available resources. Many of these competing demands stem from the range of local cultural values that characterize the Antelope Valley Region. Decisions regarding future land use and the dedication of water resources will need to weigh varying agricultural, metropolitan, and industrial needs as they continue to develop and as the balance between these interests continues to change.

2.8.4 Alternative Energy

One growing industry in the Region is alternative energy production. Wind and solar power generation facilities can be found throughout the Valley, as shown in Figure 2-15. Cities and towns such as Lancaster, Palmdale and Rosamond have set goals to promote alternative energy sources while protecting natural resources. Encouraging the growth of alternative energy production helps to meet the common goal of protecting resources by promoting alternative energy use within the Valley.

Figure 2-15: Solar and Wind Generation Facilities in the Antelope Valley Region



Source: www.avhidesert.com/A/WestAVRenewRev11.jpg

2.8.5 Visioning Document

The Lancaster Community Visioning Report (2006) helps to shed light on the current interplay of these interests and how they may influence the direction of future planning and growth in the Antelope Valley Region-wide. The Visioning Report presents a common vision for the future of Lancaster and the Antelope Valley Region that is focused on the following priorities:

- Balancing growth
- Ensuring economic well-being
- Strengthening Community Identity
- Improving public safety
- Promoting Active Living
- Focusing on Education and Youth
- Supporting Environmental Conservation

Despite the need to ensure economic vitality and longevity by bringing new industry and employment opportunities to the Antelope Valley Region, residents of the Antelope Valley Region believe that preserving a hometown feel and developing a strong sense of neighborhood stability are critical to maintaining the identity of the community and, in turn, that of the Antelope Valley Region. The preservation of existing natural open space, achieved in part through a development strategy focused on infill and parcel redevelopment combined with environmental conservation, are key components of preserving the Antelope Valley Region's rural character and strengthening the health, vitality and security of growing urban areas.

2.9 Economic Conditions and Trends

Historically, the economy within the Antelope Valley Region has focused primarily on agriculture; and crops grown in the Antelope Valley Region have included alfalfa, wheat, barley, and other livestock feed crops. However, the area is in transition as the predominant land use shifts from agricultural uses to residential and industrial uses.

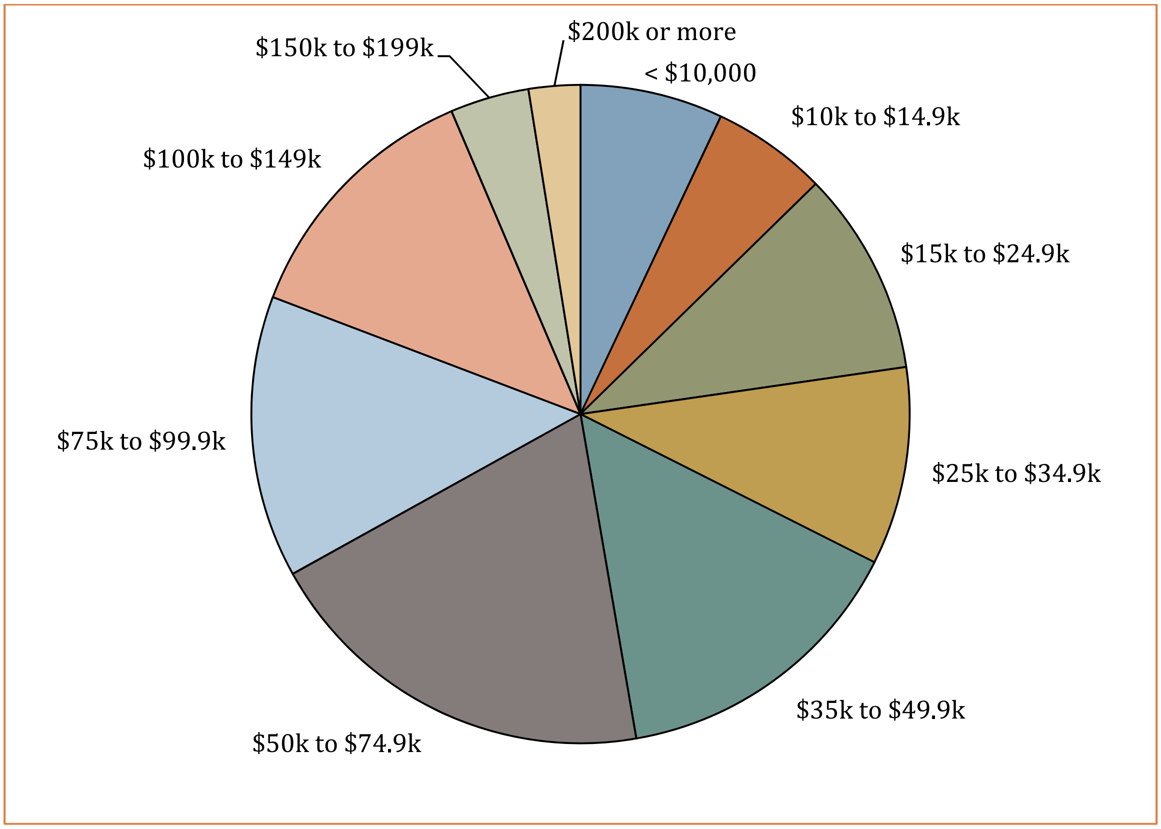
The increase in residential land use and its impact on the economy is evident from the population growth in the Antelope Valley Region, which is discussed in Section 2.7. With significantly lower home prices than in other portions of Los Angeles County, the Antelope Valley Region housing market has seen an increase as people choose to commute to the Los Angeles area. Even after acknowledging the recent slowing of the housing market, the BIA recognized that the Antelope Valley Region is the last large available open space "opportunity" for development in Southern California, whether it be for residential, commercial/industrial/retail or agricultural land uses. This is supported by the Southern California Association of Governments (SCAG) 2012 Integrated Growth Forecast, which estimates that the number of households in Palmdale and Lancaster will increase between 27% and 40% from 2008 to 2035. The same forecast projects that employment will increase between 10% and 44% from 2008 to 2035.

Industry in the Antelope Valley Region consists primarily of manufacturing for the aerospace industry and mining. EAFB and the U.S. Air Force Flight Production Center (Plant 42) provide a strong aviation and military presence in the Antelope Valley Region. Mining of borate in the northern areas and of salt extract, rock, gravel, and sand in the southern areas contribute to the Antelope Valley Region's industrial economy. Alternative energy is an emerging industry in the Region.

As previously mentioned, ensuring economic well-being is a key social and cultural value of the Antelope Valley Region's community.

As shown in Table 2-2 and Figure 2-16, approximately 47 percent of the Antelope Valley Region's population has a household income of less than $50,000, approximately 20 percent of the population has a household income between $50,000 and $74,999, and approximately 33 percent has a household income of $75,000 or higher.

Figure 2-16: Income Levels for the Antelope Valley Region



2.10 Population

This subsection provides demographic information from the 2010 Census as well as the 2006-2010 American Community Survey and regional growth projections.

2.10.1 Demographics

Table 2-2 provides a summary of the human demographics for the Antelope Valley Region as determined by 2010 U.S. Census Bureau data and 2006-2010 5-year American Community Survey (ACS) data. Regional data was estimated from the data for the census tracts within the regional boundaries. Figure 1-2 shows several DACs throughout the Antelope Valley. DACs were defined as having a MHI less than $48,706 (80% of the statewide MHI according to 2006-2010 5-year ACS data). As stated in Section 2.13, 47 percent of the Antelope Valley Region's population has a household income of less than $50,000, indicating that a large portion of the Region meets the criteria for DACs. Two technical memoranda were prepared to characterize DACs and to define issues related to DAC areas. These documents are included in Appendix D:

- DAC Water Supply, Quality and Flooding Data Final Draft TM
- DAC Monitoring Plan Final Draft TM

Figure 2-16 shows the breakdown of the income levels in the Antelope Valley Region as laid out in Table 2-2.

Table 2-2: Demographics Summary for the Antelope Valley Region

Area	Lake Los Angeles	Lancaster	Littlerock	Palmdale	Quartz Hill	Sun Village	Unincorp. LA County	North Edwards	Boron	Mojave	Rosamond	Edwards AFB	Unincorp. Kern County	Antelope Valley Region
Age Structure (by %)														
under 5	6.5	8.3	1.1	8	7.4	5.4	5.1	7.8	11.4	12.1	9.1	2.2	5.3	7.8
5-9	7.8	8.2	5.0	9.8	7.4	5.9	5.8	7.9	4.4	3.1	8.5	7.0	5.5	8.4
10-14	11.8	9.6	16.7	10.3	8.8	10.6	9.3	11.7	3.0	7.6	7.5	3.5	6.4	9.7
15-19	13.1	8.5	7.0	10.2	8.9	12.1	9.3	8.2	10.1	6.2	8.6	4.7	5.9	9.4
20-24	5.9	6.8	9.4	7.2	6.3	4.2	4.7	4.5	5.5	7.6	7.7	20.1	8.6	6.9
25-34	10.2	13.9	10.2	12	10.6	11.8	12.1	9.1	14.3	13.4	11.8	34.3	16.5	12.9
35-44	11.9	13.6	12.0	14.3	12.8	14.6	12.5	15.1	8.8	12.4	14.6	23.5	15.1	13.9
45-54	15.3	14.2	27.5	13.9	17.6	17.4	18.8	11.2	13.1	12.6	16.2	3.4	16.7	14.6
55-59	5.2	4.7	4.0	4.8	5.7	6.1	6.2	7.2	4.3	6.4	5.1	0.4	4.6	4.9
60-64	4.2	3.4	2.8	3.4	3.8	5.2	6	9.3	13.9	7.8	2.9	0	4.2	3.7
65-74	4.1	4.6	3.2	3.7	6.6	4.6	6.2	4.8	4.6	3.2	4.9	0.3	7.1	4.4
75-85	3.3	3	0.0	2.1	2.9	1.4	3.1	1.1	5.7	6.5	2.6	0.6	2.8	2.6
85 and over	0.8	1.1	1.0	0.5	1.4	0.6	1.1	2	0.9	1	0.7	0	1.2	0.8
MHI	$45,917	$51,192	$58,833	$55,696	$57,294	$50,482	$55,858	$42,375	$37,411	$26,492	$51,946	$62,895	$58,364	--
Income Levels (by %)														
< $10,000	6.7	9.0	0	5.1	7.2	4.2	4.9	13.2	14.4	19.1	9.7	0	4.0	7.02
$10k to $14.9k	4	6.5	3.4	4.8	0.8	6.2	5.5	6.6	7.6	14.8	8.9	0	5.1	5.66
$15k to $24.9k	9.8	10.6	13.5	9.6	12.4	10.8	10	15.1	7.8	14.7	8.6	2.3	4.5	10.04
$25k to $34.9k	8.7	8.2	12.1	10.9	9	11.2	10.9	10.7	13.5	9	9.6	12.8	13.3	9.72
$35k to $49.9k	26.7	14.4	15.4	14.4	14.7	17.2	15.5	15.8	16.6	13.7	12.3	14.7	13.6	14.86
$50k to $74.9k	21	19.9	23.6	20.3	20	18	16.5	20.3	12.2	14.5	16.1	29	19.8	19.65
$75k to $99.9k	11.5	12.6	14	13.9	16.4	21.6	16.7	8.4	11.9	5.6	15.4	20.6	16.4	13.86
$100k to $149k	7.9	12.6	15.4	13.5	12.3	7.4	13.8	6.6	14.5	6.1	14.4	18.9	16.6	12.81
$150k to $199k	1.2	3.7	2.5	4.7	2.9	2.6	4	3.2	0	1.6	3.5	0	4.6	3.88
$200k or more	2.4	2.5	0	2.9	4.4	0.9	2.2	0	1.4	0.8	1.3	1.7	2.1	2.53

Area	Lake Los Angeles	Lancaster	Littlerock	Palmdale	Quartz Hill	Sun Village	Unincorp. LA County	North Edwards	Boron	Mojave	Rosamond	Edwards AFB	Unincorp. Kern County	Antelope Valley Region
Population Density(persons per sq. mile)	1,276	1,584	531	1,379	2,736	999	25	87	148	62	326	209	3	215
Languages spoken at home (by %)														
English	64	73	60	54%	84%	52%	66%	95%	85%	67%	73%	85%	86%	65%
Spanish	36	22	37	41%	13%	47%	31%	4%	15%	33%	25%	10%	11%	31%
Other Indo-European languages	<1	2	1	2%	1.4	0	2%	0%	0%	0	<1%	<1%	<1%	2%
Asian and Pacific Island Languages	<1	3	2	3%	1%	1%	1%	1%	0%	<1%	1%	5%	3%	3%
Other	0	<1	0	<1	1%	<1%	<1%	0%	0%	0%	<1%	0%	0%	0%

Source: 2006-2010 5-Year American Community Survey Data

2.10.2 Regional Growth Projections

Growth in the Antelope Valley Region proceeded at a slow pace until 1985. Between 1985 and 1990, the growth rate increased approximately 1,000 percent from the average growth rate between the years 1956 to 1985 as land use shifted from agricultural to residential and industrial. The historical and projected population for the Antelope Valley Region is shown in Table 2-3. Historical population estimates up to the year 1980 were based on the Geolytics normalization of past U.S. Census tract data to 2000 census tract boundaries. This normalization allows for a direct comparison of the past U.S. Census tract population data. These Census tracts were then assigned to the individual jurisdictions in the Antelope Valley Region to determine the jurisdiction's population. Populations in the years 1990, 2000 and 2010 are based on census data for those years, and adjusted according to the percentage of area within the Region, rounded to the nearest thousand.

Projections for the Cities of Lancaster and Palmdale were derived from SCAG estimates. Population projections for the rest of the Antelope Valley Region assume the an annual growth rate similar to the City of Lancaster, estimated as approximately 1.7 percent per year up to 2020, then 1.0 percent per year up to 2035 from SCAG projections. Projections indicate that approximately 530,000 people will reside in the Antelope Valley Region by the year 2035. This represents an increase of approximately 153 percent from the 2010 population. Figures 2-17 and 2-18 below graphically depict these population projections.

Table 2-3: Population Projections

	1970[(a)]	1980[(a)]	1990[(b)]	2000[(c)]	2010[(d)]	2020[(e)]	2035[(e)]
Boron	3,000	3,000	3,000	2,000	2,000	2,000	3,000
California City[(f)]	0	0	0	0	0	0	0
Edwards AFB	10,000	9,000	7,000	7,000	4,000	5,000	5,000
Mojave	4,000	5,000	4,000	4,000	4,000	5,000	5,000
North Edwards	n/a	n/a	n/a	1,000	1,000	1,000	1,000
Rosamond	4,000	5,000	7,000	14,000	17,000	20,000	23,000
Uninc. Kern County	1,000	2,000	6,000	2,000	3,000	3,000	4,000
Lake Los Angeles	n/a	n/a	8,000	12,000	12,000	14,000	16,000
Lancaster	41,000	51,000	97,000	119,000	150,000	175,000	201,000
Littlerock	n/a	n/a	n/a	1,000	1,000	1,000	1,000
Palmdale	17,000	22,000	68,000	117,000	146,000	179,000	206,000
Quartz Hill	5,000	7,000	10,000	10,000	11,000	13,000	15,000
Sun Village	n/a	n/a	n/a	n/a	12,000	14,000	16,000
Uninc. Los Angeles County	15,000	22,000	46,000	33,000[(g)]	25,000	29,000	34,000
Region	**103,000**	**128,000**	**275,000**	**346,000**	**390,000**	**465,000**	**547,000**

Notes: Projections Rounded to the nearest 1,000 people.

(a) Based on Geolytics Normalization of Past U.S. Census Tract Data to 2000 Census Tract Boundaries.

(b) Based on 1990 Census data, and normalized by percentage of area of Census Block Group or Census Place in the Region.

(c) Based on 2000 Census data, and normalized by percentage of area of Census Block Group or Census Place in the Region.

(d) Based on 2010 Census data, and normalized by percentage of area of Census Block Group or Census Place in the Region.

(e) Projections for Palmdale and Lancaster from the SCAG *Adopted 2012 RTP Growth Forecast*. For remaining areas, it is assumed the Antelope Valley Region would have a similar annual growth rate as the City of Lancaster, estimated as approximately 1.7 percent per year up to 2020, then 1.0% per year up to 2035.

(f) The portion of California City within the Antelope Valley Region has a population of less than 500 people, and therefore is rounded down to 0.

(g) Decrease in population in unincorporated Los Angeles County likely due to addition of Census Designated Places to the census County that had previously been counted as unincorporated area.

Figure 2-17: Population Projections

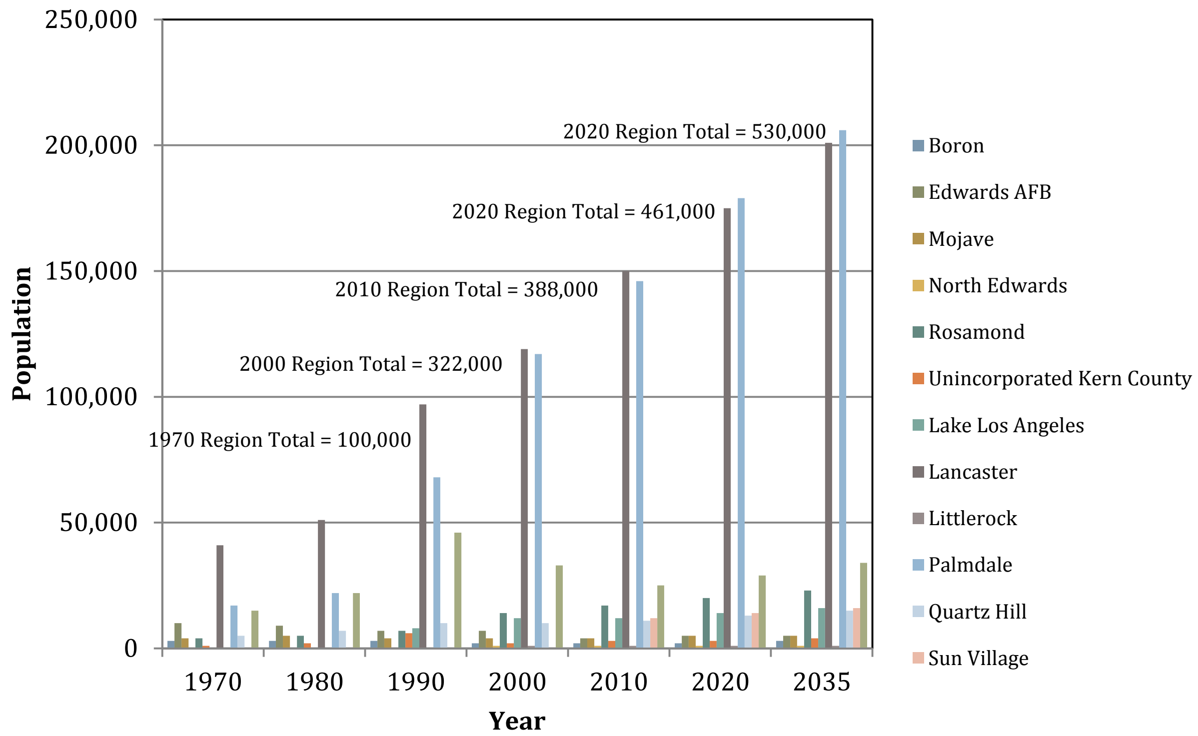
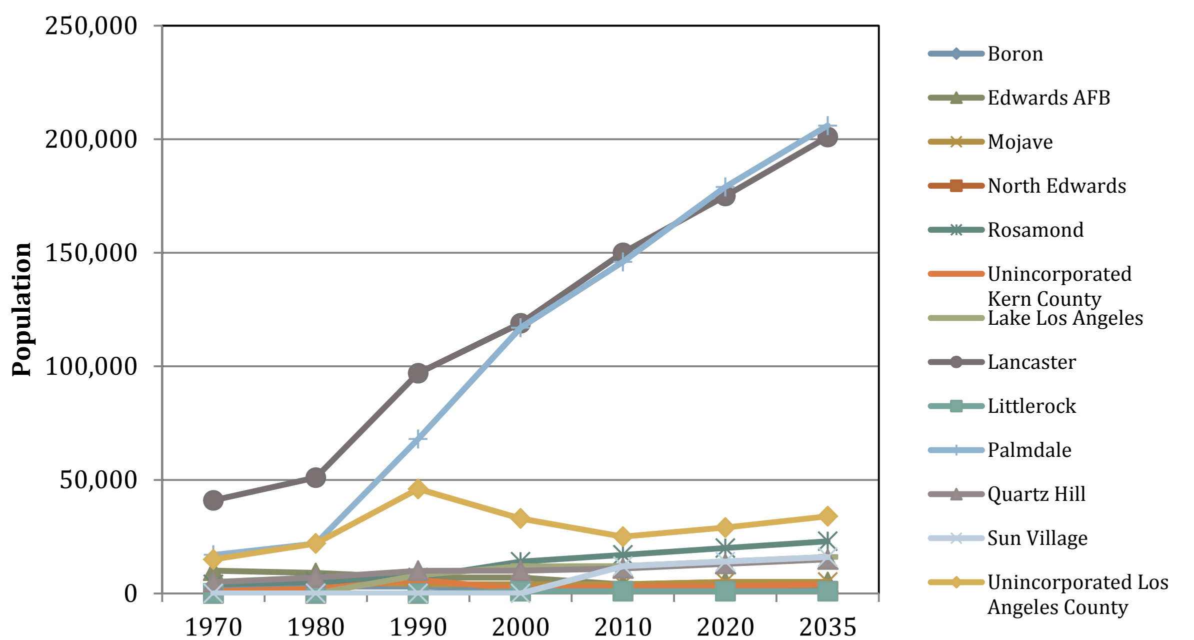


Figure 2-18: Antelope Valley Region Population



2.11 Climate Change

Climate change projections have shown that California's water resources will likely be impacted by changes to temperature, precipitation, and sea level rise. Even in the year 2013, California is beginning to experience these impacts. Water resource planners already face challenges interpreting new climate change information and determining which response methods and approaches will be most appropriate for their planning needs. However, in order for the Region to adapt to, or protect against, climate change, it must first identify the impacts. Knowing these changes will help to identify potential vulnerabilities in water resource systems, which can identify and inform planning measures. Future projects in the Region can be evaluated based on their ability to adapt to the anticipated climate change impacts and mitigate GHGs. These strategies will help the Region to be more robust in the face of a changing environment.

The following state-wide impacts are expected to impact local water resources in the Region (DWR, 2011):

- Temperature increases:
  - More winter precipitation falling as rain rather than snow (this includes precipitation for local and imported water sources), leading to reduced snowpack water storage, reduced long term soil humidity, reduced groundwater and downstream flows, and reduced imported water deliveries
  - Higher irrigation demands as temperatures alter evapotranspiration rates, and growing seasons become longer
  - Exacerbated water quality issues associated with dissolved oxygen levels, increased algal blooms, and increased concentrations of salinity and other constituents from higher evaporation rates
  - Impacted habitats for temperature-sensitive fish and other life forms, and increased susceptibility of aquatic habitats to eutrophication

- Precipitation pattern changes:
  - Increased flooding caused by more intense storms
  - Changes to growth and life cycle patterns caused by shifting weather patterns
  - Threats to soil permeability, adding to increased flood threat and decreased water availability
  - Reduced water supply caused by the inability to capture precipitation from more intense storms, and a projected progressive reduction in average annual runoff (though some models suggest that there may be some offset from tropical moisture patterns increasingly moving northward)
  - Increased turbidity caused by more extreme storm events, leading to increased water treatment needs and impacts to habitat
  - Increased wildfires with less frequent, but more intense rainfall, and possibly differently timed rainfall through the year, potentially resulting in vegetation cover changes
  - Reduction in hydropower generation potential

Although the extent of these changes is uncertain, scientists agree that some level of change is inevitable; therefore, it will be necessary to implement flexible adaptation measures that will allow natural and human systems to respond to these climate change impacts in timely and effective ways. In addition to adapting to climate change, the Region has the opportunity to mitigate against climate change by minimizing GHGs associated with provision of water and wastewater services. The following is a discussion of likely climate change impacts on the Region, as determined from a vulnerability assessment that was completed with a group of local stakeholders. Specific opportunities for adapting to and mitigating against climate change will be discussed in later chapters of this Plan.

2.11.1 Effects and Impacts of Climate Change on the Region

Estimating the impacts of climate change at a regional level is challenging due to the coarse spatial scale of the global models that project climate change impacts of temperature and rainfall. These global models also project estimates for the year 2100, which is well beyond typical planning horizons of 20 to 30 years. To incorporate climate change into water resources management, downscaled temperature and precipitation projections are input into hydrologic and water resources system models to project impacts to water supplies, water demand, snow pack, sea level rise, and wildfires.

Climate change impacts and effects are based on different climate change assumptions and analysis approaches. Table 2-4 summarizes the impacts and effects of climate change on the Region by 2100 (unless otherwise indicated), which are typically based on an average of various climate change analyses.

Table 2-4: Projected Climate Change Effects on the Region
(By the year 2100, unless otherwise noted)

Effect	Ranges
Temperature change	• Winter: Projected increases of 5°F to 6°F • Summer: Projected increases of 6°F to 10°F
Precipitation	• 3 to 5 inch decrease in average rainfall at low elevations • 8 to10 inch decrease in average rainfall at higher elevations
Snowpack	• March snowpack in San Gabriel Mountains decrease from 0.7 inches to zero
Wildfire Risk	• Little change is projected in lower elevations • Slight increases expected in mountainous areas
Demand	• *Increases expected, but not quantified*
Supply	• SWP delivery decrease of 7-10% by 2050, and 21-25% by 2100 • *Changes to local supply not quantified, but could be reduced based on precipitation effects described above*

For the Antelope Valley Region, climate change is expected to increase average temperature by at least 5 degrees Fahrenheit by 2100. Precipitation is expected to decrease by 3 to 5 inches in low elevations, and decrease by 8-10 inches at higher elevations which could reduce local supplies availability. Snowpack in the San Gabriel Mountains is expected to reduce slightly, while wildfire risk is expected to increase slightly in mountainous areas. Imported water supplies feeding the Region are also anticipating delivery decreases as a result of climate change.

2.11.2 Climate Change Reporting and Registry Coordination

Individual agencies within the Region may individually decide whether to participate in the California Adaptation Strategy Process as part of further integrating the information derived from the local climate change studies being conducted and described above. Agencies that are part of the IRWM effort may consider joining the Climate Registry (Registry), http://www.theclimateregistry.org. The Climate Registry serves as a voluntary GHG emissions registry that has developed tools and consistent reporting formats which may aid agencies in understanding their GHG emissions and understanding ways to promote early actions to reduce GHG emissions. Both the State and the federal government require reporting of emissions for regulated entities of electricity and fuel use. These programs have reporting, certifying and verifying requirements that are separate from those under the voluntary programs.