Appendix D

Land Use, Water Requirements and Water Supplies

Antelope Valley Area of Adjudication

Appendix D

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Table of Contents

Appendices

List of Tables

List of Figures

Appendix D

Land Use, Water Requirements, and Water Supplies

D.1 Introduction

As part of the overall description of conditions in the Antelope Valley Area of Adjudication, this appendix describes historical and current land uses in the Valley, most notably as they relate to water requirements for the respective land uses. Based then on those land uses, this appendix describes the amounts of water that have been used in the Valley, most notably for agricultural and municipal-type uses, the associated return flows that contribute to groundwater recharge from various land uses, and the sources of water supply that have historically been developed to meet those various uses.

D.2 Land Use

There are generally four land uses with which water requirements can be associated in the Antelope Valley: 1) agricultural, 2) municipal and industrial (M&I), and similar types of land use such as mutual water companies and rural residential, 3) military, and 4) environmental/open space (artificial lakes). Regarding rural residential land use, there is a large number of developed rural parcels in the Valley that, in aggregate, logically represent a notable water requirement. Consequently, they are accounted herein; however, since rural residential water use is similar in nature to individual water use in municipal areas, rural residential water use is separately accounted, but ultimately grouped with M&I water use herein. Regarding military lands, little is known of the land use, so a brief discussion is provided but grouped with M&I land use; accordingly, the water requirement and supply for military lands are accounted and grouped with M&I water requirements and supplies.

The ultimate intent of this appendix is to describe the historical and projected water requirements and water supplies in the Antelope Valley, so the following assessment of land use in the Valley is presented primarily as a basis for those descriptions.

D.2.1 Data Sources

In order to assess the historical land uses in the Antelope Valley, numerous references were reviewed and data compiled describing the main land uses identified in the Valley. A discussion of the data sources for the agricultural land use assessment is presented first, followed by the M&I land use (including mutual water companies, rural residential, and military lands), and lastly environmental/open space use.

Agricultural Land Use Data

Some of the earliest reports of agricultural land use in the Valley describe the commencement of farming in the late-1800's and subsequent initial development of agriculture into the early 1900's. These reports include two prepared by the US Geological Survey (Johnson, H.R., 1911, and Thompson, David G., 1929) and a third prepared for the California Conservation Commission (Tait, C.E., 1912). Both the Tait and Thompson reports note the earliest estimate of irrigated acreage in the Valley, specifically for 1910, and the latter report also describes agricultural development in 1919. Subsequently, a thorough study of the Valley's development during the first-half of the 1900's was completed for the University of California (Snyder, J. Herbert, 1955), and the report describes the irrigated acreage and crop types compiled from field surveys and reports for numerous years through 1950.

The first assessment of the spatial distribution of irrigated lands, specifically for 1947, was provided in map form in a report prepared for the California State Legislature (California Division of Water Resources, 1947). Several subsequent reports described the results of detailed land and water use surveys and included tabulations of the crop types and maps of the spatial distribution of irrigated acreages over time. The first of these reports described the land use in 1950 (SWRB, 1955), and the remaining reports described the land use for 1957, 1961, 1972, and 1986, the last complete survey year (California DWR, 1963, 1965, 1974, and 1990, respectively).

Concurrent with the land use surveys for the Valley has been the preparation of annual crop and livestock reports for Los Angeles County, available for the years 1970 through 2008 (Los Angeles County Agricultural Commissioner, 1970 to 2008). The Los Angeles County reports provided the crop acreages specific to Antelope Valley (from 1970 through 1983) and on a county-wide basis (from 1981 through 2005), including tabulations of the agricultural acreages of each individual crop or groups of crops. Recently, annual pesticide use reports for Kern County became available online (www.co.kern.ca.us/kernag) for the years 1994 through 2009 (Kern County Agricultural Commissioner, 1994 to 2009). The Kern County reports include a listing of individual crop acreages by township, range, and section throughout the Kern County portion of the Valley. In addition, GIS spatial data for crop land in Kern County have recently become available for years 1997 through 2009 (www.kernag.com/gis/gis-data.asp).

A recent investigation of the water resources of Antelope Valley (USGS, Leighton and Phillips, 2003) provided estimates of the historical crop patterns for the entire Valley based on analysis of the above-referenced 1961 and 1986 land use surveys for the Valley and annual crop reports for Los Angeles County. The USGS study determined the ratio of crop acreage between Kern and Los Angeles Counties during those two years and applied that percentage (18 percent of Los Angeles County acreage equaled Kern County) to all years in its study period to estimate the historical crop acreages for the Valley. As described in subsection **D.2.2 Agricultural Land Use**, the above-mentioned crop acreage data reported for Kern County (1994 – 2009) now supercede the estimated acreages.

Most recently, satellite imagery has been analyzed to assess the spatial extent of irrigated agricultural land in the Valley for numerous years between 1980 and 2005 (Qiu, H., 2005, conducted for Antelope Valley-East Kern Water Agency). The GIS-compatible imagery was derived from remotely-sensed multi-spectral images of Earth originally collected under the LandSat satellite program initiated by NASA in the mid-1970s and subsequently compiled by the USGS Center for Earth Resources Observation and Science (EROS). Each image consists of several bands that represent discrete portions of the electromagnetic spectrum that can be utilized to differentiate and identify various land uses. Monthly images generally covering the spring, summer, and fall of 1980, 1986, 1989, 1996, 1999, years 2000 through 2005, and 2009 were analyzed as part of this investigation.

Municipal & Industrial Land Use Data

Reports and data describing the historical M&I land use in Antelope Valley primarily provide information about the population and political boundaries of the larger cities of Lancaster and Palmdale, the smaller towns of Rosamond, Quartz Hill, and Littlerock, and the military lands of Edwards Air Force Base (and to a certain extent, US Air Force Plant 42). Recent data are also available for the population and service area boundaries for over 30 mutual and private water companies, as well as the number of rural residential parcels in the Valley.

The earliest population information for the area was derived from two of the above-referenced land use survey reports published by DWR. The first of these reports (DWR, 1965) listed the population of Lancaster in 1940, 1950, and 1960, and the second (DWR, 1990) provided the population of both Lancaster and Palmdale in 1987. For the more recent period coming forward to the present, numerous census databases and publications provided historical population data for the Antelope Valley. Specifically, they provided population data (and sometimes spatial boundaries) for the following entities: City of Lancaster, City of Palmdale, Palmdale East, Quartz Hill CDP (Census-Designated Place), Rosamond CDP, Littlerock CDP, Edwards AFB, Desert View Highlands CDP, Lake Los Angeles CDP, and North Edwards CDP.

Published population data and spatial boundaries for the entities mentioned above were also derived from the 1990 Census and Census 2000 (U.S. Census Bureau, 1990 and 2000), specifically decennial population values for the years 1970, 1980, 1990, and 2000. In addition, the Population Estimates Program (U.S. Census Bureau, 1990 to 2005) and the Demographic Research Unit (California Department of Finance, 2010), offer population estimates for years falling within the ten-year increments for major cities only; for the Antelope Valley, intermediate-year estimates were available for Lancaster and Palmdale between 1990 and 2009. The State of the Cities Data System (U.S. Dept of HUD, 2000 to 2005) reported Decennial Census data including a year 2000 value for Littlerock and estimated year 2003 values for Lancaster and Palmdale. Lastly, the California small system purveyors database (California Department of Health Services, 2000 to 2006) listed population and connection figures for

several years between 2000 and 2006 for most of the mutual and private water companies in the Valley, and the Los Angeles and Kern Counties Assessors Office records identified current improved and unimproved parcels for domestic use.

In addition to the political and service area (mutual and private water companies) boundaries established for the years 1990 and 2000 from U.S Census Bureau data, the extent of the urban development in the Valley during earlier time periods were shown, approximately, in the land use maps from the DWR land use survey reports referenced above. Specifically, the extent of urban development could be seen in 1950, 1957, 1961, 1972 (approximate), and 1986.

Environmental and Open Space Land Use Data

Reports describing the environmental and open space land use in the Valley include planning documents and environmental impact assessments prepared for the Lancaster Water Reclamation Plant (WRP), from which recycled water is conveyed to support wetlands in the Paiute Ponds Wildlife Habitat and recreational impoundments in the Apollo Lakes Regional County Park. Two recent reports evaluating alternatives for the expansion and upgrade of the WRP through 2020 included descriptions of the Paiute Ponds, which are located in the far southwest corner of Edwards AFB property, and Apollo Lakes, situated within a Regional County Park roughly six miles southwest of the Paiute Ponds (ESA, both May 2004). A recent technical paper on the use of recycled water from the Lancaster WRP provided a discussion of the land use and operations at the Paiute Ponds and Apollo Lakes, as well as the use of recycled water for agricultural irrigation (Melitas, et.al., February 2005).

D.2.2 Agricultural Land Use

As a preface to the following discussion, several assessments of the historical agricultural land use have been made for various areas loosely defined as the Antelope Valley utilizing varying sources of data and information, methodologies, and frequencies. Importantly, the estimations have been made for areas with generally similar boundaries except to the north, which have varied from a boundary running along the Cottonwood-Willow Springs-Rosamond fault, southeast edge of the Rosamond and Bissell Hills, and north edge of the Rogers dry lake bed (Thompson, 1929; Snyder, 1955; and USGS, 2003), to a boundary extending as far north as the towns of Mojave and Boron (e.g., DWR, 1947, 1955, 1963, 1965, 1974, and 1990; and Qiu, 2005).

The historical development of agriculture in the Antelope Valley is reported to have begun in the late 1800's with dry-farming of grain in the western end of the Valley, with as many as a total of 60,000 acres of wheat and barley cultivated during the period between 1880 and 1893 (Snyder, 1955) or roughly 4,000 to 5,000 acres on average annually. Orchards were also planted during this time primarily along the southern flank of the Valley with some unspecified acreage of fruit, almond, and olive trees (Thompson, 1929). Their cultivation was by either dry-farming or

irrigation from stream diversions that commenced around 1890 primarily, and possibly solely, from Big Rock and Littlerock Creeks (Johnson, 1911). This initial agricultural development was all but lost during a prolonged period of drought from 1894 to roughly 1905, during which time most farmers were forced to abandon their holdings due to inadequate rainfall and associated surface water supplies for irrigation.

The recovery of agriculture in the Valley began around 1910 with the return of normal rainfall and, most importantly, the development of groundwater supplies for irrigation to augment surface water supplies. With approximately 5,000 acres of alfalfa and orchards in production, it is from this time forward that agriculture expanded northward into great portions of the Valley where farming is still practiced today. It is also around 1910 that information about crop acreages became sufficiently available to describe the historical development of agricultural land use in the Valley through to the present. The following discussion of agricultural land use is summarized in Tables D.2-1a/b and D.2-2a/b, and illustrated in Figures D.2-1 through D.2-11. Supporting details are included in Appendices D-1 and D-2.

Period of Agricultural Expansion, 1910 to 1950

The amount of irrigated crop land in the Antelope Valley significantly increased during the 40 years from 1910 to 1950, as seen in the tables and graph of the historical irrigated crop acreage (Tables D.2-1a/b and Figure D.2-1). By 1920, it was reported to have slightly increased to about 12,000 acres, consisting primarily of alfalfa and some fruit orchards, mainly pears with some apples (Thompson, 1929). In addition, some (unspecified) acreage of grain crop was grown in a "dry-farm district" along the southwestern flank of the Valley in the area between Del Sur and Neenach, stretching from approximately 15 to 20 miles northwest of the City of Palmdale. Irrigated crop land increased to about 31,000 acres (roughly 25,000 acres in alfalfa) by 1930; to about 37,800 acres (29,600 acres alfalfa) by 1945; and to approximately 55,000 acres (38,500 acres alfalfa) by 1950 (Snyder, 1955). Also during this period of agricultural expansion, the amount of orchard land was reported to have generally remained below 2,500 acres, with the balance of crop land comprised of gradually increasing acreages of grain and pasture.

The first comprehensive land and water use surveys for the Valley, conducted in 1945/47[1] and 1950 as agricultural expansion was nearing a peak, provided additional estimates of the irrigated crop acreage at that time (Calif. Div. Water Resources, 1947, and SWRB, 1955, respectively). The surveys reported that irrigated crop land occupied 46,000 acres (30,000 acres in alfalfa) in 1945 and 71,200 acres (62,100 acres alfalfa) in 1950. The crop acreage determined by the survey for 1945 (46,000 acres) roughly coincides with the estimate made by Snyder for 1945 (37,800 acres), but a greater contrast exists between the crop acreages reported for 1950, specifically 71,200 acres determined from the survey and 55,000 acres by Snyder's estimate. Although the two studies cover somewhat different areas, the contrast appears to be due to their

[1] The 1945/47 survey provided individual and total crop acreages for 1945 and a crop land map for 1947.

different study methodologies and availability of information. The crop acreage information utilized by Snyder was slightly incomplete in that acreage information for crops other than alfalfa was available for only the Los Angeles County portion of the Valley, likely resulting in a slight underestimation of total crop acreages. Alternatively, the alfalfa and total acreages from the land survey (62,100 and 71,200 ac, respectively) appear to be over-reported based on comparison to the typical values for the time period, reported as 30,000 to 40,000 acres alfalfa and 38,000 to 55,000 total acres (Snyder, 1955, and Calif. Div. Water Resources, 1947) (see Tables D.2-1a/b and Figure D.2-1). While the range in crop acreage values for 1950 is acknowledged, this investigation relies primarily on Snyder's estimate to describe the beginning of the peak period of agricultural activity in the Valley.

It is noteworthy that the land use surveys from 1945/47 and 1950 provided the first maps showing the spatial distribution of irrigated crop land throughout the Valley. The land use maps for 1947 and 1950 (Figures D.2-2 and D.2-3, respectively) show the extent of the agricultural expansion into the greater portion of the Valley; in particular, the crop land generally formed a semi-circle around Rosamond Lake and surrounding the Valley towns of Lancaster, Palmdale, Rosamond, Quartz Hill, and Littlerock. Crop land was primarily located within the Los Angeles County portion of the Valley, extending southeastward to the San Bernardino County line and westward to the apex of the Valley at the junction of the San Gabriel and Tehachapi Mountains. The 1950 land use survey is also noteworthy in its detailed listing of crop acreages, specifying that the irrigated crop land was comprised of 62,100 acres of alfalfa (possibly over-reported, as noted above), 4,500 acres of orchard, 4,200 acres of hay/grain, and 400 acres of truck, pasture, and miscellaneous crop (DWR, 1955). It is with this survey that information about individual crop types and acreages became sufficiently detailed to describe the historical cropping pattern in the Valley through to the present.

Period of Peak Agricultural Activity, 1950 to Early 1970s

Agricultural development in the Antelope Valley was at its highest level from 1950 until the early 1970s, during which time the agricultural land use remained generally stable in total irrigated acreage, cropping patterns, and spatial distribution throughout the Valley. The total irrigated crop land ranged between about 55,000 acres in 1950 (reported by Snyder) and roughly 60,000 acres in the early 1970s (analysis of county crop reports, described below) (see Tables D.2-1a/b and Figure D.2-1). The land and water use surveys of the period completed for 1957, 1961, and 1972 (DWR 1963, 1965, 1974, respectively) reported totals ranging between 57,100 and 42,300 acres of irrigated crop land. The type and relative acreages of crops grown during this period remained primarily alfalfa (and pasture) with small but stable acreages of truck, field, and deciduous (orchard) crops and a noteworthy increase in grain crops, as shown in a bar chart of the historical cropping pattern (Figure D.2-4). In addition, the spatial distribution of crop land in the Valley was similar to that observed in 1950, as illustrated in the land use maps for 1957,

1961, and 1972[2] (Figures D.2-5, D.2-6, and D.2-7, respectively). The crop land was located primarily within the Los Angeles County portion of the Valley, from the San Bernardino County line to the western apex of the Valley, with a smaller amount established in Kern County west of the town of Rosamond.

Period of Agricultural Decline, Early 1970s to Early 1990s

A fluctuating but overall decline in agricultural activity occurred during the 1970s, followed by a more rapid decline through the 1980s, before reaching the lowest point reported in 70 years by 1991. During this period, the agricultural land use dwindled in total irrigated acreage and spatial extent, and the cropping pattern changed with fluctuating proportions of the various crop types. The annual crop reports for the Los Angeles County portion of the Valley, combined with limited crop information for the Kern County portion, provided the crop acreage data with which to describe the agricultural decline.

For the Los Angeles County portion of the Antelope Valley, comparison of the Valley-specific and county-wide reports (available for 1981 through 1983), as well as input from County staff, identified the crop types that were exclusively grown in the Valley (e.g., peaches), those that were not (e.g., citrus), and those grown county-wide but with typical percentages within the Valley (e.g., 90 percent of the other orchard fruit reported county-wide). Appendix D-1: Table 1 lists the annual individual crop acreages within the Los Angeles County portion of the Valley from 1970 to present and provides the bases for extracting the Valley crop acreages from the county-wide reports beginning in 1984. In addition, Table D.2-2a shows these annual crop acreages individually as well as grouped by crop categories utilized by DWR (for comparison to historical acreage reports) and applied crop water requirements (for subsequent estimation of the applied agricultural water requirements from 1970 on). The grouped crop acreages are also shown in Tables D.2-1a/b.

For this period, the crop acreages within the Kern County portion of Antelope Valley were estimated to be 18 percent of the Los Angeles County acreages, based on a recent investigation conducted by the U.S. Geological Survey (USGS, 2003). In the latter study, to compensate for the lack of available crop data for the Kern County portion of the Valley, estimates of the historical crop acreages for the entire Valley were made based on analysis of the annual Los Angeles County crop data (above) and the 1961 and 1986 land use surveys for the Valley (DWR, 1965 and 1990, respectively). The ratio of crop acreage between Kern and Los Angeles Counties during those two survey years was determined to be approximately 18 percent (irrigated lands in the Kern County portion of the Antelope Valley were about 18 percent of those in the Los Angeles County portion). Table D.2-2b shows the estimated Kern County annual crop acreages individually as well as grouped by DWR crop category and by applied crop

[2] The 1972 land use survey crop land map shows approximately twice the irrigated acreage as described in the corresponding report (DWR, 1974), and is provided solely to show the approximate spatial distribution of crop land during that time.

water requirement. The crop acreages for the Kern County portion of Antelope Valley are also shown in Tables D.2-1a/b in conjunction with those for the Los Angeles County portion, which were combined to determine the crop acreages for the entire Valley.

The decline in agricultural activity in Antelope Valley from the early 1970s through early 1990s is most prominently shown in the graph of historical irrigated crop acreage (Figure D.2-1). While the total irrigated crop land in 1970 was approximately 60,000 acres, the amount declined to around 40,000 acres by the early 1980s and more rapidly thereafter, decreasing to 11,900 acres in 1991. Accordingly, crop land in the Valley became more sparse and spatially less extensive during this period, as seen in the land use maps for 1986 and 1989 (Figures D.2-8 and D.2-9, respectively). It is noteworthy that, by 1989, crop land was essentially limited to areas east of Lancaster and west of Rosamond (each within approximately 10 miles), no longer extending to the San Bernardino County line or the western apex of the Valley.

Along with the decline in crop acreage and extent within the Valley was a change in the cropping pattern, specifically fluctuating proportions of several of the various crop types (see Figure D.2-4). In particular, as alfalfa farming declined during the 1970s and 1980s from 33,000 to 7,000 acres, grain crops increased from 17,000 to as much as 29,000 acres (by 1975), before declining to a minor crop of about 1,500 acres. During this period, field crops showed a small increase (mid-1970s) before declining to a few hundred acres, while deciduous and truck crops remained fairly stable, generally comprising less than 3,000 to 4,000 acres each.

It should be noted that the crop report results for the period indicate greater total crop acreages than do the 1972 and 1986 land use surveys referenced above. Specifically, the 1972 survey reported 42,300 acres compared to a range of 50,000 to 63,000 acres from crop reports for the early 1970s. In general, higher acreages could result from multiple cropping recorded in crop reports but not detected in land use surveys. However, the 1972 land use survey reports only 1,400 acres of grain compared to the range of 17,000 to 25,000 acres indicated in crop reports for the early 1970s, so the 1972 land use survey results are interpreted to have under-reported crop land in the Valley that year. Likewise, regarding the 1986 land use survey, the total crop acreage reported was approximately 16,000 acres compared to the crop report results of around 25,000 acres; grain crop acreages were also much lower than in the crop reports. Interestingly, the 1987 crop report results are quite close to the 1986 land use survey results in total and grain crop acreages.

Importantly, the 1986 land use map (Figure D.2-8) was produced by compiling the individual 7-1/2’ crop maps prepared by DWR into a GIS database. In addition, the individual crop acreages in the database were verified in a quad-by-quad comparison of the compiled map with crop acreage summaries from DWR. The database and compiled map indicate that crop land comprised approximately 16,000 acres total with about 1,400 acres of grain crop, so the source of the contrast in acreages between the 1986 land use survey and crop reports is unknown, unless the survey reflects crop acreage from only a portion of 1986 and not the entire year (the DWR

study was reportedly completed by reviewing aerial photography from 1983 and 1985 and conducting field checks during the summer/fall of 1986). It is noteworthy that the 1986 land use map confirmed the results of the recent USGS investigation referenced above, specifically that the total crop acreage within the Kern County portion of the Valley was approximately 18 percent of the total in the Los Angeles County portion at that time. The land use survey also identified a moderate amount of non-irrigated crop land designated by DWR as primarily grain (fallow) along the southwestern flank of the Valley, as shown in the land use map (see Figure D.2-8), which is reminiscent of the earliest period of agricultural development in the Valley.

Recent Period of Agricultural Growth, Early 1990s to the Present

A gradual increase in agricultural activity occurred in the 1990s and early 2000s, followed by general stability to a slight recent decline to the present. During this period, the agricultural land use increased in total irrigated acreage, generally within the same agricultural areas as the previous period, and the cropping pattern changed with an increasing proportion of truck crops. Annual crop reports for Los Angeles County and annual pesticide use reports for Kern County, combined with satellite imagery analysis, provided the crop acreage data and spatial extent with which to describe the recent agricultural growth.

For the Los Angeles County portion of the Valley, comparison of the Valley-specific and county-wide reports (from 1981 through 1983), as well as input from County staff, again provided the bases for extracting the Valley crop acreages from the county-wide reports, which were available through 2008 (see Appendix D-1: Table 1). The annual crop acreages for this period are also compiled in Tables D.2-1a/b and D.2-2a, and the acreages in 2009 were assumed equal to those in 2008. For the Kern County portion of the Valley, the specific crop types and acreages listed by township, range, and section in the annual pesticide use reports from 1994 through 2009 were compiled in Table D.2-2b. The crop acreages for the Kern County portion of Antelope Valley are also shown in Tables D.2-1a/b in conjunction with those for the Los Angeles County portion, which were combined to determine the crop acreages for the entire Valley.

Satellite imagery from NASA's LandSat satellite program provided the bases for determining the spatial extent of irrigated crop acreages in the Valley during the period. Images of the Antelope Valley for 1989, 1996, and years 1999 through 2005 were analyzed by differentiating the bands of light within the electromagnetic spectrum that comprise the images and, in so doing, differentiated the areas of soil, water, and vegetation located in the Valley during those years. The analysis was conducted by calculating a Normalized Difference Vegetation Index (NDVI) for each image, which provided an initial assessment of the location of irrigated and non-irrigated lands. Visual interpretation of the images was also performed to verify or refine the NDVI results. The analysis was conducted on several images for each year, specifically those covering the spring, summer, and fall, in order to develop a "composite" of irrigated acreages throughout the entire year for each year analyzed (Qiu, H., 2005). As part of the current

investigation, analysis was performed of additional seasonal images for each year, resulting in minor revision of the irrigated crop land acreages and locations determined in the earlier analysis. The spatial extent of irrigated lands during the period is shown on the land use maps for 1999 and 2005 (Figures D.2-10 and D.2-11, respectively). A detailed description of the technique utilized to analyze the satellite imagery is provided in Appendix D-2. The extent of irrigated lands in Kern County during 2009 was similarly evaluated with analysis of several satellite images and the GIS spatial data from Kern County

The recent growth in agricultural activity in the Valley is shown in the graph of historical irrigated crop acreage (see Figure D.2-1). The total irrigated crop land reported in 1991 was 11,900 acres; by 2002 the amount had more than doubled to 28,300 acres; total crop land is presently around 24,000 acres. The county crop totals indicate that the fraction of crop land in the Kern County portion of the Valley increased between 1994 and 2004 from 29 to 38 percent of the Los Angeles County portion; through 2009, that fraction continued to increase into the range of 50 to 60 percent of Los Angeles County's cropland. Crop land in the Valley during this period became slightly more dense but still essentially limited to areas east of Lancaster and west of Rosamond (each within approximately 10 miles), as seen in the land use maps for 1999 and 2005 (see Figures D.2-10 and D.2-11, respectively). Exceptions to this are the apparent reestablishment of agriculture in the western apex of the Valley, as well as denser growth in Kern County.

Along with the recent increase in total crop acreage and density within the Valley was a change in the cropping pattern, specifically an increase of truck crops to the point of becoming the primary crop type in the Valley (see Figure D.2-4). While alfalfa cropping remained stable between 7,000 and 8,500 acres, truck crops increased from 2,200 to 17,000 acres by 2002 before gradually declining to presently around 11,800 acres. Carrots were the primary truck crop during the period, increasing from less than one hundred acres at the beginning to as much as 14,000 acres in 2002, and are presently around 8,300 acres. In contrast, the grain, deciduous, and field crops remained stable, with grain and deciduous crops generally comprising less than 4,000 and 2,000 acres, respectively, and field crops totaling only a few hundred acres.

It should be noted that the results of the satellite imagery analyses and crop report determinations were generally in good agreement throughout this period, in County and total crop acreages. For example, the 1999 acreages/county percentages from the crop reports (LA: 16,720 ac, Kern: 6,560 ac, Kern County fraction of Los Angeles County acreage: 39 percent) are almost identical to those from the satellite imagery-based land use map (LA: 16,990 ac, Kern: 6,260 ac, Kern County fraction of Los Angeles County acreage: 37 percent). As noted in Appendix D-2, the two methods for determining historical crop acreage in the Valley produced results that were, on average, within 11 percent of each other.

D.2.3 Municipal and Industrial Land Uses

The initial settlements within the Antelope Valley were small, generally established to promote agricultural development, and therefore scattered along the southwestern flanks of the Valley near known sources of surface water for irrigation and domestic supply. The settlements were established in the mid- to late-1800s and included towns still present today such as Littlerock, as well as many barely or no longer in existence such as Almondale, Harold, Del Sur, Manzana, and Neenach (Johnson, 1911; Thompson, 1929). With the completion of railroad lines to service other portions of the Valley in the late-1800s, towns such as Palmdale and in particular Lancaster eventually grew into the primary population centers (Snyder, 1955). The establishment in 1933 of Muroc Army Air Field (today's Edwards AFB) and the development following World War II of the aerospace industry at the Air Force's Plant 42 facility near Palmdale also contributed to growth in the Antelope Valley. Beginning in the 1940s and 1950s, sufficient information existed about urban population and spatial extent with which to describe the historical development of M&I land use in the Valley to the present. The discussion of M&I land use presented herein is summarized and illustrated in Table D.2-3 and Figure D.2-12, as well as the series of historical land use maps (Figures D.2-2, D.2-3, and D.2-5 through D.2-11).

Since about 1940 to 1950, when the town of Lancaster was the largest and essentially only urban center, with a reported population of less than 4,000 people, the total population and extent of urban development in the Valley have continually grown. The initial population increase of note was during the period from 1950 to 1970, when the Valley's population is reported to have grown from around 3,600 to over 70,000. This increase is shown in the table and graph of historical population for the Valley (Table D.2-3 and Figure D.2-12). In 1970, the City of Palmdale and towns like Quartz Hill, Rosamond, and Littlerock were still quite small, and it wasn't until the late 1980s that a marked increase in total population occurred, specifically from about 85,000 in 1980 to over 206,000 in 1990. Further, the population in the City of Palmdale had grown sufficiently to approach that of Lancaster and, by the year 2000, the two cities each had a population of about 125,000 (see Figure D.2-12).

By 2006, the Valley had a total population of over 300,000 with Lancaster and Palmdale having by far the greatest populations of any urban center in the Valley (about 135,000 each). In contrast, the towns of Quartz Hill, Rosamond, Littlerock, and North Edwards, the developments of Desert View Highlands and Lake Los Angeles, as well as the Edwards AFB, each had a population of about 15,000 or less. Similarly, the combined populations of the mutual and private water companies in the Valley were around 12,000 (see Table D.2-3). Population data through 2009 are more limited, but the cities of Lancaster and Palmdale, by far the largest in the Valley, presently have reported populations of 146,400 and 144,400, respectively (California Department of Finance, 2010). Finally, while there is no readily available record of rural residential population in the Valley, available data from Los Angeles and Kern Counties indicate

that slightly more than 7,000 improved parcels are located throughout the Valley, outside the service areas of municipal water purveyors or smaller mutual or other private water companies.

The historical population increases in the Valley since 1950 were accommodated by a corresponding expansion in the extent of each urban center, which can be seen in the series of land use maps for the Valley (see Figures D.2-2, D.2-3 and D.2-5 through D.2-11). Some minor amount of expansion is visible in the maps throughout the 1950s and 1960s, and the urban centers of the Valley (Lancaster, Palmdale, Quartz Hill, Rosamond, and Littlerock) were well established by the 1970s. By the late 1980s, the agricultural land between Lancaster and Palmdale had essentially been replaced by urban land as the two cities, as well as Quartz Hill, grew together. Between 1990 and 2000, the boundaries of the Valley cities, towns, and developments reached their approximate present limits.

D.2.4 Environmental and Open Space Land Uses

In the Antelope Valley, two environmental/open space areas are recognized as having water requirements separate from those associated with M&I or agricultural land use, specifically the Paiute Ponds wetlands and Apollo Lakes Park impoundments, which are shown on a map of the central portion of the Valley (Figure D-2.13). The Paiute Ponds were originally created in 1961 with the construction of a dike across Amargosa Creek to prevent its overflow into Rosamond Dry Lake (LACSD14, May 2004). Currently, the Paiute Ponds wetlands occupy an area of 400 acres, and consist of five main ponds and an extensive marshland area (Melitas, et.al., February 2005). Within the wetlands, a minimum of 200 acres is to be maintained as marsh-type habitat according to a three-party Letter of Agreement between the LACSD14, the California Dept. of Fish and Game, and Edwards AFB. The ponds include a series of impoundments for duck hunting built by Ducks Unlimited and Edwards AFB in 1991 occupying an additional 90 acres.

The Paiute Ponds wetlands receive recycled water from the Lancaster WRP with two requirements: sufficient water is to be delivered to maintain the minimum 200 acres of marshland habitat but controlled to prevent its overflow to the Rosamond Dry Lake. Additional water is periodically utilized to flush the ponds of accumulating salts. The recreational impoundments at the Apollo Lakes Park occupy a collective area of about 40 acres, and they first received deliveries of recycled (currently tertiary-treated) water from the Lancaster WRP in 1972 (LACSD14, May 2004). The deliveries to Apollo Lakes are sufficient to replace evaporative losses and thus maintain water levels in the impoundments.

D.3 Water Requirements

As stated earlier, the focus of this appendix report is to describe the historical water requirements and water supplies related to the four primary land uses in the Antelope Valley, continued for purposes of this overall assessment into three categories: agricultural, M&I (including mutual water companies, rural residential, and military lands), and environmental/open space (artificial

lakes). Another component of the overall analysis of water resources in the Valley is an assessment of historical return flows to the aquifer system from these uses. Accordingly, this section discusses the historical water requirements for all three categories of water use, as well as the associated return flows during the historical period of investigation.

D.3.1 Data Sources

The following discussion of historical water requirements in the Antelope Valley is based on a combination of available references describing water requirements for the primary land uses in the Valley and numerous data compiled and interpreted to provide updated estimates of agricultural water requirements and comprehensive summaries of M&I and environmental/open space water requirements. The discussion of return flows is based on available references estimating the historical fate of water associated with the primary land uses. A discussion of the data sources for the agricultural requirements assessment is presented first, followed by the M&I and environmental/open space water requirements.

Agricultural Water Requirements Data

The earliest comprehensive report describing agricultural land use in the Valley (Snyder, 1955) also provided estimates of the associated total water requirements for numerous individual years between 1919 and 1950. Snyder's estimates were made by two methods: 1) evaluation of electrical power consumption records to estimate groundwater pumpage and 2) determination of crop acreages and applied crop water duties to calculate the total applied water requirements. The above-described series of land and water use surveys of the Valley that tabulated agricultural acreages by crop type (Calif. Div. Water Res., 1947; SWRB, 1955; DWR, 1963, 1965, 1974, and 1990) also provided estimates of the associated total water requirement for the years 1945, 1950, 1957, 1961, 1972, and 1986. The requirements were derived from consumptive use values for designated crop types (alfalfa, other pasture, grain, field, deciduous, truck, and vineyard) and estimated irrigation efficiencies for the Valley.

Estimates of total agricultural water requirements reported herein for the period 1970 through 2009 were based on multiple data, including those needed to determine the crop acreages and respective applied crop water duties specific to the Valley. As described above, the crop acreages for the Valley were estimated from annual Los Angeles County crop reports (available 1970 through 2008) and Kern County pesticide use reports (available 1994 through 2009). Applied water duties for various crops grown in the Valley were calculated from a combination of: 1) records of reference evapotranspiration (ETo) obtained from the California Irrigation Management Information System (CIMIS) Victorville station, for years 1994 – 2003 (California Dept. of Water Resources); 2) reported crop coefficients (Kc) and growth periods specific to the region (University of California Cooperative Extension, 2004); 3) records of precipitation from numerous stations located throughout the Valley (NOAA, for years 1946 - 2003); and 4)

published and anecdotal information about irrigation efficiencies, distribution uniformity values, and water application associated with cultural practices specific to the Valley.

Municipal & Industrial Water Requirements Data

Reports and data describing historical M&I water requirements in Antelope Valley primarily provide information about the larger water purveyors for Lancaster, Palmdale, Quartz Hill, Rosamond, Littlerock, and Edwards Air Force Base. The earliest M&I water requirement data for the area were derived from an investigation of historical land and water use in the Valley (USGS, Templin, 1995), which included a tabulation of annual water requirements from 1946 through 1992 by individual water purveyor and source (groundwater and surface water). A subsequent investigation (USGS, 2003) extended the water requirements and water supply data through 1995. As part of the work reported herein, additional water requirement data from the purveyors were compiled to provide annual records of M&I water requirements and supplies from 1946 through 2009.

Retail and wholesale purveyors in the Valley include the Los Angeles County Waterworks District 40 (LACWWD40), Palmdale Water District (PWD), Quartz Hill Water District (QHWD), Rosamond Community Services District (RCSD), Littlerock Creek Irrigation District (LCID), Palm Ranch Irrigation District (PRID), Antelope Valley Water Company (AVWC), Edwards Air Force Base (EAFB), and the Antelope Valley-East Kern Water Agency (AVEK). The Desert Lake Community Services District (DLCSD), Boron Community Services District (BCSD), and mutual and private water companies are also included in this assessment, as is the large number of rural residential parcels in the Valley. Since water use data are extremely limited for the mutual and private water companies, and not available for rural residential parcels, their respective historical water requirements were estimated utilizing other available data such as population and service connection data.

Two reports describe historical and projected M&I return flows of recycled water from the Valley's two primary wastewater reclamation plants (WRPs), Lancaster and Palmdale. The reports provide information about the infiltration and percolation of recycled water from ponds and storage reservoirs at the Lancaster WRP (CH2MHill, 2006) and from ponds and land application areas at the Palmdale WRP and adjacent Los Angeles World Airports (LAWA) property, respectively (LACSD, 1999). In addition, data were compiled on the metered influent and effluent volumes, evaporation and precipitation rates, and disposal volumes at the Lancaster WRP (1975-2009) and Palmdale WRP (1953-2009) in order to estimate historical annual amounts of recycled water return flows (Section 4.6 and Appendix G).

Environmental and Open Space Water Requirements Data

Two recent reports evaluating alternatives for the expansion and upgrade of the Lancaster WRP through 2020 describe the current and projected water requirements specifically for maintaining

the Paiute Ponds wetlands and Apollo Lakes impoundments (ESA, both May 2004). Another recent report provides information about the current environmental water demand as well as the projected total available recycled water through 2035 from the Lancaster, Palmdale, and RCSD WRPs (IUWMP, 2005). In addition, as part of this investigation, the data recorded by the LACSD14 for annual water deliveries to the Paiute Ponds and Apollo Lakes were compiled to provide annual records of the environmental water requirements from 1975 through 2009. Two additional reports provide estimates of the return flows from the Paiute Ponds (CH2MHill, 2006; GTC, 2006).

D.3.2 Agricultural Water Requirements

Estimates of historical agricultural water requirements in Antelope Valley have been made for various periods of time by several investigators, each utilizing similar methods but different parameters (e. g., crop consumptive use values and irrigation efficiencies). The first comprehensive estimate was made for around 1920 and subsequent determinations were made for numerous years during the period of agricultural expansion until 1950. Thereafter, until the mid-1980s, agricultural land and water use surveys were made much less frequently, approximately once per decade. As part of this overall assessment, primarily to update the historical record of water use by agriculture through the present, estimates were made of agricultural water requirements for each year from 1970 through 2009. Additionally, the results from the historical land and water use surveys between 1945 and 1986 were evaluated in the context of the entire historical period, in part by comparing previously reported water use with revised estimates based on current understanding of crop water requirements and irrigation practices for the historically surveyed years (1945, 1950, 1957, 1961, 1972 and 1986). The following discussion of agricultural water requirements is summarized in Tables D.3-1 and D.3-2, and illustrated in Figure D.3-1. Supporting details related to the development of individual applied crop water duties, as well as the estimation of agricultural return flows, are included in Appendix D-3.

Period of Agricultural Expansion, 1910 to 1950

Early in the development of agricultural land use in the Valley, around 1920, the agricultural water requirement was reported to be from about 38,000 to 64,000 acre-feet per year (afy) (Thompson, 1929, and Snyder, 1955, respectively). During the overall expansion of agriculture over the next 30 years, the associated water requirements are reported to have initially increased to about 155,000 afy by the late 1920's; followed by a notable decline through the Great Depression to roughly 100,000 afy by 1935; followed by significant increases over the next 15 years to about 160,000 afy in 1940; then reaching approximately 205,000 afy by 1945 and 350,000 afy by 1950 (Snyder, 1955). The reported water requirements for the period were calculated as the product of annual crop acreages and corresponding applied crop water duties, the latter based on the understanding of crop consumptive use values and irrigation efficiencies for the Antelope Valley at that time. The reported agricultural water requirements for the period

were also separately estimated from interpretation of electrical power consumption records; the results corresponded reasonably well with the calculations based on crop acreages and water duties (Snyder, 1955).

As noted above, the reported agricultural water requirements for the period 1920-1950 (Snyder, 1955) were based on the understanding of crop water requirements and irrigation efficiencies at that time. Using alfalfa as an example, since it was the predominant crop through that era, the reported water requirements derived from a reported crop water requirement (ET_C) of 3.4 feet per year and irrigation efficiencies in the range of 41 to 50 percent. In brief summary, the latter values suggest that about half, to nearly 60 percent, of applied water would have been in excess of the actual requirements of the crop, ultimately contributing to introduction of a substantial return flow percolating below irrigated fields. Since another key component to the overall assessment reported herein is to analyze inflows to groundwater, including return flows from various water uses in the Valley, the notably low reported irrigation efficiencies were re-examined as part of this effort.

Current knowledge of crop water requirements indicates that the historical estimate of crop water requirements was also low. As a result of the combined low estimates of crop water requirements and irrigation efficiencies, which tend to cancel each other in a calculation of applied water, the historically reported amounts of applied water are not notably different than would be calculated with current estimates of crop water requirements and irrigation efficiencies for that time period.

As a result of the preceding, the historically reported amounts of applied irrigation were re-examined using current values of individual crop water requirements (e.g., ET_C of alfalfa equal to 5.2 feet per year) and a range of irrigation efficiencies (65 to 75 percent) considered to be applicable for the irrigation methods in practice at that time. Examination of the range of results indicated that, on average through the 1920-1950 period, an irrigation efficiency of about 70 percent (combined with current estimates of crop water requirements) would result in about the same amount of applied water as historically reported, but would more efficiently meet the crop water requirements and, as a result, produce smaller return flows (about 30 percent of applied water, in contrast to the historically reported 50 to 60 percent of applied water).

In light of the results derived from re-examination of historically reported irrigation from about 1920-1950, and in light of a general question about whether historical irrigation could have been as great as 60 percent inefficient, the results of the re-examined irrigation analysis are included herein to estimate applied water through that era. Those results are reflected in Table D.3-1 and illustrated in Figure D.3-1.

Period of Peak Agricultural Activity, 1950 to Early 1970s

With agricultural development in the Valley at its highest level from 1950 until the early 1970s, the associated agricultural water requirements remained fairly stable at historical high levels during the period. Estimated water requirements ranged between nearly 350,000 af in 1950 and about 300,000 af in the early 1970s (analysis of county crop reports and applied crop water duties, described below) (see Table D.3-1 and Figure D.3-1). A majority of the total agricultural water requirements in the Valley came from irrigating alfalfa and pasture crops because they comprised the majority of crop land and also have the highest applied crop water requirements.

The land and water use surveys completed for 1957, 1961, and 1972 (DWR 1963, 1965, 1974, respectively) included estimates of the total agricultural water requirements ranging between 167,000 and 207,000 af. The survey water requirement estimates for the period were based on applied crop water duties derived from essentially the same crop consumptive use values as in 1945 and 1950, but with an assumed irrigation efficiency of 70 percent. While the irrigation efficiency of 70 percent was lower than in previous DWR surveys, the crop water duties for the peak period survey years were much lower than is now known. Thus, the agricultural water requirements reported in the 1957, 1961, and 1972 surveys appear underestimated. As a result, revised estimates of the water requirements for those survey years, utilizing the crop acreages reported by DWR but with crop water duties and irrigation efficiencies as described above, range between 287,000 and 357,000 afy (see Table D.3-1 and Figure D.3-1). For the time period between Snyder's last estimate (1950) and the current estimates from 1970 to the present, this overall assessment utilizes the revised estimates 334,000 afy for 1957 and 357,000 afy for 1961.

Period of Agricultural Decline, Early 1970s to Early 1990s

During the period of decline in agricultural land use in the 1970s and 1980s, the associated water requirements fell to the lowest levels in 70 years (by 1991). The aforementioned Los Angeles County annual crop reports and Kern County crop information, combined with applied crop water duties, provided the data with which to describe the decline in agricultural water requirements during the period.

The annual county crop reports identified the primary crops grown in the Valley, and nine primary crops or crop categories grouped by water requirements were designated for which applied crop water duties were determined in this overall assessment. In each case, the crop water requirement, specifically the crop evapotranspiration (ETc), was calculated using a CIMIS-based approach utilizing reference evapotranspiration (ETo) data coupled with reported crop coefficients (Kc) specific to crop growth stage and location. The applied crop water requirement was calculated by subtracting effective precipitation (considered to be one-half of average precipitation in the months of December through February, only for crops in the ground during those months) from the total crop water requirement. Applied crop water duties were then calculated by factoring an assumed irrigation system distribution uniformity (80 percent).

For some crops, the resultant applied water duty was augmented with additional applied water to account for cultural practices in the Valley, for erosion control, field preparation, and pre-irrigation. The resultant total applied crop water duties (AW_T) are listed in Table D.3-2; Appendix D-3 provides a detailed description of the calculations; and Appendix D-3: Tables 1 through 5 summarize the individual calculation steps.

The total applied crop water duties calculated for each crop (Table D.3-2) were combined with the crop acreage data for the Valley (Table D.2-1b) to generate annual estimates of total agricultural water requirements for the period from 1970 through the present (see Table D.3-1 and Figure D.3-1). The total estimated water requirements include an additional 5 percent above the requirement for reported crop acreages to account for unreported small farms in the Valley.

The decline in agricultural water requirements in Antelope Valley from the early 1970s through early 1990s is quite evident in the graph of historical agricultural water requirements (see Figure D.3-1). Total agricultural water requirements were generally around 270,000 afy through the 1970s (as high as about 311,000 af in 1971 and as low as about 227,000 af in 1976). Throughout the 1980's, agricultural water use rapidly declined, to about 70,000 af by 1989, with a slightly smaller decline (to about 68,000 af) by 1991. With alfalfa and other pasture crops still comprising the majority of crop land in the Valley during most of the period, a majority of the total agricultural water requirements still derived from the irrigation of alfalfa and pasture.

Recent Period of Agricultural Growth, Early 1990s to the Present

As described above, the crop acreages derived from county annual crop reports and the applied crop water duties calculated as part of this investigation were combined in order to estimate the agricultural water requirements for the period 1970 through 2009. The resultant estimates are summarized in Table D.3-1 and illustrated in Figure D.3-1, both of which reflect an increase in agricultural water requirements beginning in the early 1990s as a result of the reported increase in agricultural activity during the period. Agricultural water requirements increased through the 1990s and early 2000s, followed by general stability to a slight recent decline to the present. At the beginning of the period, the agricultural water requirement was approximately 70,000 afy; that amount essentially doubled to about 140,000 afy by 2000. Since then, agricultural water requirements have slightly declined to around 110,000 to 120,000 afy over the last five years.

It is noteworthy that the change in cropping pattern that occurred during this most recent period, specifically the increase in truck crop acreages to replace alfalfa and pasture as the primary crop (see Figure D.2-4), produced a dramatic change in the proportions by crop of the total water requirements. While irrigation of alfalfa and pasture crops comprised about two-thirds of the total water requirements at the beginning of the period (early 1990s), alfalfa consumed less than half of the total agricultural water requirements by 2000 and has remained at just over one-third of the total through 2009.

Historical Agricultural Return Flows

As a component of the overall analysis of water resources in the Antelope Valley, an assessment was made of return flows from the historical application of agricultural irrigation water. The return flows were calculated from the estimates of additional applied water for irrigation efficiency/distribution uniformity values and cultural and irrigation practices in the Valley developed in the current investigation (see Appendix D-3). First, rates of return flow were developed for each crop based on the additional applied water beyond the crops' consumptive use (ET_{AW}) minus the portion of water applied for cultural irrigation practices expected to be lost to evaporation from the uppermost soil profile. As described in detail in Appendix D-3, all water applied for erosion control and a small part of the water for field preparation and pre-irrigation were subtracted from the amount of applied water beyond the ET_{AW} of each crop, with the balance equal to the crops' rates of return flow (see Appendix D-3: Table 6).

Secondly, the return flow rates were utilized in conjunction with reported annual crop acreages to calculate the total return flow amounts for years 1970 through 2009. For the years preceding 1970, when information about crop acreages and applied crop water requirements was less detailed, total return flow amounts were estimated to be 30 percent of the total applied water. The calculated return flow amounts are listed by year in Appendix D-3: Table 7 and shown with the total agricultural water requirement (total applied water) in graphical form in Appendix D-3: Figure 1. It should be noted that, while the return flows become deep percolation within the year irrigation water is applied, their arrival at sufficient depth to actually recharge groundwater is delayed until years later, based on additional water resources analyses conducted for this overall report on basin conditions (Appendix E). As such, the calculated flows are labeled "Gross Return Flows" in the latter table and figure, review of which shows that historical gross return flows from agriculture increased from approximately 25,000 to almost 110,000 afy between 1920 and 1950, remained around 100,000 afy until the early part of the 1960s, steadily declined to about 15,000 afy by 1990, and subsequently increased into a range between about 26,000 and 34,000 afy during the last decade.

D.3.3 Municipal and Industrial Water Requirements

The municipal and industrial (M&I) water requirements of the urban and suburban areas within Antelope Valley are met by several water purveyors, the largest of which are Los Angeles County Waterworks District 40 (LACWWD40) and Palmdale Water District (PWD). Together, those districts currently provide 75 to 80 percent of the total M&I water requirement in the valley. Several smaller purveyors, including the Quartz Hill Water District (QHWD), Rosamond Community Services District (RCSD), and Littlerock Creek Irrigation District (LCID), together provide about 10 percent of the total M&I water requirement. The balance of the total M&I water requirement is met by a combination of the Palm Ranch Irrigation District (PRID), Antelope Valley Water Company (AVWC), Desert Lake Community Services District (DLCSD), Boron Community Services District (BCSD, well field located in the Valley),

Edwards Air Force Base (serving the base only), and numerous mutual or private water companies. The service area boundaries of the main purveyors are shown relative to the urban centers in a map of the Valley (Figure D.3-2).

Unlike agricultural water requirements, which are estimated as described above, almost all M&I water use in the Valley is recorded by the individual water purveyors. Records (meter readings) are maintained of the various components of overall M&I water supply, specifically local groundwater, local surface water, and imported water deliveries from the State Water Project (SWP). Historical records of M&I water use by the main purveyors and by about half of the mutual/private water companies in the Valley were previously compiled for the period 1946 through 1995 (USGS, 1995 and 2003). In this overall assessment, the record of historical M&I water use was extended through the present by compiling water use records of the main purveyors and estimating the water use of the mutual and private water companies. Extended records of the mutual and private companies' water use were not available, and were thus estimated as described below. Similarly, records of rural residential water use are not available. In light of the large number of recorded improved parcels in the Valley, however, the water requirements associated with rural residential land use were also estimated as described below.

Historical M&I Water Requirements

Historical water use by the respective purveyors in the Valley is summarized in Table D.3-3 and illustrated in Figure D.3-3; in addition, Appendix D-4: Table 1 shows calculations of water company per capita water use rates and Appendix D-5: Figures 1 through 9 show the historical water requirements of the Valley purveyors.

M&I water requirements in the Valley have steadily increased from 1946 through the present. The annual total water requirements of the main water purveyors in the Valley were less than 20,000 af until about 1960, after which total M&I water use gradually increased to around 30,000 afy by the early 1980s. Annual water requirements then began to increase at a much more rapid pace, exceeding 60,000 af by 1990 and approaching 100,000 af by 2000. Since then, the annual water requirements of the main purveyors continued to increase, to a high of about 107,000 af in 2007 before decreasing to roughly 87,000 af over the last two years. The historical total water use of the mutual and private water companies is estimated to have been less than 1,000 afy through the late 1960s, after which annual water use is estimated to have progressively increased to approximately 5,400 af by 2007 with a slight decline to about 4,300 af presently. Finally in the general category of municipal-type water requirements, rural residences (considered to be represented by some 7,000 improved land parcels located outside the service areas of municipal water purveyors or smaller mutual or other private water companies) were estimated to have utilized a total of about 8,200 afy in 2006 (approximately 1.2 afy per parcel). Similar to the method employed for estimating the historical rate of growth of mutual water company water demand (described below), the 2006 rural residential water requirement of 8,200 afy equaled approximately 8 percent of the requirement of the major purveyors, and the

historical rural residential water requirements are considered to be that constant fraction of the historical M&I water requirements of the major purveyors. As such, the rural residential water requirement in 2009 is estimated to be about 7,000 af.

In order to estimate the annual total water use of the mutual and private water companies for years 1946 through 2009, their per capita water use rate was estimated based on limited available population data and reported water use for 16 of the companies (1992 through 1995, the most recent years available; USGS, 1995 and 2003). The resultant unit rate of water use, 0.40 afy per capita, was then utilized to calculate annual total water use for all water companies for those years when population figures were available (2001, 2004, 2005, and 2006; California Department of Health Services). The total calculated water requirements were then compared to the total recorded water requirements of the major water purveyors for those four years in order to develop a ratio of water use between the mutual and private companies and major purveyors (5 percent). That percentage was then applied to the annual total recorded water requirements of the major purveyors for the remaining years in order to complete the estimation of annual total water requirements of the water companies for the period 1946 through the 2009. Appendix D-4: Table 1 shows the individual calculations made to develop the estimated per capita water use for the water companies, and the resultant estimates are included in Table D.3-3.

In summary, the total M&I water requirements in the Valley, including those recorded by the main purveyors and estimated for the water companies and rural residential users, was as high as about 122,000 af in 2007 and is currently about 98,000 afy.

Historical M&I Return Flows

Historical M&I return flows have originated from two sources: 1) on-property, including from landscape irrigation and other outdoor water use around all homes, and from the discharge of water to on-site disposal systems of unsewered homes and 2) off-property, specifically from infiltration of recycled water at water reclamation plants (WRPs) serving sewered homes and other municipal service connections. Regarding return flows from irrigation/outdoor water use, and as part of this investigation, it was estimated that the percentages of indoor and outdoor water use in the Valley are 45 and 55 percent, respectively, based on interpretation of the variations in monthly municipal water requirements for LACWWD40 (data available for 2001 forward). Further, it was assumed that the percentages of irrigation water consumptively used vs. generating return flows are 80 and 20 percent, respectively, which are considered to reasonably meet irrigation requirements without generating excessive runoff or deep percolation. Thus, of the 55 percent of total municipal-type water requirements (urban, mutual and small water company, and rural residential) utilized outdoors, 20 percent would become return flow. This equates to 11 percent of the total M&I water requirements becoming return flow from M&I irrigation.

In the case of return flows from on-site disposal systems such as septic tanks and leach fields, it was estimated that the percentages of sewered and unsewered homes in the Valley's urban areas are approximately 70 and 30 percent, respectively. These were based on comparison of WRP influent volumes and urban area water requirements, as well as the spatial overlap of developed service areas of the municipal and sanitation districts (district information available for 2000, 2005, and 2008). As above, an estimated 45 percent of total municipal water requirements would be utilized indoors and 100 percent of water disposed on-site would produce return flows. Thus, 30 percent of the urban municipal water requirements (26.5 percent of the total M&I water requirements) plus 100 percent of the mutual/small water company and rural residential water requirements (4.4 and 7.1 percent of the total M&I water requirements, respectively), or a combined 38 percent of the total M&I water requirements, were estimated to be utilized in unsewered areas in the Valley. Of this amount, 45 percent would be discharged on-site and become return flow, which equates to approximately 17.1 percent of the total M&I water requirements. The percentages of total M&I water requirements for irrigation/outdoor water use (11 percent) and on-site disposal systems (17.1 percent) were uniformly utilized to estimate the historical on-property M&I return flows, which are listed in Appendix D-6: Table 1 and shown in graphical form in Appendix D-6: Figure 1.

The off-property return flows were derived from an assessment made of the deep percolation of recycled water from the Lancaster and Palmdale WRP ponds, storage reservoirs, and land application areas, as described in Section 4.6 and Appendix G of this overall report. Annual return flow volumes were estimated from 1975 (Lancaster) and 1953 (Palmdale) through 2009, as shown in Tables 4.6-1 and 4.6-2, respectively, in Section 4.6 of this report. In addition, M&I return flows from the on- and off-property sources are compiled in Appendix D-6: Table 1 and shown in Appendix D-6: Figure 1.

As with agricultural return flows, the M&I irrigation return flows infiltrate within the year the water is utilized, but do not reach sufficient depth to actually recharge groundwater until years later. In contrast, M&I return flows from the on-site disposal systems as well as the WRPs have been ongoing and are considered to provide recharge to groundwater as they become available (no delay). As a result, while both on- and off-property M&I return flows are referred to as "Gross Return Flows" in Appendix D-6: Table 1 and Figure 1, those from the on-site disposal systems and WRPs are considered to be net flows in the corresponding analysis of water resources and natural recharge in the Antelope Valley described in this overall report (Chapter 4.3 and Appendix E).

Review of the M&I return flow tables and graph shows that return flows from the M&I service areas and rural residential parcels (on-property sources) have comprised all or the great majority of the total flows and, as expected, have paralleled the historical increase in M&I water requirements in the Valley. These return flows were typically less than 3,000 afy in the 1950s, increasing to about 10,000 afy during the 1970s, steadily increasing to a high of about 32,000 af in 2007 before slightly declining to roughly 28,000 af by 2009. In contrast, return flows from the

WRPs have been much smaller, essentially limited to less than 200 afy from the time of the WRPs' construction until the 1980s, at which point increasing effluent volumes from the Palmdale WRP were disposed by land application at the adjacent LAWA property, reaching around 7,000 afy by 2000. Subsequently, land application was replaced by agricultural irrigation and reduced to about 3,000 afy by 2005 and less than 500 afy currently. The overall effect of these diverse trends has been to produce historically increasing amounts of return flows until recently, to a total of nearly 40,000 afy in 2001, followed by a gradual decline, to about 28,000 afy currently.

D.3.4 Environmental and Open Space Water Requirements

The current contracted water requirements for the Paiute Ponds wetlands, including the impoundments for duck hunting, are reported to be about 3,300 afy; the current contracted water requirements for the Apollo Lakes impoundments are approximately 170 afy (LACSD14, May 2004, and IUWMP, 2005). Records of water deliveries dating back to 1975 indicate that the actual deliveries to the Paiute Ponds have grown from roughly 1,000 afy in 1975 to as much as 9,700 af in 2005 and are currently 6,700 afy (Table D.3-4). Recycled water deliveries have exceeded the contracted amount of 3,300 afy since 1993. The actual water deliveries to the Apollo Lakes impoundments have ranged between 100 and 300 afy with an average of around 190 afy since 1975, which is in general agreement with the contracted amount of 170 afy.

It is unclear whether Paiute Ponds and Apollo Lakes represent an actual "demand" in the classical sense of water requirements for uses such as agricultural irrigation and municipal water supply, or whether they represent forms of water disposal, specifically of treated water (recycled water) that have produced environmental features now requiring water to maintain the resultant environment. Based on available documents (ESA, May 2004, and IUWMP, 2005) it appears that the latter would be an appropriate classification and that there is truly a "water requirement" to maintain the environmental features at Paiute Ponds and Apollo Lakes.

Regarding return flows from these environmental features, they have historically been derived solely from infiltration of recycled water from the Paiute Ponds. As described in Section 4.6 and Appendix G of this overall summary report, these flows are estimated to be consistently small, on the order of 20 afy, due to the presence of thick clay layers extending beneath the ponds from the adjacent Rosamond Dry Lake (CH2MHill, 2006; GTC, 2006). Since the return flows from the Paiute Ponds have been ongoing for decades, they are considered to provide recharge to groundwater as they are generated (no delay) and thus treated as net flows in the corresponding water resources and natural recharge analysis (Appendix E).

D.3.5 Summary of Historical Water Requirements

In summary, historical agricultural water requirements for 1920 to 2009 were determined by compiling previously reported estimates for the period 1920 to 1950 and estimating the water

demand for the period thereafter. Historical M&I water requirements for 1946 to 2009 were established by compiling reported annual water use data (from 1946 to 1995) and water use records (through 2009) for the public water purveyors and estimating the water demand of mutual and private water companies and rural residential land use (1946 to 2009). All available environmental water use data from the LACSD14 were compiled for the period 1975 to 2009.

Total historical water requirements in the Valley, consisting of agricultural, M&I, and environmental water uses, are summarized in Table D.3-5 and illustrated in Figure D.3-4. The total water requirements have varied greatly throughout the historical period, primarily affected by agricultural water use. During the period of agricultural expansion through 1950, the Valley experienced the greatest increase in water requirements from early development to nearly 360,000 afy. Agricultural water demand comprised the vast majority of the total requirements, through that period, increasing to nearly 350,000 afy by 1950, while M&I use comprised the balance of about 10,000 afy. During the period of peak agricultural activity through the early 1970s, total water requirements remained high, between about 300,000 and 370,000 afy. Through that period, agricultural water use was slightly declining, and M&I water requirements were gradually increasing, from about 10,000 to 30,000 afy.

With the subsequent large decline in agricultural activity through the early 1990s, total water requirements substantially decreased, from approximately 300,000 to about 150,000 afy, primarily as a result of the decline in agricultural water demand from about 270,000 to about 70,000 afy. During the latter half of that period of agricultural decline, M&I water requirements increased from about 30,000 afy to about the same as the agricultural water demand, about 70,000 afy, by 1990. Environmental water requirements during the period made up a miniscule portion of the total, ranging from 1,000 to 5,000 afy. Subsequently, both agricultural and M&I water requirements increased at comparable rates throughout the 1990s and, by 2000, total water requirements, including a small amount for environmental uses, had increased to approximately 250,000 afy. From 2000 through 2008, total water demand remained generally stable, a result of a generally offsetting increase in M&I water use and slight decrease in agricultural water use. In 2009, the agricultural water demand was about 115,000 afy, total M&I water requirements were about 98,000 afy (87,000 for all uses by the main purveyors and about 11,000 afy by mutual, small private and rural residential users), and environmental water use was about 7,000 afy, for a total water requirement of approximately 220,000 af.

D.4 Water Supplies

Prior to 1972, essentially all water requirements in the Antelope Valley were met by local groundwater, augmented by a small amount of local surface water, generally less than 3,000 afy, diverted from Littlerock Creek. Beginning in 1972, supplemental water has been imported into the Valley from the State Water Project (SWP) to augment the local water supplies. SWP deliveries are imported by three State Water Contractors in the Valley, specifically the Antelope Valley-East Kern Water Agency (AVEK), Palmdale Water District (PWD), and Littlerock Creek

Irrigation District (LCID). Collectively, these contractors have SWP Table A amounts of 165,000 acre-feet per year. Imported SWP water was first made available for treatment and municipal and agricultural use by LCID in 1972; SWP water was initially imported for agricultural water supply to augment local groundwater by AVEK in 1976.

Since the 1970s, overall water demand in the Valley has been met by a combination of local groundwater and imported SWP water, plus continued use of a small amount of local surface water diversions and recycled water from the Lancaster and Palmdale WRPs. The relative contributions of those components of overall water supply toward total water requirements are detailed as follows.

D.4.1 Data Sources

The following discussion of water supplies in the Antelope Valley is based on a combination of available references describing historical water requirements and supplies for the primary land uses in the Valley and numerous data compiled and evaluated to update records of water use and supply through 2009. The earliest reports describing water requirements in the Valley also provided limited information about the development of local surface water diversions from Littlerock Creek and local groundwater supplies (Thompson, 1929; Snyder, 1955). Previous reports compiling historical data on the water requirements for agriculture, M&I, and environmental land uses in the Valley noted the associated water supplies utilized to meet the water requirements (USGS, 1995 and 2003), specifically groundwater, local surface water diversions, imported SWP water, and recycled water.

Water supply records through 2009 were collected as follows: 1) local surface water diversions for agricultural and M&I water requirements from LCID and PWD; 2) imported SWP water deliveries for agricultural and M&I water requirements from AVEK and the main M&I water purveyors; 3) recycled water for agricultural irrigation and environmental water use from LACSD14 and LACSD20 (treated effluent data also collected from RCSD and EAFB); and 4) groundwater for M&I water requirements from the main M&I water purveyors. Agricultural groundwater pumpage was calculated as the balance of total agricultural water requirements minus all other components of agricultural water supply (surface water and recycled water from sources noted above). Information was provided about the Littlerock Creek Dam history, through the PWD home page (www.palmdalewater.org/YW/PH/ph_01trans.html), and post-rehabilitation (1995) agreements for utilizing surface water diversions, through LCID (personal comm., Brad Bones, March 23, 2007, and June 22, 2010).

D.4.2 Surface Water Supplies, Local and Imported

The earliest reported development of surface water supplies in the Valley involved the diversion of streamflow from local creeks such as Littlerock and Big Rock Creeks for irrigating orchards in the late 1880s (Thompson, 1929). Further development led to the construction of a dam on

Littlerock Creek in 1924 to provide supplemental water for irrigation locally. Later, from the mid-1950s through early 1970s, Littlerock Creek diversions were utilized by both LCID and PWD, although PWD's use of the diversions transitioned from agricultural water supply toward primarily meeting M&I water demands. Since completion of the Littlerock Dam rehabilitation project in 1995, Littlerock Creek diversions have been primarily for M&I water supply for PWD and LCID with small amounts for agricultural irrigation within the LCID service area. Records of the diversions for PWD and LCID were previously compiled back to 1946 (USGS, 1995); however, the data for LCID compiled by the USGS are inconsistent with available records provided by LCID from 1970 forward and are excluded from this summary. The Littlerock Creek diversion data for 1946 through 2009 are shown in Table D.4-1 and Figures D.4-1a and D.4-1b.

For about 50 years beginning in 1946, Littlerock Creek diversions were generally stable, typically providing a total of 1,000 to 3,000 afy of local surface water toward agricultural and M&I water supplies (see Table D.4-1 and Figure D.4-1a). There have been only a few years, in the 1960s and in 2002 and 2007, when water was not available for diversion. Beginning in the mid-1990s, coincident with the dam rehabilitation project (during which time the dam was also raised 12 feet, increasing the reservoir's capacity), total diversions have typically exceeded 3,000 afy and in some years have approached 7,000 afy, all toward M&I water supplies (see Table D.4-1 and Figure D.4-1b).

Records of imported water from the State Water Project begin with the first deliveries to the Valley in 1972 and continue through the present. The first SWP deliveries in 1972 were limited, when 338 af were delivered for M&I and agricultural irrigation water supply by LCID. SWP deliveries greatly increased beginning in 1976, when about 27,000 af were delivered for agricultural irrigation by AVEK. Imported SWP water for irrigation notably increased into the early 1980's, reaching a peak of nearly 64,000 af in 1981 (see Table D.4-1 and Figure D.4-1a). Since then, deliveries of SWP water for agricultural irrigation have been notably smaller, approaching 40,000 af in only one year (1982) and less than 30,000 af in all other years. Over the last decade, deliveries of SWP water for agricultural use have ranged between approximately 1,900 and 28,000 afy and averaged about 12,000 afy.

SWP deliveries for municipal water supply have nearly linearly increased since the early 1980's, to almost 72,000 afy in 2006 and 2007, before declining to 52,000 af in 2008 and 2009. Municipal SWP deliveries have exceeded SWP deliveries for agricultural water supply since 1986 (see Table D.4-1 and Figure D.4-1a). Combined SWP deliveries for agricultural and municipal water supply were as high as about 89,600 af in 2007 and are currently around 54,000 afy. Added to local surface water diversions from Littlerock Creek, the total surface water supply is presently about 54,200 afy (see Table D.4-1 and Figure D.4-1b). Historical supplemental surface water use for M&I water supply is listed by purveyor in Appendix D-7: Table 1.

D.4.3 Groundwater Supply

Groundwater use in the Valley has dramatically fluctuated in response to wide variations in historical agricultural activity and, more recently, in response to development of M&I water demand. Groundwater pumping for M&I water supply is generally recorded by Valley water purveyors. In contrast however, as described earlier, total agricultural water requirements are necessarily estimated from historical agricultural land use; and groundwater pumping for agricultural water supply is calculated as the difference between total agricultural water requirements and all other components of agricultural water supply (supplemental surface water and recycled water). The calculation of historical agricultural groundwater pumping is summarized in Appendix D-7: Table 2. Historical M&I groundwater pumping for individual water purveyors is listed in Appendix D-7: Table 3. Total groundwater pumping for agricultural and M&I water supplies from 1946 through 2009 is provided in Table D.4-2 and Figure D.4-2.

Groundwater pumping for agricultural irrigation has fluctuated greatly throughout the historical period, and has always exceeded pumping for M&I supply in the Valley. At the peak of agricultural irrigation in the early 1950's, groundwater pumping for agricultural water supply was as high as about 360,000 afy (see Table D.4-2 and Figure D.4-2). During the 1950s and 1960s, agricultural pumping consistently exceeded 300,000 afy, and remained above 200,000 afy through most of the 1970s. Groundwater pumping for agricultural water supply significantly declined through the 1980s, to about 50,000 afy by 1990. Since then, agricultural pumping notably increased, to about 120,000 afy in 2002, subsequently fluctuating between about 80,000 and 115,000 afy through 2009.

Groundwater pumping for M&I water supply (main purveyors) gradually and steadily increased for over 50 years, from about 5,000 af in 1946 to about 45,000 af in 2001; since 2000, groundwater pumping for the main M&I water supply has ranged from as low as about 31,000 afy to peaks of about 45,000 afy in 2001 and 2008. Addition of the estimated pumping by mutual and small private water companies and the rural residential water users increases the total estimated current pumping for municipal-type uses into a range of about 42,000 to 57,000 afy since 2000 (see Table D.4-2 and Figure D.4-2). While M&I water requirements have rapidly increased since the early 1980s, to a peak of about 107,000 afy in 2007 for the main purveyors (and about 122,000 afy including estimated mutual and small private water company and rural residential uses), an increasingly large part of the M&I water demand has been met by imported SWP water supplies (Figure D.4-1a).

Overall, groundwater pumping to meet both agricultural and M&I water requirements in the Valley has ranged from as much as 370,000 to 380,000 afy in the 1950's-1960's to about 85,000 afy by 1990. Since then, total groundwater pumping has increased, to as high as nearly 175,000 afy in 2002, followed by a fluctuating but overall decline within the range of 130,000 to 160,000 afy and roughly 145,000 af in 2009. Over the last decade, total groundwater pumping has averaged about 153,000 afy.

D.4.4 Recycled Water Supply

Recycled water from the Lancaster and Palmdale WRPs has been utilized for agricultural irrigation in the Valley since 1988 and 1959, respectively. Water from the Lancaster WRP has also served an environmental water use maintaining the Paiute Ponds wetland and Apollo Lakes Park since at least 1975. Annual records of recycled water volume and usage for both WRPs compiled from 1975 through 2009 are listed in Table D.4-3 and shown in graphical form in Figure D.4-3; Appendix D-7: Figures 1 through 3 show annual recycled water volumes by water use for the Lancaster, Palmdale, and Rosamond CSD WRPs. Information on WRP facilities and water treatment methods, as well as historical water balances for Lancaster and Palmdale WRPs, are summarized in Section 4.6 and Appendix G of this overall summary report.

Use of recycled water for agricultural irrigation has increased from less than 1,000 afy in 1975 to almost 15,000 afy in 2009 (see Table D.4-3 and Figure D.4-3). The use of recycled water for environmental water supply (Paiute Ponds and Apollo Lakes) had been fairly steady from about 1,000 afy in 1975 to almost 10,000 afy in 2005, reflecting gradually increasing flows since 1975 to the Paiute Ponds wetland area. Subsequently, environmental water supply declined to about 6,900 afy in 2009. In contrast, water reuse for agricultural irrigation has risen over time in steps, generally less than 1,000 afy until 1988, approximately 3,000 to 4,500 afy through 2001 (primarily reflecting Lancaster WRP deliveries to Nebeker Ranch), and rapidly increasing to almost 15,000 afy presently (reflecting Palmdale WRP conversion of land application practices) (see Appendix D-7: Figures 1 and 2). Total recycled water use in the Valley currently amounts to about 21,000 afy.

D.4.5 Summary of Water Supplies

Water requirements in the Antelope Valley are met by a combination of four water supply components, specifically groundwater, local and imported surface waters from Littlerock Creek and the State Water Project, respectively, and recycled water from the Lancaster and Palmdale WRPs. The historical amounts of those various components of total water supply, and the various uses of each supply, are summarized in Table D.4-4. Historical trends in the various components of total water supply are illustrated in Figure D.4-4. In general, groundwater was the predominant water supply in the Valley throughout the period of highest water demand, generally between about 280,000 and 380,000 afy, from the late 1940s through the mid-1970s. Groundwater pumping has subsequently decreased, into a range of about 130,000 to nearly 175,000 afy with an average of about 153,000 afy over the last decade. Since the mid-1970s, imported SWP water has added to a small amount of local surface water to provide a total surface water supply that varied through the 1980s and 1990s, and has ranged between about 70,000 to 90,000 afy since 2000, except during the last two years of reduced SWP deliveries, when total surface water supplies were reduced to between 54,000 and 59,000 afy. Recycled water supply has steadily increased since the mid-1970s to about 21,000 afy since 2005.

Table D.2-1a
Summary of Historical Crop Acreages Grouped by DWR Standard Crop Categories
Crop Acreages Shown by County and in Total for the Antelope Valley

		Los Angeles County Portion of Antelope Valley								Kern County Portion of Antelope Valley								Total Acreage for Antelope Valley							
Year	Source	Alfalfa	Other Pasture	Grain and Hay	Field	Deciduous	Truck	Vineyard	Total	Alfalfa	Other Pasture	Grain and Hay	Field	Deciduous	Truck	Vineyard	Total	Alfalfa	Other Pasture	Grain and Hay	Field	Deciduous	Truck	Vineyard	Total
1910	(1)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	**4,629**
1919	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	7,155	-------	-------	-------	-------	-------	-------	**11,960**
1920	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	7,400	-------	-------	-------	-------	-------	-------	-------
1922	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	7,000	-------	-------	-------	-------	-------	-------	-------
1924	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	12,000	-------	-------	-------	-------	-------	-------	**16,780**
1925	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	14,000	-------	-------	-------	-------	-------	-------	-------
1927	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	20,250	-------	-------	-------	-------	-------	-------	-------
1929	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	25,000	-------	-------	-------	-------	-------	-------	**31,420**
1930	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	22,000	-------	-------	-------	-------	-------	-------	-------
1931	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	21,700	-------	-------	-------	-------	-------	-------	-------
1934	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	15,317	-------	-------	-------	-------	-------	-------	**23,800**
1935	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	16,000	-------	-------	-------	-------	-------	-------	-------
1938	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	23,000	-------	-------	-------	-------	-------	-------	-------
1939	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	20,000	-------	-------	-------	-------	-------	-------	-------
1945	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	29,600	-------	-------	-------	-------	-------	-------	**37,795**
1945	(3)	30,000	-------	9,000	-------	2,260	740	-------	**42,000**	-------	-------	4,000	-------	-------	-------	-------	**4,000**	30,000	-------	13,000	-------	2,260	740	-------	**46,000**
1946	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	31,500	-------	-------	-------	-------	-------	-------	**40,027**
1947	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	34,700	-------	-------	-------	-------	-------	-------	-------
1948	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	37,700	-------	-------	-------	-------	-------	-------	-------
1949	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	38,900	-------	-------	-------	-------	-------	-------	**52,497**
1950	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	38,525	-------	-------	-------	-------	-------	-------	**54,666**
1950	(4)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	62,100	100	4,200	200	4,500	100	0	**71,200**
1951	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	39,845	-------	-------	-------	-------	-------	-------	**54,455**
1957	(5)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	32,410	5,120	14,570	2,210	1,540	1,290	0	**57,140**
1961	(6)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	41,320	2,630	4,890	2,290	1,410	2,110	60	**54,710**
1970	(7)	27,700	1,500	15,000	1,800	1,855	160	-------	**48,015**	3,633	0	1,689	960	520	1,841	0	**8,643**	31,333	1,500	16,689	2,760	2,375	2,001	0	**56,658**
1971	(7)	25,400	1,000	23,200	2,000	1,867	150	-------	**53,617**	4,057	0	1,886	1,072	581	2,055	0	**9,651**	29,457	1,000	25,086	3,072	2,448	2,205	0	**63,268**
1972	(7)	22,400	1,000	15,500	2,000	1,591	165	-------	**42,656**	3,228	0	1,500	853	462	1,635	0	**7,678**	25,628	1,000	17,000	2,853	2,053	1,800	0	**50,334**
1972	(8)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	34,400	1,680	1,390	2,650	1,400	710	60	**42,290**
1973	(7)	21,400	400	17,400	1,920	1,590	310	-------	**43,020**	3,255	0	1,513	860	466	1,649	0	**7,744**	24,655	400	18,913	2,780	2,056	1,959	0	**50,764**
1974	(7)	19,800	400	22,500	2,270	1,540	405	-------	**46,915**	3,550	0	1,650	938	508	1,798	0	**8,445**	23,350	400	24,150	3,208	2,048	2,203	0	**55,360**
1975	(7)	19,000	400	26,200	2,150	1,393	900	-------	**50,043**	3,787	0	1,760	1,001	542	1,918	0	**9,008**	22,787	400	27,960	3,151	1,935	2,818	0	**59,051**
1976	(7)	20,000	375	11,000	2,668	1,162	1,680	-------	**36,885**	2,791	0	1,297	738	400	1,414	0	**6,639**	22,791	375	12,297	3,406	1,562	3,094	0	**43,524**
1977	(7)	23,000	375	18,300	3,900	1,162	4,500	-------	**51,237**	3,877	0	1,802	1,025	555	1,964	0	**9,223**	26,877	375	20,102	4,925	1,717	6,464	0	**60,460**
1978	(7)	23,000	400	14,150	5,300	1,180	2,011	-------	**46,041**	3,484	0	1,619	921	499	1,765	0	**8,287**	26,484	400	15,769	6,221	1,679	3,776	0	**54,328**
1979	(7)	22,800	-------	9,634	2,600	1,219	2,035	-------	**38,288**	2,897	0	1,346	766	415	1,468	0	**6,892**	25,697	0	10,980	3,366	1,634	3,503	0	**45,180**
1980	(7)	22,500	100	12,395	3,860	1,349	790	-------	**40,994**	3,102	0	1,442	820	444	1,571	0	**7,379**	25,602	100	13,837	4,680	1,793	2,361	0	**48,373**
1981	(7)	20,000	100	11,350	2,925	1,015	1,477	-------	**36,867**	2,790	0	1,296	737	399	1,413	0	**6,636**	22,790	100	12,646	3,662	1,414	2,890	0	**43,503**
1982	(7)	16,200	100	12,730	460	1,046	2,238	-------	**32,774**	2,480	0	1,153	655	355	1,256	0	**5,899**	18,680	100	13,883	1,115	1,401	3,494	0	**38,673**
1983	(7)	13,757	200	14,617	417	1,004	2,395	-------	**32,390**	2,451	0	1,139	648	351	1,242	0	**5,830**	16,208	200	15,756	1,065	1,355	3,637	0	**38,220**
1984	(7)	11,932	135	12,733	395	1,047	2,105	-------	**28,348**	2,145	0	997	567	307	1,087	0	**5,103**	14,078	135	13,730	962	1,354	3,192	0	**33,451**
1985	(7)	10,458	135	11,591	135	993	2,162	-------	**25,474**	1,928	0	896	509	276	977	0	**4,585**	12,385	135	12,487	644	1,269	3,139	0	**30,059**
1986	(7)	8,245	216	9,504	216	862	1,925	-------	**20,968**	1,587	0	737	419	227	804	0	**3,774**	9,831	216	10,241	635	1,090	2,729	0	**24,742**
1986	(9)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	8,810	1,050	1,330	60	1,970	2,380	30	**15,630**
1987	(7)	8,717	150	2,491	150	936	1,805	-------	**14,248**	1,138	0	529	301	163	577	0	**2,707**	9,855	150	3,019	451	1,099	2,381	0	**16,956**
1988	(7)	7,468	131	7,544	131	965	2,131	-------	**18,369**	1,622	0	754	429	232	821	0	**3,857**	9,089	131	8,297	559	1,197	2,953	0	**22,226**
1989	(7)	6,174	56	775	56	1,005	1,773	-------	**9,840**	951	0	442	251	136	482	0	**2,263**	7,125	56	1,217	308	1,141	2,255	0	**12,103**
1990	(7)	6,087	136	887	136	1,057	1,676	-------	**9,979**	1,049	0	487	277	150	531	0	**2,495**	7,136	136	1,375	413	1,208	2,208	0	**12,474**
1991	(7)	5,653	146	621	146	1,015	1,786	-------	**9,367**	1,063	0	494	281	152	539	0	**2,529**	6,716	146	1,115	427	1,167	2,324	0	**11,896**
1992	(7)	5,118	163	5,249	163	1,031	1,785	-------	**13,509**	1,647	0	765	435	236	834	0	**3,918**	6,764	163	6,014	599	1,267	2,619	0	**17,426**
1993	(7)	5,421	160	1,654	160	1,315	1,673	-------	**10,385**	1,353	0	629	358	194	686	0	**3,219**	6,775	160	2,283	518	1,509	2,359	0	**13,604**
1994	(7)	5,454	74	2,547	74	1,505	1,531	-------	**11,184**	1,362	0	633	360	195	690	0	**3,240**	6,816	74	3,180	434	1,700	2,221	0	**14,424**
1995	(7)	5,370	91	4,171	91	1,257	2,365	-------	**13,347**	1,631	0	491	120	85	1,465	0	**3,792**	7,001	91	4,662	211	1,342	3,830	0	**17,139**
1996	(7)	5,455	82	3,630	82	1,196	4,003	-------	**14,447**	1,551	0	729	180	190	2,496	0	**5,146**	7,006	82	4,359	262	1,386	6,499	0	**19,593**
1997	(7)	5,356	149	3,168	149	1,261	5,907	15	**16,005**	1,987	0	605	75	150	2,946	0	**5,763**	7,343	149	3,773	224	1,411	8,853	15	**21,768**
1998	(7)	5,165	101	1,459	101	1,457	7,808	24	**16,115**	2,035	0	345	75	150	3,957	0	**6,562**	7,200	101	1,804	176	1,607	11,765	24	**22,677**
1999	(7)	5,935	133	900	133	1,704	7,888	26	**16,718**	2,350	0	345	75	45	3,744	0	**6,559**	8,285	133	1,245	208	1,749	11,632	26	**23,277**
2000	(7)	6,042	124	950	124	1,959	10,525	33	**19,755**	2,555	0	378	408	165	4,607	0	**8,113**	8,597	124	1,328	532	2,124	15,132	33	**27,868**
2001	(7)	5,595	110	1,050	110	2,023	9,231	49	**18,167**	2,103	0	464	265	120	4,081	0	**7,033**	7,698	110	1,514	375	2,143	13,312	49	**25,200**
2002	(7)	5,096	107	1,200	107	1,327	11,878	54	**19,770**	2,288	467	395	40	120	5,255	0	**8,565**	7,384	574	1,595	147	1,447	17,133	54	**28,335**
2003	(7)	5,390	71	1,300	71	1,340	11,448	63	**19,684**	1,800	0	175	80	70	4,992	0	**7,117**	7,190	71	1,475	151	1,410	16,440	63	**26,801**
2004	(7)	5,631	97	1,185	97	1,279	10,367	74	**18,730**	1,975	0	501	40	147	4,485	66	**7,214**	7,606	97	1,686	137	1,426	14,852	140	**25,944**
2005	(7)	5,411	173	1,347	173	1,293	8,085	107	**16,588**	1,335	156	1,106	40	70	5,883	0	**8,590**	6,746	329	2,453	213	1,363	13,968	107	**25,178**
2006	(7)	5,346	210	1,750	210	1,304	5,669	113	**14,602**	1,185	0	905	0	498	6,338	0	**8,926**	6,531	210	2,655	210	1,802	12,007	113	**23,528**
2007	(7)	5,688	174	1,501	174	1,299	5,775	109	**14,721**	935	0	1,797	0	498	4,942	0	**8,172**	6,623	174	3,298	174	1,797	10,717	109	**22,893**
2008	(7)	5,584	173	1,752	173	1,322	6,909	132	**16,046**	967	0	1,587	0	498	6,623	0	**9,675**	6,551	173	3,339	173	1,820	13,532	132	**25,721**
2009*	(7)	5,584	173	1,752	173	1,322	6,909	132	**16,046**	1,008	0	1,570	0	498	4,840	0	**7,916**	6,592	173	3,322	173	1,820	11,749	132	**23,962**

*Los Angeles County acreages for 2009 are assumed to equal to those from 2008; 2009 annual crop report unavailable.

(1) Tait, C.E., 1912
(2) Snyder, J. Herbert, 1955
(3) California Division of Water Resources, 1947
(4) State Water Resources Board, 1955
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(1): Area Northern Boundary Unknown
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(4, 5, 6, 8, and 9): Area Northern Boundary defined by Antelope Valley Hydrographic Unit (encompasses towns of Mojave and Boron)

Table D.2-1b
Summary of Historical Crop Acreages Grouped by Applied Crop Water Requirements
Crop Acreages Shown by County and in Total for the Antelope Valley

		Los Angeles County Portion of Antelope Valley										Kern County Portion of Antelope Valley										Total Acreage for Antelope Valley									
Year	Source	Alfalfa/ Pasture	Grain	Carrots	Onions	Orchard	Sugar Beets	Melons and Squash	Potatoes	Grapes	Total	Alfalfa/ Pasture	Grain	Carrots	Onions	Orchard	Sugar Beets	Melons and Squash	Potatoes	Grapes	Total	Alfalfa/ Pasture	Grain	Carrots	Onions	Orchard	Sugar Beets	Melons and Squash	Potatoes	Grapes	Total
1910	(1)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	**4,629**
1919	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	7,155	-------	-------	-------	-------	-------	-------	-------	-------	**11,960**
1920	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	7,400	-------	-------	-------	-------	-------	-------	-------	-------	-------
1922	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	7,000	-------	-------	-------	-------	-------	-------	-------	-------	-------
1924	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	12,000	-------	-------	-------	-------	-------	-------	-------	-------	**16,780**
1925	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	14,000	-------	-------	-------	-------	-------	-------	-------	-------	-------
1927	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	20,250	-------	-------	-------	-------	-------	-------	-------	-------	-------
1929	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	25,000	-------	-------	-------	-------	-------	-------	-------	-------	**31,420**
1930	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	22,000	-------	-------	-------	-------	-------	-------	-------	-------	-------
1931	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	21,700	-------	-------	-------	-------	-------	-------	-------	-------	-------
1934	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	15,317	-------	-------	-------	-------	-------	-------	-------	-------	**23,800**
1935	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	16,000	-------	-------	-------	-------	-------	-------	-------	-------	-------
1938	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	23,000	-------	-------	-------	-------	-------	-------	-------	-------	-------
1939	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	20,000	-------	-------	-------	-------	-------	-------	-------	-------	-------
1945	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	29,600	-------	-------	-------	-------	-------	-------	-------	-------	**37,795**
1945	(3)	30,000	9,000	-------	-------	2,260	-------	740	-------	-------	**42,000**	-------	4,000	-------	-------	-------	-------	-------	-------	-------	**4,000**	30,000	13,000	-------	-------	2,260	-------	740	-------	-------	**46,000**
1946	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	31,500	-------	-------	-------	-------	-------	-------	-------	-------	**40,027**
1947	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	34,700	-------	-------	-------	-------	-------	-------	-------	-------	-------
1948	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	37,700	-------	-------	-------	-------	-------	-------	-------	-------	-------
1949	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	38,900	-------	-------	-------	-------	-------	-------	-------	-------	**52,497**
1950	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	38,525	-------	-------	-------	-------	-------	-------	-------	-------	**54,666**
1950	(4)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	62,200	4,200	-------	-------	4,500	200	100	-------	0	**71,200**
1951	(2)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	39,845	-------	-------	-------	-------	-------	-------	-------	-------	**54,455**
1957	(5)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	37,530	14,570	-------	-------	1,540	2,210	1,290	-------	0	**57,140**
1961	(6)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	43,950	4,890	-------	-------	1,410	2,290	2,110	-------	60	**54,710**
1970	(7)	29,200	15,300	-------	60	1,855	1,500	100	-------	-------	**48,015**	3,633	1,689	80	907	520	960	854	0	0	**8,643**	32,833	16,989	80	967	2,375	2,460	954	0	0	**56,658**
1971	(7)	26,400	23,700	-------	-------	1,867	1,500	150	-------	-------	**53,617**	4,057	1,886	89	1,013	581	1,072	953	0	0	**9,651**	30,457	25,586	89	1,013	2,448	2,572	1,103	0	0	**63,268**
1972	(7)	23,400	16,000	-------	80	1,591	1,500	85	-------	-------	**42,656**	3,228	1,500	71	806	462	853	758	0	0	**7,678**	26,628	17,500	71	886	2,053	2,353	843	0	0	**50,334**
1972	(8)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	36,080	1,390	-------	-------	1,400	-------	-------	-------	60	**42,290**
1973	(7)	21,800	18,100	-------	240	1,590	1,220	70	-------	-------	**43,020**	3,255	1,513	72	813	466	860	765	0	0	**7,744**	25,055	19,613	72	1,053	2,056	2,080	835	0	0	**50,764**
1974	(7)	20,200	23,700	-------	250	1,540	1,070	155	-------	-------	**46,915**	3,550	1,650	78	886	508	938	834	0	0	**8,445**	23,750	25,350	78	1,136	2,048	2,008	989	0	0	**55,360**
1975	(7)	19,400	27,150	-------	700	1,393	1,200	200	-------	-------	**50,043**	3,787	1,760	83	945	542	1,001	890	0	0	**9,008**	23,187	28,910	83	1,645	1,935	2,201	1,090	0	0	**59,051**
1976	(7)	20,375	11,800	-------	1,200	1,162	1,868	480	-------	-------	**36,885**	2,791	1,297	61	697	400	738	656	0	0	**6,639**	23,166	13,097	61	1,897	1,562	2,606	1,136	0	0	**43,524**
1977	(7)	23,375	18,500	1,160	2,500	1,162	3,700	340	500	-------	**51,237**	3,877	1,802	85	968	555	1,025	911	0	0	**9,223**	27,252	20,302	1,245	3,468	1,717	4,725	1,251	500	0	**60,460**
1978	(7)	23,400	16,250	-------	1,700	1,180	3,200	311	-------	-------	**46,041**	3,484	1,619	77	870	499	921	819	0	0	**8,287**	26,884	17,869	77	2,570	1,679	4,121	1,130	0	0	**54,328**
1979	(7)	22,800	10,034	90	1,715	1,219	2,200	150	80	-------	**38,288**	2,897	1,346	64	723	415	766	681	0	0	**6,892**	25,697	11,380	154	2,438	1,634	2,966	831	80	0	**45,180**
1980	(7)	22,600	12,395	50	425	1,349	3,860	315	-------	-------	**40,994**	3,102	1,442	68	774	444	820	729	0	0	**7,379**	25,702	13,837	118	1,199	1,793	4,680	1,044	0	0	**48,373**
1981	(7)	20,100	11,500	80	977	1,015	2,775	420	-------	-------	**36,867**	2,790	1,296	61	696	399	737	655	0	0	**6,636**	22,890	12,796	141	1,673	1,414	3,512	1,075	0	0	**43,503**
1982	(7)	16,300	12,850	180	1,433	1,046	340	625	-------	-------	**32,774**	2,480	1,153	55	619	355	655	583	0	0	**5,899**	18,780	14,003	235	2,052	1,401	995	1,208	0	0	**38,673**
1983	(7)	13,957	14,717	-------	1,810	1,004	317	585	-------	-------	**32,390**	2,451	1,139	54	612	351	648	576	0	0	**5,830**	16,408	15,856	54	2,422	1,355	965	1,161	0	0	**38,220**
1984	(7)	12,068	12,868	61	1,447	1,047	260	597	-------	-------	**28,348**	2,145	997	47	535	307	567	504	0	0	**5,103**	14,213	13,865	108	1,983	1,354	827	1,101	0	0	**33,451**
1985	(7)	10,593	11,726	71	1,548	993	0	543	-------	-------	**25,474**	1,928	896	42	481	276	509	453	0	0	**4,585**	12,520	12,622	113	2,030	1,269	509	996	0	0	**30,059**
1986	(7)	8,461	9,719	85	1,451	862	-------	389	-------	-------	**20,968**	1,587	737	35	396	227	419	373	0	0	**3,774**	10,047	10,457	120	1,847	1,090	419	762	0	0	**24,742**
1986	(9)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	9,860	1,330	-------	-------	1,970	-------	-------	-------	30	**15,630**
1987	(7)	8,867	2,641	92	1,467	936	-------	246	-------	-------	**14,248**	1,138	529	25	284	163	301	267	0	0	**2,707**	10,005	3,169	117	1,751	1,099	301	514	0	0	**16,956**
1988	(7)	7,598	7,674	74	1,668	965	-------	389	-------	-------	**18,369**	1,622	754	36	405	232	429	381	0	0	**3,857**	9,220	8,428	110	2,073	1,197	429	770	0	0	**22,226**
1989	(7)	6,230	831	86	1,642	1,005	-------	46	-------	-------	**9,840**	951	442	21	237	136	251	224	0	0	**2,263**	7,182	1,273	106	1,879	1,141	251	270	0	0	**12,103**
1990	(7)	6,223	1,023	110	1,519	1,057	-------	47	-------	-------	**9,979**	1,049	487	23	262	150	277	246	0	0	**2,495**	7,271	1,511	133	1,781	1,208	277	294	0	0	**12,474**
1991	(7)	5,799	768	27	1,656	1,015	-------	103	-------	-------	**9,367**	1,063	494	23	265	152	281	250	0	0	**2,529**	6,862	1,262	50	1,922	1,167	281	353	0	0	**11,896**
1992	(7)	5,281	5,412	4	1,632	1,031	-------	149	-------	-------	**13,509**	1,647	765	36	411	236	435	387	0	0	**3,918**	6,928	6,177	40	2,043	1,267	435	536	0	0	**17,426**
1993	(7)	5,582	1,815	16	1,533	1,315	-------	125	-------	-------	**10,385**	1,353	629	30	338	194	358	318	0	0	**3,219**	6,935	2,444	46	1,871	1,509	358	442	0	0	**13,604**
1994	(7)	5,528	2,621	21	1,319	1,505	-------	191	-------	-------	**11,184**	1,362	633	30	340	195	360	320	0	0	**3,240**	6,890	3,254	51	1,659	1,700	360	511	0	0	**14,424**
1995	(7)	5,462	4,263	549	1,636	1,257	-------	180	-------	-------	**13,347**	1,631	491	320	775	85	120	370	0	0	**3,792**	7,093	4,754	869	2,411	1,342	120	550	0	0	**17,139**
1996	(7)	5,537	3,712	2,324	1,493	1,196	-------	186	-------	-------	**14,447**	1,551	729	1,046	1,262	190	180	188	0	0	**5,146**	7,088	4,441	3,370	2,755	1,386	180	374	0	0	**19,593**
1997	(7)	5,505	3,317	3,811	1,893	1,261	-------	203	-------	15	**16,005**	1,987	605	1,695	925	150	75	326	0	0	**5,763**	7,492	3,922	5,506	2,818	1,411	75	529	0	15	**21,768**
1998	(7)	5,265	1,560	5,252	2,377	1,457	-------	179	-------	24	**16,115**	2,035	345	2,887	605	150	75	145	320	0	**6,562**	7,300	1,905	8,139	2,982	1,607	75	324	320	24	**22,677**
1999	(7)	6,067	1,033	5,508	2,166	1,704	-------	215	-------	26	**16,718**	2,350	345	2,654	540	45	75	70	480	0	**6,559**	8,417	1,378	8,162	2,706	1,749	75	285	480	26	**23,277**
2000	(7)	6,165	1,074	8,132	2,264	1,959	-------	129	-------	33	**19,755**	2,555	378	2,655	1,040	165	408	115	797	0	**8,113**	8,720	1,452	10,787	3,304	2,124	408	244	797	33	**27,868**
2001	(7)	5,705	1,160	7,417	1,697	2,023	-------	117	-------	49	**18,167**	2,103	464	2,068	1,295	120	265	120	598	0	**7,033**	7,808	1,624	9,485	2,992	2,143	265	237	598	49	**25,200**
2002	(7)	5,203	1,307	9,964	1,686	1,327	-------	228	-------	54	**19,770**	2,755	395	4,164	537	120	40	95	459	0	**8,565**	7,958	1,702	14,128	2,223	1,447	40	323	459	54	**28,335**
2003	(7)	5,461	1,371	8,555	2,758	1,340	-------	136	-------	63	**19,684**	1,800	175	3,227	1,020	70	80	80	665	0	**7,117**	7,261	1,546	11,782	3,778	1,410	80	216	665	63	**26,801**
2004	(7)	5,728	1,282	7,403	2,833	1,279	-------	131	-------	74	**18,730**	1,975	501	3,551	455	147	40	85	394	66	**7,214**	7,703	1,783	10,954	3,288	1,426	40	216	394	140	**25,944**
2005	(7)	5,583	1,520	5,361	2,623	1,293	-------	101	-------	107	**16,588**	1,491	1,106	4,548	735	70	40	130	470	0	**8,590**	7,074	2,626	9,909	3,358	1,363	40	231	470	107	**25,178**
2006	(7)	5,556	1,960	3,754	1,838	1,304	-------	77	-------	113	**14,602**	1,185	905	4,372	1,404	498	0	0	562	0	**8,926**	6,741	2,865	8,126	3,242	1,802	0	77	562	113	**23,528**
2007	(7)	5,862	1,675	3,803	1,862	1,299	-------	110	-------	109	**14,721**	935	1,797	3,639	742	498	0	166	395	0	**8,172**	6,797	3,472	7,442	2,604	1,797	0	276	395	109	**22,893**
2008	(7)	5,757	1,925	4,582	2,244	1,322	-------	83	-------	132	**16,046**	967	1,587	5,491	731	498	0	83	318	0	**9,675**	6,724	3,512	10,073	2,975	1,820	0	166	318	132	**25,721**
2009*	(7)	5,757	1,925	4,582	2,244	1,322	-------	83	-------	132	**16,046**	1,008	1,570	3,733	1,024	498	0	83	0	0	**7,916**	6,765	3,495	8,315	3,268	1,820	0	166	0	132	**23,962**

*Los Angeles County acreages for 2009 are assumed to equal to those from 2008; 2009 annual crop report unavailable.

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(2) Snyder, J. Herbert, 1955
(3) California Division of Water Resources, 1947
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(4, 5, 6, 8, and 9): Area Northern Boundary defined by Antelope Valley Hydrographic Unit (encompasses towns of Mojave and Boron)

Table D.2-2a
Individual Crop Acreages for the Los Angeles County Portion of the Antelope Valley
Designation of Individual Crop Acreages from LA County Annual Crop Reports to DWR Standard Crop Categories and Applied Crop Water Requirement Groupings

Individual Crop Acreages from LA County Annual Crop Reports

Source: Reports Specific to Antelope Valley

	Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Fruit and Nut															
	Almonds	1,169	1,169	901	900	800	650	410	410	400	400	395	100	-------	-------
	Apples	24	24	29	29	29	29	32	32	32	32	-------	35	36	36
	Cherries	23	24	30	30	35	35	39	39	43	49	50	50	50	70
	Nectarines	14	-------	-------	-------	-------	-------	-------	-------	-------	15	-------	35	-------	20
	Peaches	328	339	329	329	360	363	365	365	383	420	500	500	500	520
	Pears	286	284	277	277	290	290	290	290	290	260	260	260	260	230
	Plums	6	6	-------	-------	-------	-------	-------	-------	-------	8	-------	-------	-------	15
	Grapes	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
	Misc.	5	21	25	25	26	26	26	26	32	35	144	35	200	113
	Total	1,855	1,867	1,591	1,590	1,540	1,393	1,162	1,162	1,180	1,219	1,349	1,015	1,046	1,004
Field															
	Alfalfa	27,700	25,400	22,400	21,400	19,800	19,000	20,000	23,000	23,000	22,800	22,500	20,000	16,200	13,757
	Corn (Milo)	100	-------	-------	-------	-------	-------	700	200	100	400	-------	-------	-------	-------
	Grain - Barley	5,000	5,000	4,500	6,000	5,500	7,500	3,000	7,600	5,840	4,525	5,450	4,500	7,500	6,700
	Grain - Wheat	6,500	13,800	8,000	7,900	14,000	15,500	5,000	7,600	6,310	5,109	6,945	6,600	4,930	6,512
	Grain - Hay	3,500	4,400	3,000	3,500	3,000	3,200	3,000	3,100	2,000	-------	-------	250	300	1,405
	Pasture	1,500	1,000	1,000	400	400	400	375	375	400	-------	100	100	100	200
	Sudan Hay	-------	-------	-------	700	1,200	-------	100	-------	-------	-------	-------	150	120	100
	Silage/Sorghum	200	500	500	-------	-------	950	-------	-------	-------	-------	-------	-------	-------	-------
	Sugar Beets	1,500	1,500	1,500	1,220	1,070	1,200	1,868	3,700	3,200	2,200	3,860	2,775	340	317
	Safflower	-------	-------	-------	-------	-------	-------	-------	-------	2,000	-------	-------	-------	-------	-------
	Total	46,000	51,600	40,900	41,120	44,970	47,750	34,043	45,575	42,850	35,034	38,855	34,375	29,490	28,991
Vegetables															
	Canteloupes	20	30	35	40	40	40	40	40	-------	-------	-------	20	120	-------
	Watermelons	50	100	50	-------	100	60	160	65	-------	150	-------	350	435	415
	Melons-Other (squash, pumpkin)	20	10	-------	-------	-------	-------	-------	155	150	-------	265	20	40	140
	Onion	60	-------	80	240	250	700	1,200	2,500	1,700	1,715	425	977	1,433	1,810
	Misc. Veg.	10	10	-------	30	15	100	280	80	161	-------	50	30	30	30
	Carrots	-------	-------	-------	-------	-------	-------	-------	1,160	-------	90	50	80	180	-------
	Potatoes	-------	-------	-------	-------	-------	-------	-------	500	-------	80	-------	-------	-------	-------
	Total	160	150	165	310	405	900	1,680	4,500	2,011	2,035	790	1,477	2,238	2,395
Total All Crops (LA Co Portion)		**48,015**	**53,617**	**42,656**	**43,020**	**46,915**	**50,043**	**36,885**	**51,237**	**46,041**	**38,288**	**40,994**	**36,867**	**32,774**	**32,390**

Source: County-wide Reports

	Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009*
Fruit and Nut																											
	Almonds	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
	Apples	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	70	70	71	75	301	321	320	71	150	150	150	145	130	131	131
	Cherries	-------	-------	-------	-------	-------	-------	140	140	140	140	140	140	140	140	150	150	150	150	130	130	140	150	155	155	150	150
	Nectarines	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	110	110	110	110	110	110	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
	Peaches	600	652	600	700	700	800	815	705	728	738	720	732	650	651	901	1,000	1,201	1,300	841	720	-------	-------	-------	-------	-------	-------
	Pears	220	200	104	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	40	40	30	25	-------	-------	-------	-------	-------	-------	-------	-------	-------
	Plums	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	28	28	28	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
	Grapes	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	15	24	26	33	49	54	63	74	107	113	109	132	132
	Misc.	227	141	158	236	265	205	242	170	163	437	535	177	198	221	181	113	262	253	285	340	989	993	1,004	1,014	1,041	1,041
	Total	1,047	993	862	936	965	1,005	1,057	1,015	1,031	1,315	1,505	1,257	1,196	1,276	1,481	1,730	1,992	2,071	1,382	1,403	1,353	1,400	1,417	1,408	1,454	1,454
Field																											
	Alfalfa	11,932	10,458	8,245	8,717	7,468	6,174	6,087	5,653	5,118	5,421	5,454	5,370	5,455	5,356	5,165	5,935	6,042	5,595	5,096	5,390	5,631	5,411	5,346	5,688	5,584	5,584
	Corn (Milo)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
	Grain - Barley	7,952	6,764	6,494	1,346	4,244	225	437	146	3,062	605	1,248	2,601	2,598	1,797	101	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
	Grain - Wheat	4,104	4,000	2,200	500	2,700	0	-------	-------	1,500	160	74	91	82	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
	Grain - Hay	678	828	810	645	600	550	450	475	687	890	1,225	1,479	950	1,371	1,359	900	950	1,050	1,200	1,300	1,185	1,347	1,750	1,501	1,752	1,752
	Pasture	135	135	216	150	131	56	136	146	163	160	74	91	82	149	101	133	124	110	107	71	97	173	210	174	173	173
	Sudan Hay	135	135	216	150	131	56	136	146	163	160	74	91	82	149	101	133	124	110	107	71	97	173	210	174	173	173
	Silage/Sorghum	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
	Sugar Beets	260	0	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
	Safflower	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
	Total	25,196	22,319	18,180	11,508	15,272	7,062	7,246	6,567	10,693	7,396	8,148	9,725	9,248	8,822	6,826	7,100	7,239	6,865	6,511	6,832	7,010	7,103	7,516	7,538	7,682	7,682
Vegetables																											
	Canteloupes	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
	Watermelons	-------	-------	-------	120	191	20	22	50	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	68	66	50	39	55	42	42
	Melons-Other (squash, pumpkin)	568	515	368	120	191	20	22	50	149	125	191	180	186	203	179	215	129	117	228	68	66	50	39	55	42	42
	Onion	1,447	1,548	1,451	1,467	1,668	1,642	1,519	1,656	1,632	1,533	1,319	1,636	1,493	1,893	2,377	2,166	2,264	1,697	1,686	2,758	2,833	2,623	1,838	1,862	2,244	2,244
	Misc. Veg.	29	28	21	6	8	6	3	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Carrots	61	71	85	92	74	86	110	27	4	16	21	549	2,324	3,811	5,252	5,508	8,132	7,417	9,964	8,555	7,403	5,361	3,754	3,803	4,582	4,582
	Potatoes	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
	Total	2,105	2,162	1,925	1,805	2,131	1,773	1,676	1,786	1,785	1,673	1,531	2,365	4,003	5,907	7,808	7,888	10,525	9,231	11,878	11,448	10,367	8,085	5,669	5,775	6,909	6,909
Total All Crops (LA Co Portion)		**28,348**	**25,474**	**20,968**	**14,248**	**18,369**	**9,840**	**9,979**	**9,367**	**13,509**	**10,385**	**11,184**	**13,347**	**14,447**	**16,005**	**16,115**	**16,718**	**19,755**	**18,167**	**19,770**	**19,684**	**18,730**	**16,588**	**14,602**	**14,721**	**16,046**	**16,046**

Crop Acreages Assigned to DWR Standard Crop Categories

Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Alfalfa	27,700	25,400	22,400	21,400	19,800	19,000	20,000	23,000	23,000	22,800	22,500	20,000	16,200	13,757
Other Pasture	1,500	1,000	1,000	400	400	400	375	375	400	-------	100	100	100	200
Grain and Hay	15,000	23,200	15,500	17,400	22,500	26,200	11,000	18,300	14,150	9,634	12,395	11,350	12,730	14,617
Field	1,800	2,000	2,000	1,920	2,270	2,150	2,668	3,900	5,300	2,600	3,860	2,925	460	417
Deciduous	1,855	1,867	1,591	1,590	1,540	1,393	1,162	1,162	1,180	1,219	1,349	1,015	1,046	1,004
Truck	160	150	165	310	405	900	1,680	4,500	2,011	2,035	790	1,477	2,238	2,395
Vineyard	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Total	**48,015**	**53,617**	**42,656**	**43,020**	**46,915**	**50,043**	**36,885**	**51,237**	**46,041**	**38,288**	**40,994**	**36,867**	**32,774**	**32,390**

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009*
Alfalfa	11,932	10,458	8,245	8,717	7,468	6,174	6,087	5,653	5,118	5,421	5,454	5,370	5,455	5,356	5,165	5,935	6,042	5,595	5,096	5,390	5,631	5,411	5,346	5,688	5,584	5,584
Other Pasture	100	100	100	200	135	135	216	150	131	56	136	146	163	160	74	91	82	149	101	133	124	110	107	71	97	173	210	174	173	173
Grain and Hay	12,395	11,350	12,730	14,617	12,733	11,591	9,504	2,491	7,544	775	887	621	5,249	1,654	2,547	4,171	3,630	3,168	1,459	900	950	1,050	1,200	1,300	1,185	1,347	1,750	1,501	1,752	1,752
Field	3,860	2,925	460	417	395	135	216	150	131	56	136	146	163	160	74	91	82	149	101	133	124	110	107	71	97	173	210	174	173	173
Deciduous	1,349	1,015	1,046	1,004	1,047	993	862	936	965	1,005	1,057	1,015	1,031	1,315	1,505	1,257	1,196	1,261	1,457	1,704	1,959	2,023	1,327	1,340	1,279	1,293	1,304	1,299	1,322	1,322
Truck	790	1,477	2,238	2,395	2,105	2,162	1,925	1,805	2,131	1,773	1,676	1,786	1,785	1,673	1,531	2,365	4,003	5,907	7,808	7,888	10,525	9,231	11,878	11,448	10,367	8,085	5,669	5,775	6,909	6,909
Vineyard	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	15	24	26	33	49	54	63	74	107	113	109	132	132
Total	**28,348**	**25,474**	**20,968**	**14,248**	**18,369**	**9,840**	**9,979**	**9,367**	**13,509**	**10,385**	**11,184**	**13,347**	**14,447**	**16,005**	**16,115**	**16,718**	**19,755**	**18,167**	**19,770**	**19,684**	**18,730**	**16,588**	**14,602**	**14,721**	**16,046**	**16,046**

Crop Acreages Assigned to Applied Water Requirement Groupings

Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Alfalfa/Pasture	29,200	26,400	23,400	21,800	20,200	19,400	20,375	23,375	23,400	22,800	22,600	20,100	16,300	13,957
Grain	15,300	23,700	16,000	18,100	23,700	27,150	11,800	18,500	16,250	10,034	12,395	11,500	12,850	14,717
Carrots	-------	-------	-------	-------	-------	-------	-------	1,160	-------	90	50	80	180	-------
Onions	60	-------	80	240	250	700	1,200	2,500	1,700	1,715	425	977	1,433	1,810
Orchard	1,855	1,867	1,591	1,590	1,540	1,393	1,162	1,162	1,180	1,219	1,349	1,015	1,046	1,004
Sugar Beets	1,500	1,500	1,500	1,220	1,070	1,200	1,868	3,700	3,200	2,200	3,860	2,775	340	317
Melons and Squash	100	150	85	70	155	200	480	340	311	150	315	420	625	585
Potatoes	-------	-------	-------	-------	-------	-------	-------	500	-------	80	-------	-------	-------	-------
Grapes	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Total	**48,015**	**53,617**	**42,656**	**43,020**	**46,915**	**50,043**	**36,885**	**51,237**	**46,041**	**38,288**	**40,994**	**36,867**	**32,774**	**32,390**

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009*
Alfalfa/Pasture	12,068	10,593	8,461	8,867	7,598	6,230	6,223	5,799	5,281	5,582	5,528	5,462	5,537	5,505	5,265	6,067	6,165	5,705	5,203	5,461	5,728	5,583	5,556	5,862	5,757	5,757
Grain	12,868	11,726	9,719	2,641	7,674	831	1,023	768	5,412	1,815	2,621	4,263	3,712	3,317	1,560	1,033	1,074	1,160	1,307	1,371	1,282	1,520	1,960	1,675	1,925	1,925
Carrots	61	71	85	92	74	86	110	27	4	16	21	549	2,324	3,811	5,252	5,508	8,132	7,417	9,964	8,555	7,403	5,361	3,754	3,803	4,582	4,582
Onions	1,447	1,548	1,451	1,467	1,668	1,642	1,519	1,656	1,632	1,533	1,319	1,636	1,493	1,893	2,377	2,166	2,264	1,697	1,686	2,758	2,833	2,623	1,838	1,862	2,244	2,244
Orchard	1,047	993	862	936	965	1,005	1,057	1,015	1,031	1,315	1,505	1,257	1,196	1,261	1,457	1,704	1,959	2,023	1,327	1,340	1,279	1,293	1,304	1,299	1,322	1,322
Sugar Beets	260	0	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Melons and Squash	597	543	389	246	389	46	47	103	149	125	191	180	186	203	179	215	129	117	228	136	131	101	77	110	83	83
Potatoes	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Grapes	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	15	24	26	33	49	54	63	74	107	113	109	132	132
Total	**28,348**	**25,474**	**20,968**	**14,248**	**18,369**	**9,840**	**9,979**	**9,367**	**13,509**	**10,385**	**11,184**	**13,347**	**14,447**	**16,005**	**16,115**	**16,718**	**19,755**	**18,167**	**19,770**	**19,684**	**18,730**	**16,588**	**14,602**	**14,721**	**16,046**	**16,046**

*Los Angeles County acreages for 2009 are assumed to equal to those from 2008; 2009 annual crop report unavailable.
"-------" denotes no crop classification provided in report.

Table D.2-2b
Individual Crop Acreages for the Kern County Portion of the Antelope Valley
Designation of Individual Crop Acreages from Estimates and Kern County Annual Pesticide Use Reports to DWR Standard Crop Categories and Applied Crop Water Requirement Groupings

Individual Crop Acreages from Estimates (1970 - 93) and Kern County Annual Pesticide Use Reports (1994 - 2009)

	Source: Estimated as a Percentage of Total Reported Crop Acreage in the Los Angeles County Portion of Antelope Valley*																								Source: Kern County Annual Pesticide Use Reports**															
Year	**1970**	**1971**	**1972**	**1973**	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**	**1980**	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Fruit																																								
Peaches	387	432	344	347	378	403	297	413	371	308	330	297	264	261	228	205	169	121	173	101	112	113	175	144	145	65	170	130	130	45	165	120	120	70	103	70	70	70	70	70
Orchard-Misc.	133	149	118	119	130	139	102	142	128	106	114	102	91	90	79	71	58	42	60	35	39	39	60	50	50	20	20	20	20	0	0	0	0	0	44	0	428	428	428	428
Vineyard	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	66	0	0	0	0	0
Total	520	581	462	466	508	542	400	555	499	415	444	399	355	351	307	276	227	163	232	136	150	152	236	194	195	85	190	150	150	45	165	120	120	70	213	70	498	498	498	498
Field																																								
Alfalfa	3,633	4,057	3,228	3,255	3,550	3,787	2,791	3,877	3,484	2,897	3,102	2,790	2,480	2,451	2,145	1,928	1,587	1,138	1,622	951	1,049	1,063	1,647	1,353	1,362	1,631	1,551	1,987	2,035	2,350	2,555	2,103	2,288	1,800	1,975	1,335	1,185	935	967	1,008
Vetch	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	467	0	0	156	0	0	0	0
Barley	1,054	1,177	936	944	1,030	1,098	809	1,124	1,010	840	900	809	719	711	622	559	460	330	470	276	304	308	478	392	395	70	319	365	0	80	378	209	300	0	0	818	617	1,459	739	516
Wheat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	175	80	0	0	0	0	0	0	306	43	43	43	485	751
Oat Hay	635	709	564	569	620	662	488	677	609	506	542	487	433	428	375	337	277	199	283	166	183	186	288	236	238	421	235	160	345	265	0	255	95	175	195	245	245	295	363	303
Sudan Grass/Hay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	0	0	40	0	0	0	0	0	0
Silage/Forage	400	447	355	359	391	417	307	427	384	319	342	307	273	270	236	212	175	125	179	105	116	117	181	149	150	0	80	0	0	0	50	35	0	0	0	0	0	0	0	0
Corn	400	447	355	359	391	417	307	427	384	319	342	307	273	270	236	212	175	125	179	105	116	117	181	149	150	100	100	75	75	75	40	80	40	40	40	40	0	0	0	0
Safflower	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	279	150	0	0	0	0	0	0	0	0
Field - Misc.	160	179	142	143	156	167	123	171	153	128	137	123	109	108	94	85	70	50	71	42	46	47	73	60	60	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	6,282	7,015	5,581	5,628	6,138	6,547	4,826	6,704	6,024	5,009	5,363	4,823	4,288	4,238	3,709	3,333	2,743	1,968	2,804	1,645	1,813	1,838	2,847	2,340	2,355	2,242	2,460	2,667	2,455	2,770	3,341	2,832	3,190	2,055	2,516	2,637	2,090	2,732	2,554	2,578
Vegetables																																								
Cantaloupes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	65	20	20	0	0	0	0	0	0	0	0	0
Watermelon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	45	0	35	0	0	0	0	0	0	0
Melon - Misc.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pumpkins	160	179	142	143	156	167	123	171	153	128	137	123	109	108	94	85	70	50	71	42	46	47	73	60	60	120	60	70	80	50	50	120	60	60	60	50	0	0	0	0
Onions	907	1,013	806	813	886	945	697	968	870	723	774	696	619	612	535	481	396	284	405	237	262	265	411	338	340	775	1,262	925	605	540	1,040	1,295	537	1,020	455	615	1,284	742	731	1,024
Garlic	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	120	120	0	0	0
Vegetables-Misc.	694	774	616	621	678	723	533	740	665	553	592	533	473	468	409	368	303	217	310	182	200	203	314	258	260	190	128	256	0	0	0	0	0	20	25	80	0	166	83	83
Carrots	80	89	71	72	78	83	61	85	77	64	68	61	55	54	47	42	35	25	36	21	23	23	36	30	30	320	1,046	1,695	2,887	2,654	2,655	2,068	4,164	3,227	3,551	4,548	4,372	3,639	5,491	3,733
Potatoes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	480	797	598	459	665	394	470	562	395	318	0
Total	1,841	2,055	1,635	1,649	1,798	1,918	1,414	1,964	1,765	1,468	1,571	1,413	1,256	1,242	1,087	977	804	577	821	482	531	539	834	686	690	1,465	2,496	2,946	3,957	3,744	4,607	4,081	5,255	4,992	4,485	5,883	6,338	4,942	6,623	4,840
Rangeland* **																																								
"Pastureland"																									0	0	0	0	0	2,815	0	0	0	0	0	0	0	0	0	0	0
"Uncultivated Ag"																									120	120	20	20	20	879	3,105	3,105	3,105	3,105	3,142	3,142	3,853	2,563	2,563	2,563
Total																									120	120	20	20	20	3,694	3,105	3,105	3,105	3,105	3,142	3,142	3,853	2,563	2,563	2,563
	Total Kern Co. Acreage Estimated as 18% of Total LA Co. Acreage																	**Total Kern Co. Acreage Estimated as 19 - 31% of Total LA Co. Acreage**							**Reported Kern Co. Total Crop Acreage**															
Total All Crops (Kern County Portion)	**8,643**	**9,651**	**7,678**	**7,744**	**8,445**	**9,008**	**6,639**	**9,223**	**8,287**	**6,892**	**7,379**	**6,636**	**5,899**	**5,830**	**5,103**	**4,585**	**3,774**	**2,707**	**3,857**	**2,263**	**2,495**	**2,529**	**3,918**	**3,219**	**3,240**	**3,792**	**5,146**	**5,763**	**6,562**	**6,559**	**8,113**	**7,033**	**8,565**	**7,117**	**7,214**	**8,590**	**8,926**	**8,172**	**9,675**	**7,916**
Total All Crops (LA County Portion)	48,015	53,617	42,656	43,020	46,915	50,043	36,885	51,237	46,041	38,288	40,994	36,867	32,774	32,390	28,348	25,474	20,968	14,248	18,369	9,840	9,979	9,367	13,509	10,385																
(Percentage of LA County Crop Acreage)	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	19	21	23	25	27	29	31	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

* Individual crop acreages for 1970 - 93 estimated from the 1994 cropping pattern (crop acreage percentages: 6% Fruit; 73% Field; 21% Vegetables)
** From Kern Co Dept of Ag/Standards of Measure/Data Requests/Pesticide Use Reports online annual data (www.co.kern.ca.us/kernag)
*** Assumed nonirrigated and excluded from Crop Acreage Totals

Crop Acreages Assigned to DWR Standard Crop Categories

Year	**1970**	**1971**	**1972**	**1973**	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**	**1980**	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Alfalfa	3,633	4,057	3,228	3,255	3,550	3,787	2,791	3,877	3,484	2,897	3,102	2,790	2,480	2,451	2,145	1,928	1,587	1,138	1,622	951	1,049	1,063	1,647	1,353	1,362	1,631	1,551	1,987	2,035	2,350	2,555	2,103	2,288	1,800	1,975	1,335	1,185	935	967	1,008
Other Pasture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	467	0	0	156	0	0	0	0
Grain and Hay	1,689	1,886	1,500	1,513	1,650	1,760	1,297	1,802	1,619	1,346	1,442	1,296	1,153	1,139	997	896	737	529	754	442	487	494	765	629	633	491	729	605	345	345	378	464	395	175	501	1,106	905	1,797	1,587	1,570
Field	960	1,072	853	860	938	1,001	738	1,025	921	766	820	737	655	648	567	509	419	301	429	251	277	281	435	358	360	120	180	75	75	75	408	265	40	80	40	40	0	0	0	0
Deciduous	520	581	462	466	508	542	400	555	499	415	444	399	355	351	307	276	227	163	232	136	150	152	236	194	195	85	190	150	150	45	165	120	120	70	147	70	498	498	498	498
Truck	1,841	2,055	1,635	1,649	1,798	1,918	1,414	1,964	1,765	1,468	1,571	1,413	1,256	1,242	1,087	977	804	577	821	482	531	539	834	686	690	1,465	2,496	2,946	3,957	3,744	4,607	4,081	5,255	4,992	4,485	5,883	6,338	4,942	6,623	4,840
Vineyard	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	66	0	0	0	0	0
Total	**8,643**	**9,651**	**7,678**	**7,744**	**8,445**	**9,008**	**6,639**	**9,223**	**8,287**	**6,892**	**7,379**	**6,636**	**5,899**	**5,830**	**5,103**	**4,585**	**3,774**	**2,707**	**3,857**	**2,263**	**2,495**	**2,529**	**3,918**	**3,219**	**3,240**	**3,792**	**5,146**	**5,763**	**6,562**	**6,559**	**8,113**	**7,033**	**8,565**	**7,117**	**7,214**	**8,590**	**8,926**	**8,172**	**9,675**	**7,916**

Crop Acreages Assigned to Applied Water Requirement Groupings

Year	**1970**	**1971**	**1972**	**1973**	**1974**	**1975**	**1976**	**1977**	**1978**	**1979**	**1980**	**1981**	**1982**	**1983**	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Alfalfa/Pasture	3,633	4,057	3,228	3,255	3,550	3,787	2,791	3,877	3,484	2,897	3,102	2,790	2,480	2,451	2,145	1,928	1,587	1,138	1,622	951	1,049	1,063	1,647	1,353	1,362	1,631	1,551	1,987	2,035	2,350	2,555	2,103	2,755	1,800	1,975	1,491	1,185	935	967	1,008
Grain	1,689	1,886	1,500	1,513	1,650	1,760	1,297	1,802	1,619	1,346	1,442	1,296	1,153	1,139	997	896	737	529	754	442	487	494	765	629	633	491	729	605	345	345	378	464	395	175	501	1,106	905	1,797	1,587	1,570
Carrots	80	89	71	72	78	83	61	85	77	64	68	61	55	54	47	42	35	25	36	21	23	23	36	30	30	320	1,046	1,695	2,887	2,654	2,655	2,068	4,164	3,227	3,551	4,548	4,372	3,639	5,491	3,733
Onions	907	1,013	806	813	886	945	697	968	870	723	774	696	619	612	535	481	396	284	405	237	262	265	411	338	340	775	1,262	925	605	540	1,040	1,295	537	1,020	455	735	1,404	742	731	1,024
Orchard	520	581	462	466	508	542	400	555	499	415	444	399	355	351	307	276	227	163	232	136	150	152	236	194	195	85	190	150	150	45	165	120	120	70	147	70	498	498	498	498
Sugar Beets/Field	960	1,072	853	860	938	1,001	738	1,025	921	766	820	737	655	648	567	509	419	301	429	251	277	281	435	358	360	120	180	75	75	75	408	265	40	80	40	40	0	0	0	0
Melons and Squash	854	953	758	765	834	890	656	911	819	681	729	655	583	576	504	453	373	267	381	224	246	250	387	318	320	370	188	326	145	70	115	120	95	80	85	130	0	166	83	83
Potatoes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	320	480	797	598	459	665	394	470	562	395	318	0
Grapes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	66	0	0	0	0	0
Total	**8,643**	**9,651**	**7,678**	**7,744**	**8,445**	**9,008**	**6,639**	**9,223**	**8,287**	**6,892**	**7,379**	**6,636**	**5,899**	**5,830**	**5,103**	**4,585**	**3,774**	**2,707**	**3,857**	**2,263**	**2,495**	**2,529**	**3,918**	**3,219**	**3,240**	**3,792**	**5,146**	**5,763**	**6,562**	**6,559**	**8,113**	**7,033**	**8,565**	**7,117**	**7,214**	**8,590**	**8,926**	**8,172**	**9,675**	**7,916**

Date	Desert View Highlands		Edwards AFB		Lake Los Angeles		Lancaster		Littlerock		North Edwards		Palmdale		Palmdale East		Quartz Hill		Rosamond		Mutual and Private Water Companies
	Population	Area (square miles)	Population	Area (square miles)	Population	Area (square miles)	Population	Area (square miles)	Population	Area (square miles)	Population	Area (square miles)	Population	Area (square miles)	Population	Area (square miles)	Population	Area (square miles)	Population	Area (square miles)	Population Served
April, 1940							2,100														
April, 1950							3,600														
April, 1960							26,000														
April, 1970	2,172		10,331				38,582						8,511		3,560		4,935		2,281		
April, 1980	2,175		8,554				48,027				1,107		12,277		2,920		7,421		2,869		
April, 1987							68,000						33,000								
April, 1990	2,154	1	7,423	15	7,977	5	97,291	89	1,320	2	1,259	4	68,842	78	3,052	1	9,626	4	7,430	20	
July, 1990							98,578						77,405								
July, 1991							106,319						92,404								
July, 1992							108,927						95,273								
July, 1993							113,887						98,912								
July, 1994							116,588						101,559								
July, 1995							117,176						103,215								
July, 1996							118,268						104,980								
July, 1997							119,877						107,000								
July, 1998							121,913						109,169								
July, 1999							123,962						111,272								
April, 2000	2,337	0	5,909	17	11,523	13	118,718	94	1,402				116,670	105			9,890	4	14,349	52	
July, 2000							119,184						117,573								
July, 2001							121,224						120,507								10,187
July, 2002							123,802						123,892								
April, 2003							125,687						127,756								
July, 2003							125,652						127,718								
July, 2004							128,672						130,876								10,569
April, 2005							134,032						134,570								
July, 2005			7,000(1)				134,032						134,570				15,500(2)		15,510(2)		10,569
July, 2006																					10,668
Jan, 2008							143,512						146,209								
Jan, 2009							145,074						151,346								
April, 2010																	17,980(2)		24,901(2)		
April, 2015			10,000(1)				192,000(1)						218,000(1)				20,857(2)		36,944(2)		
April, 2020																	24,194(2)		54,812(2)		
April, 2025																	28,065(2)		81,322(2)		
April, 2030																	32,555(2)		120,656(2)		
April, 2035			16,000(1)				283,000(1)						380,000(1)								

(1) Population is a projection from IRWMP, 2008
(2) Population is a projection from IUWMP, 2005

	1940	1950	1960	1970	1980	1987	1990	2000	2005
Total Population*	**2,100**	**3,600**	**26,000**	**70,372**	**85,350**	**101,000**	**206,374**	**280,798**	**306,612**

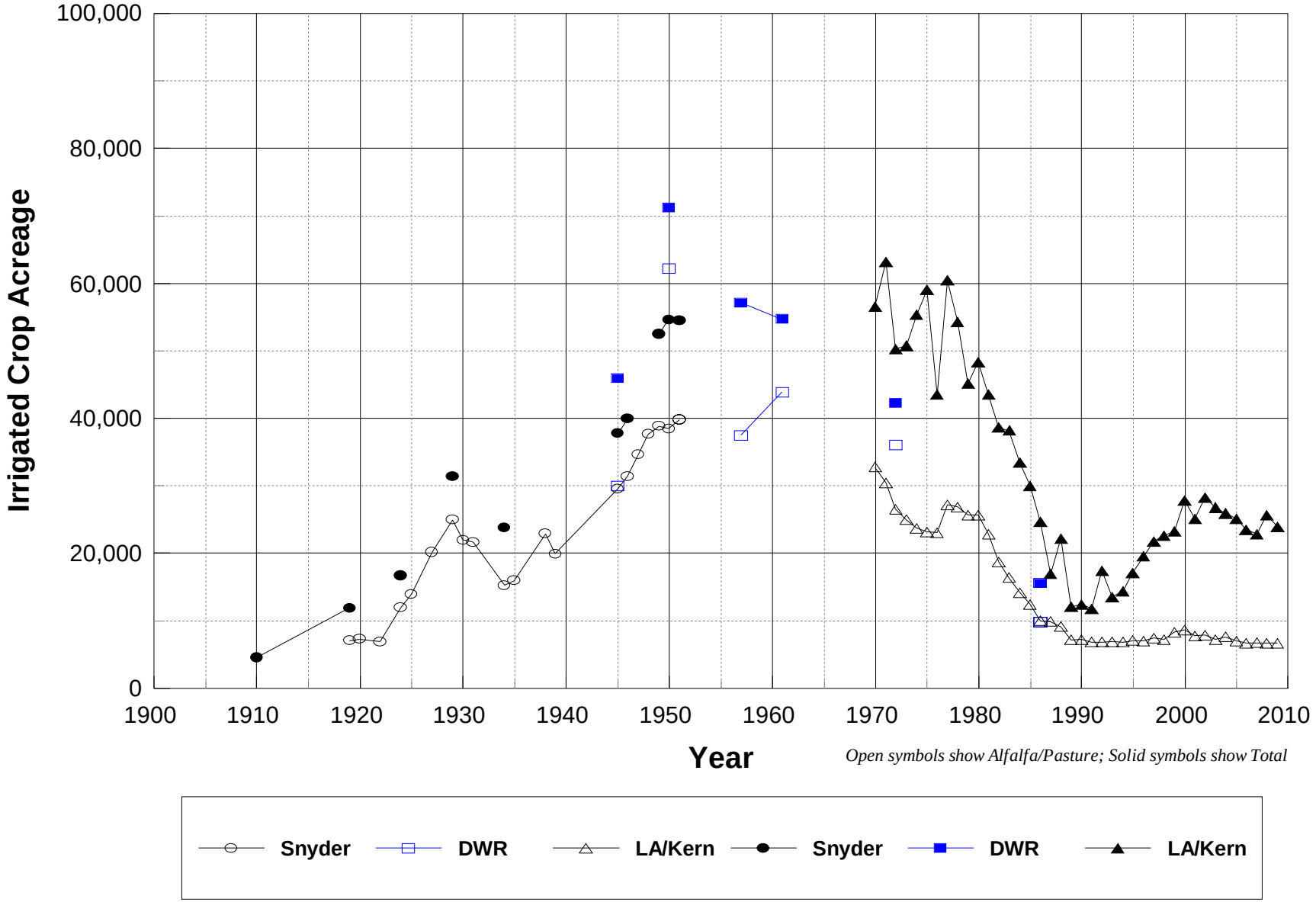
* This value does not include Mutual and Private Water Company Populations Served. No interpolation is included in total values of population for cities not reported in a specific year.

Sources:
California Department of Health Services
DWR, 1965
DWR, 1990
Integrated Regional Water Management Plan, 2008
Integrated Urban Water Management Plan for Antelope Valley, 2005
Population Estimates Program, Population Division, U.S. Census Bureau, Washington, DC 20240
SOCDS Census Data, 2006
U.S. Census Bureau, Census 2000, 1990 Census
California Department of Finance, 2010

Figure D.2-1

Historical Irrigated Crop Acreage

Antelope Valley Area of Adjudication



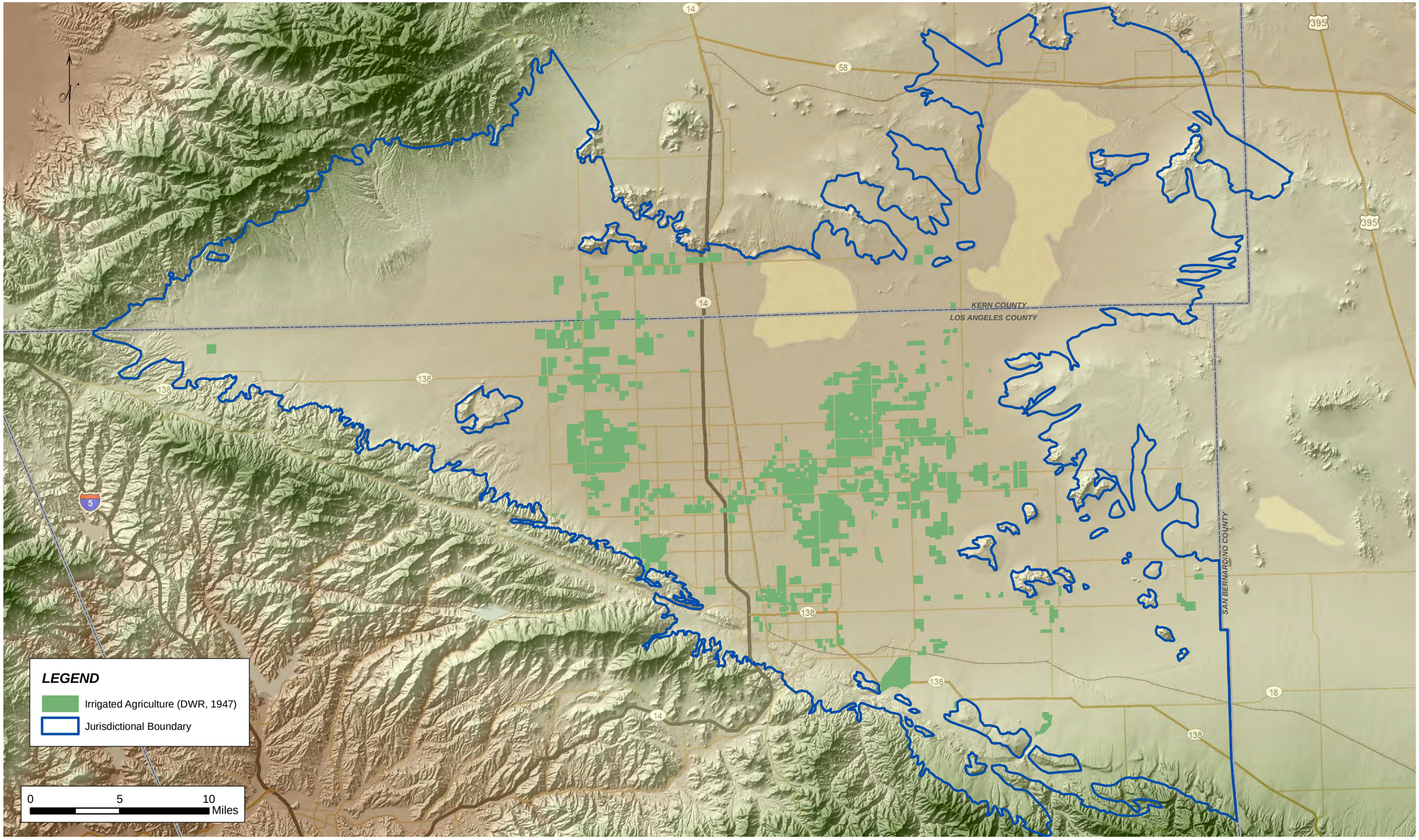


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Figure D.2-2
Landuse in 1947
Antelope Valley, CA

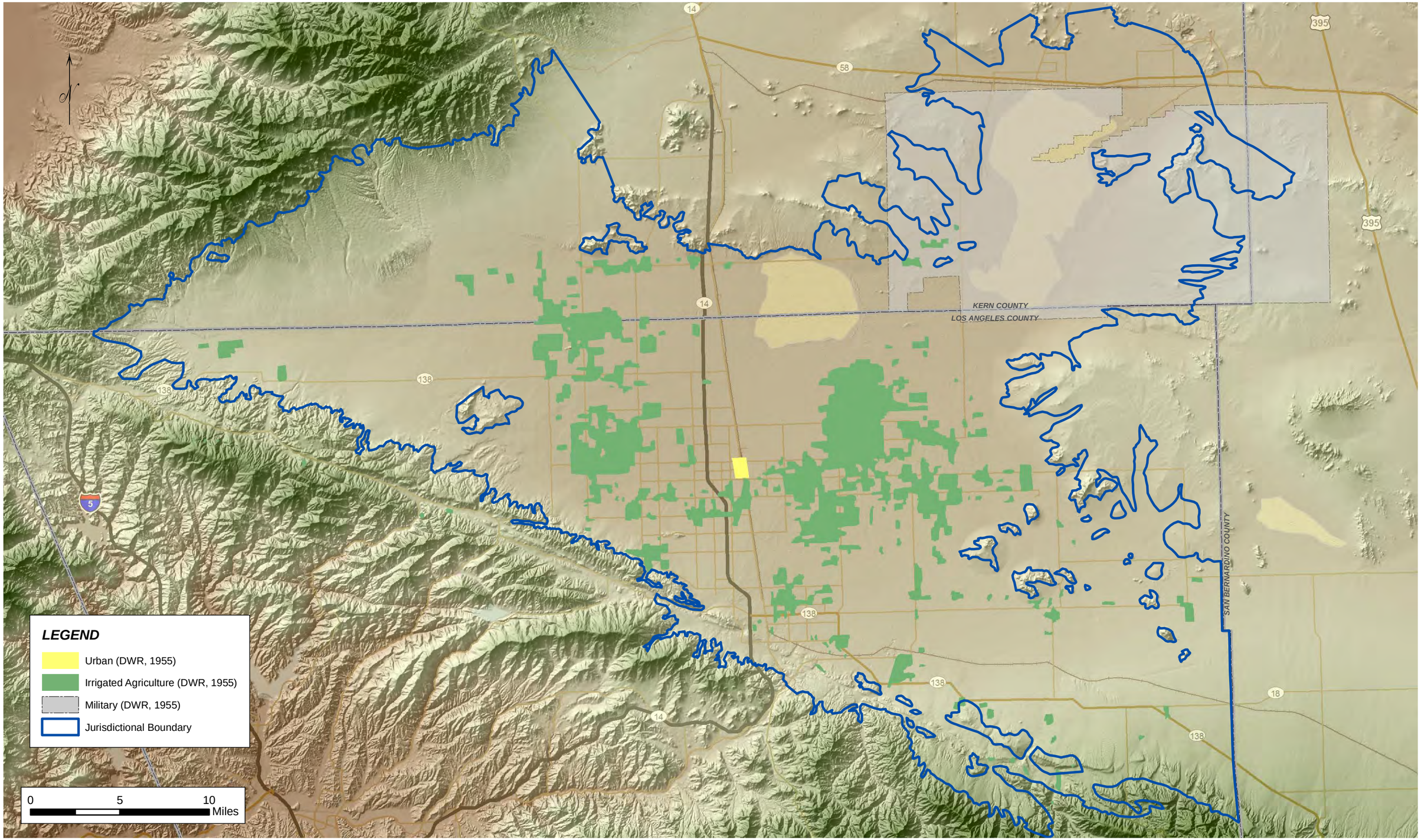

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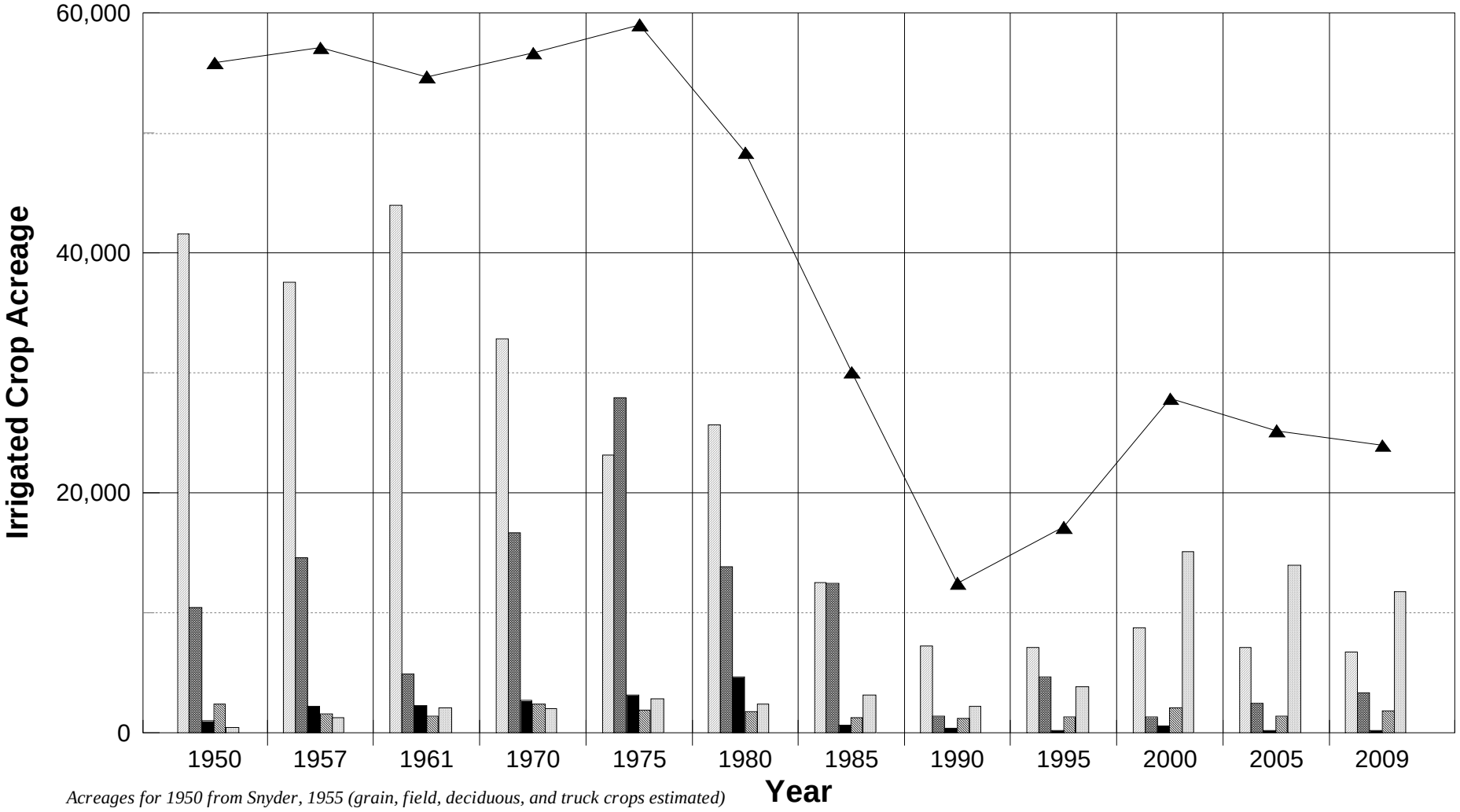
Figure D.2-3
Landuse in 1950
Antelope Valley, CA

Figure D.2-4

Historical Cropping Pattern

Antelope Valley Area of Adjudication



Acreages for 1950 from Snyder, 1955 (grain, field, deciduous, and truck crops estimated)

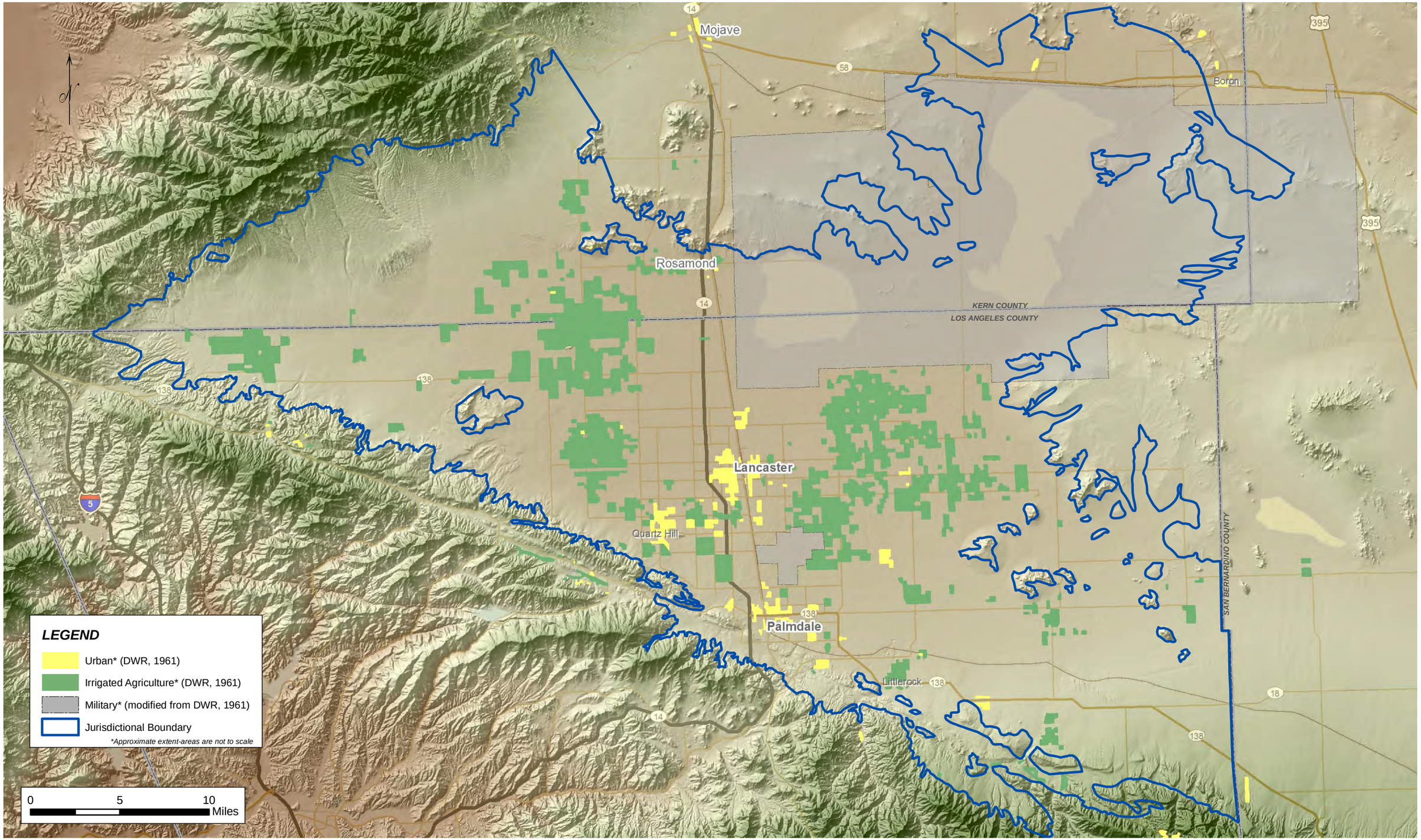


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Figure D.2-5
Landuse in 1957
Antelope Valley, CA

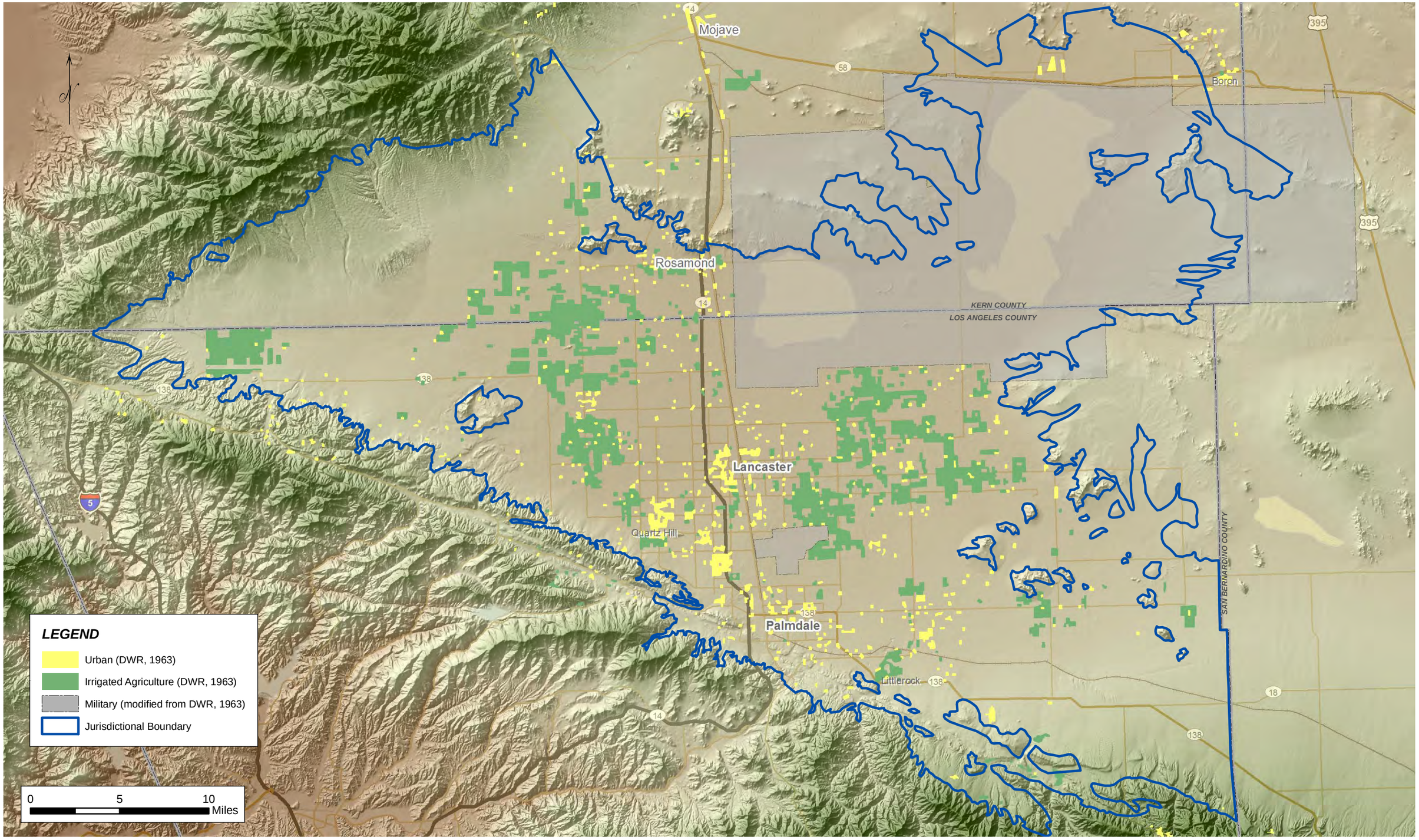

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Figure D.2-6
Landuse in 1961
Antelope Valley, CA

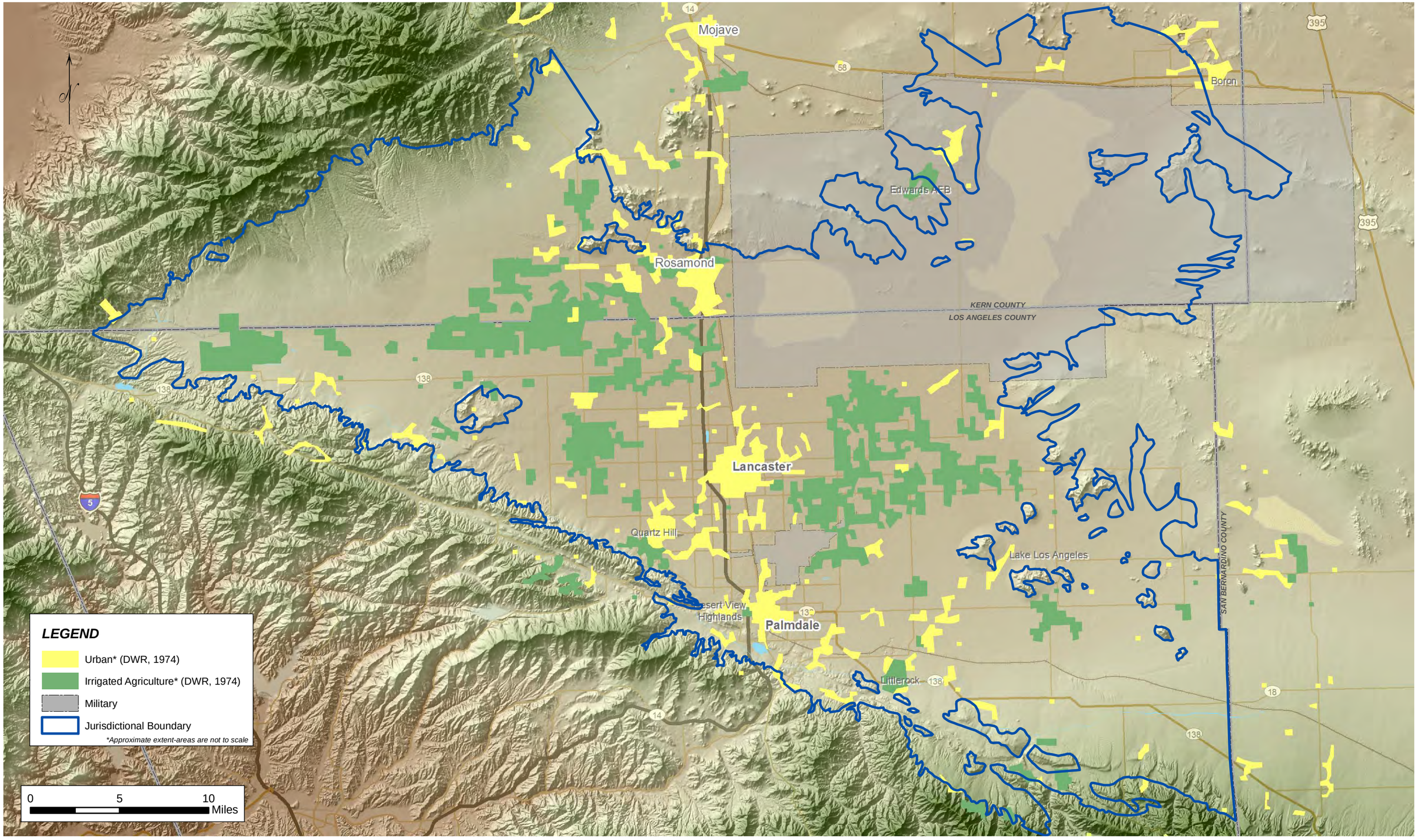

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Figure D.2-7
Landuse in 1972
Antelope Valley, CA

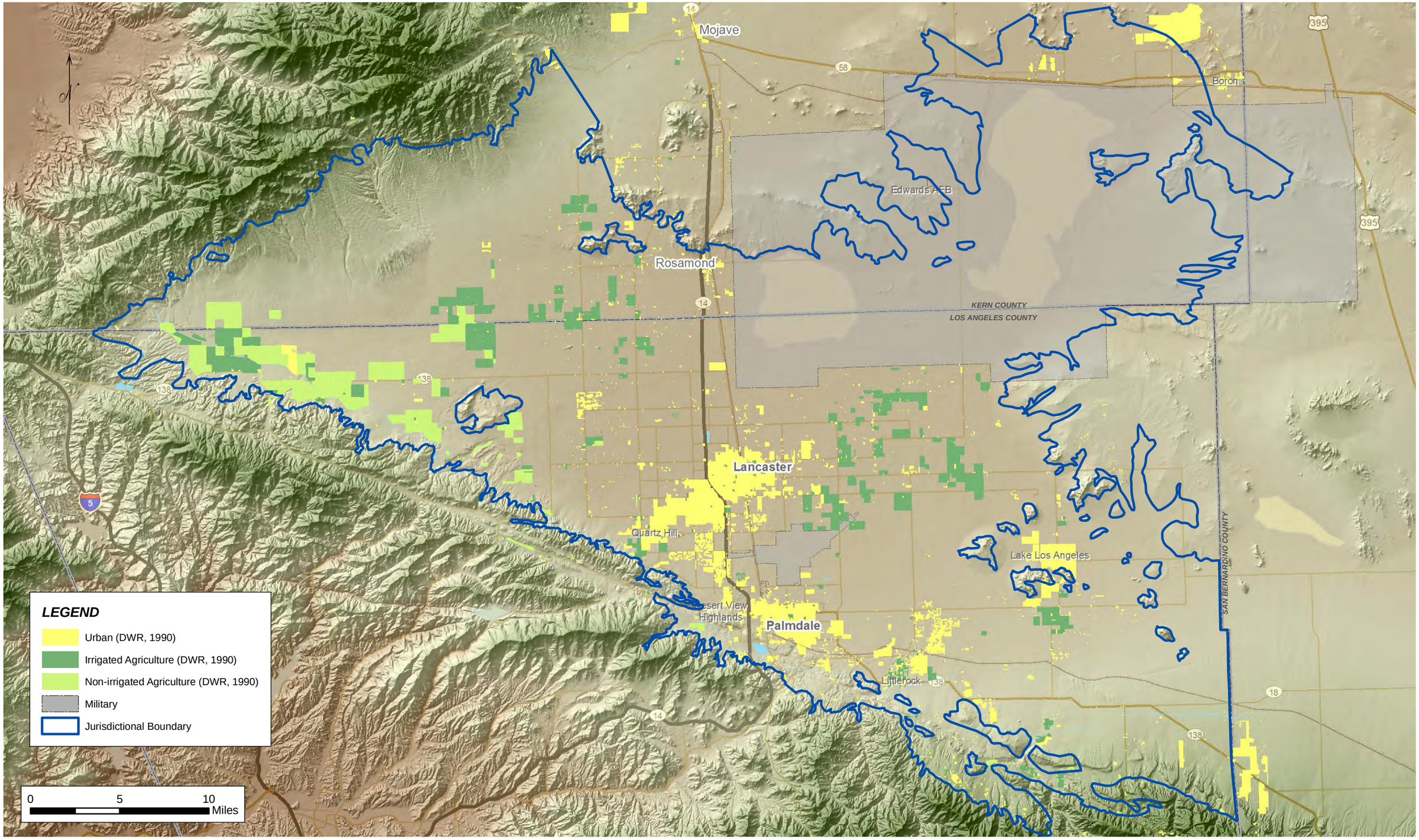

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Figure D.2-8
Landuse in 1986
Antelope Valley, CA

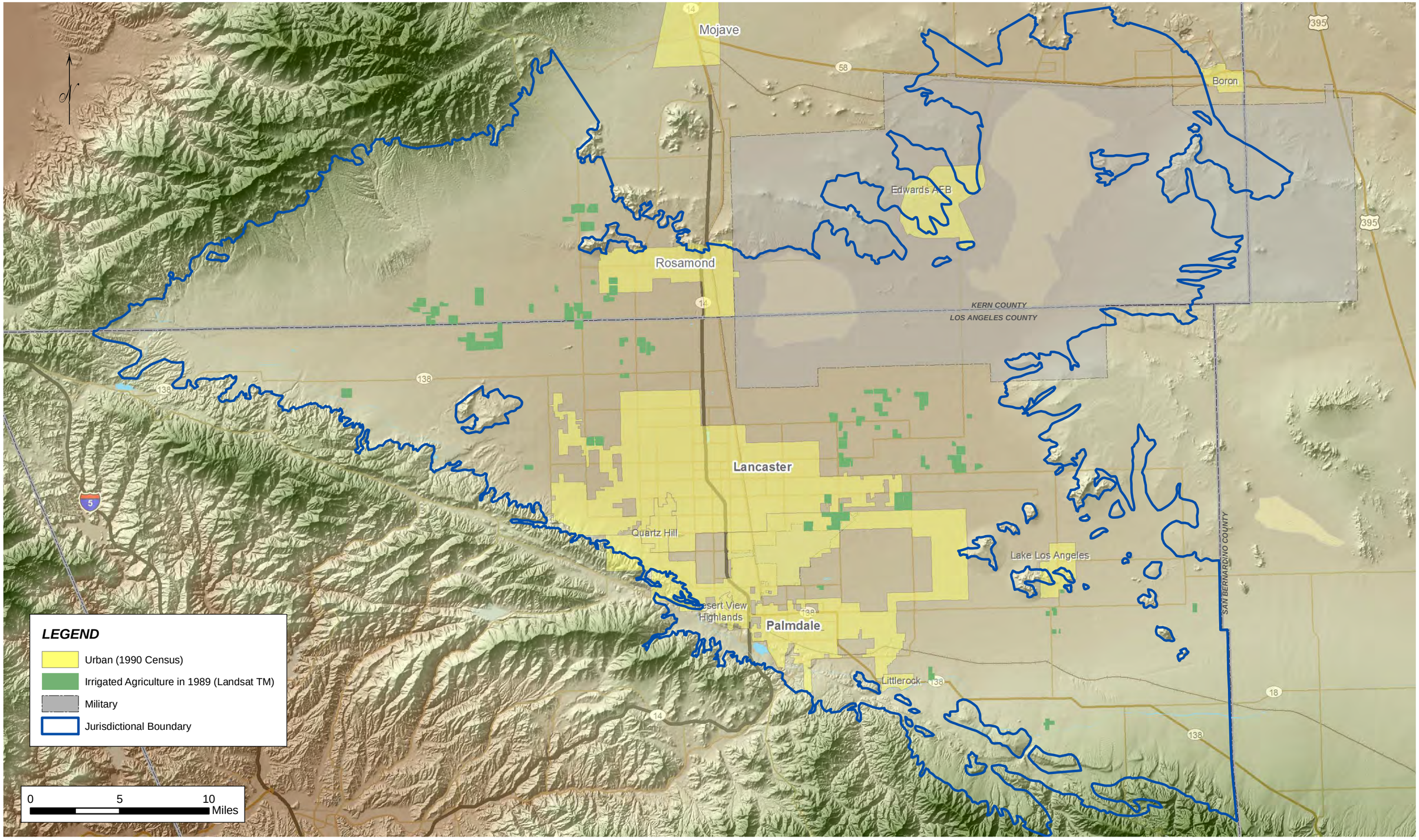

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Figure D.2-9
Landuse in 1989/90
Antelope Valley, CA

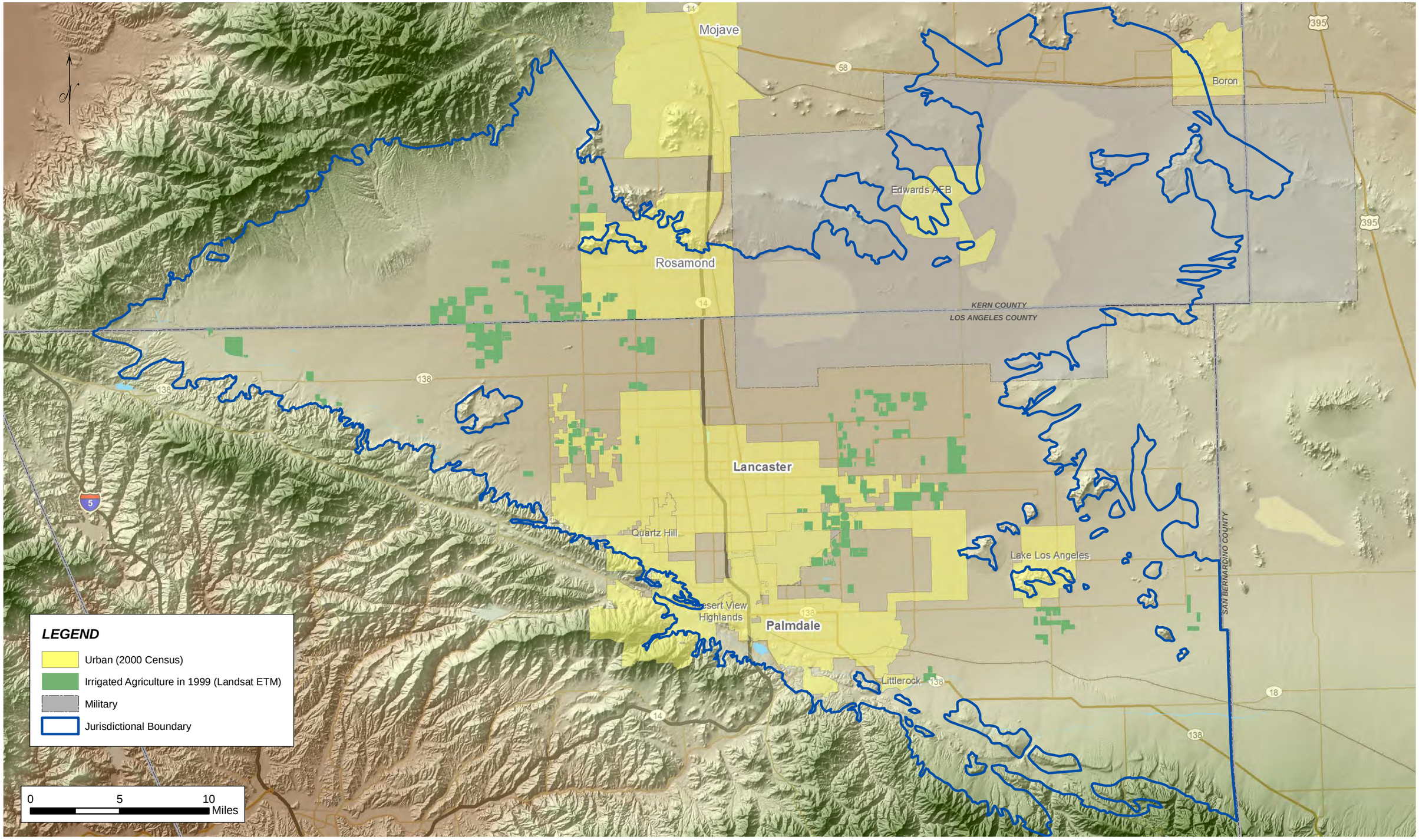

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Figure D.2-10
Landuse in 1999/2000
Antelope Valley, CA

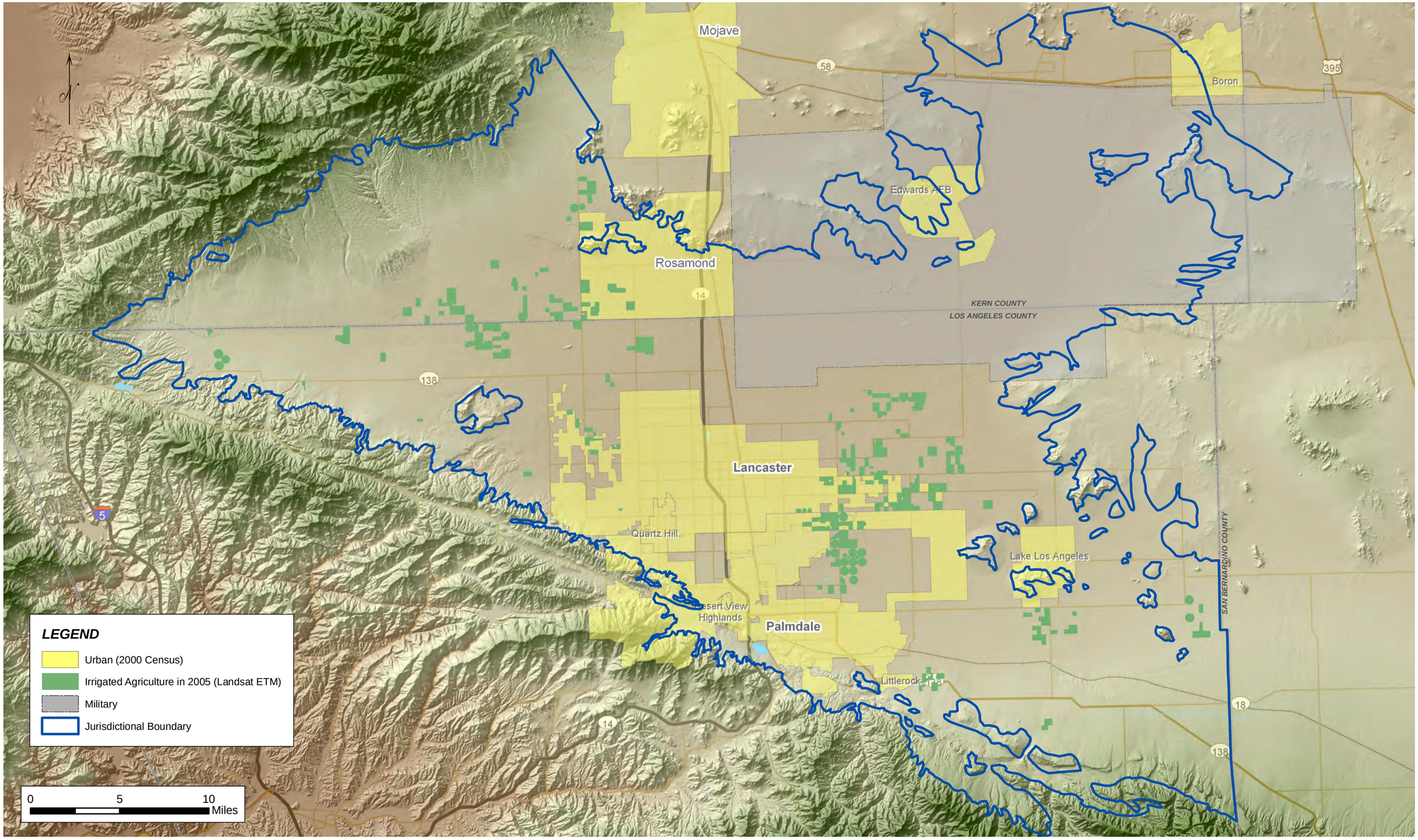

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Figure D.2-11
Landuse in 2005
Antelope Valley, CA

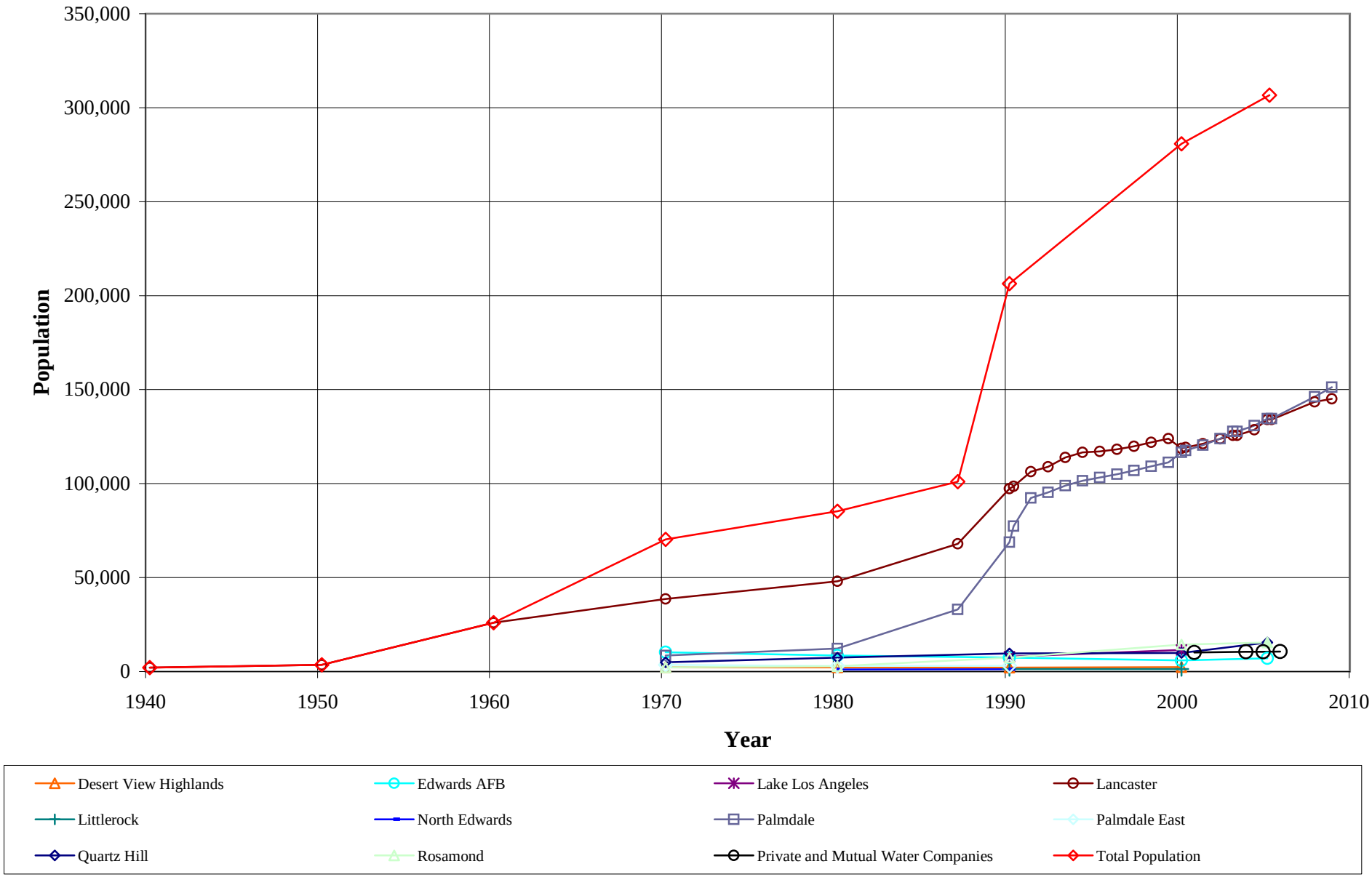

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Figure D.2-12
Historical Population
Antelope Valley Area of Adjudication

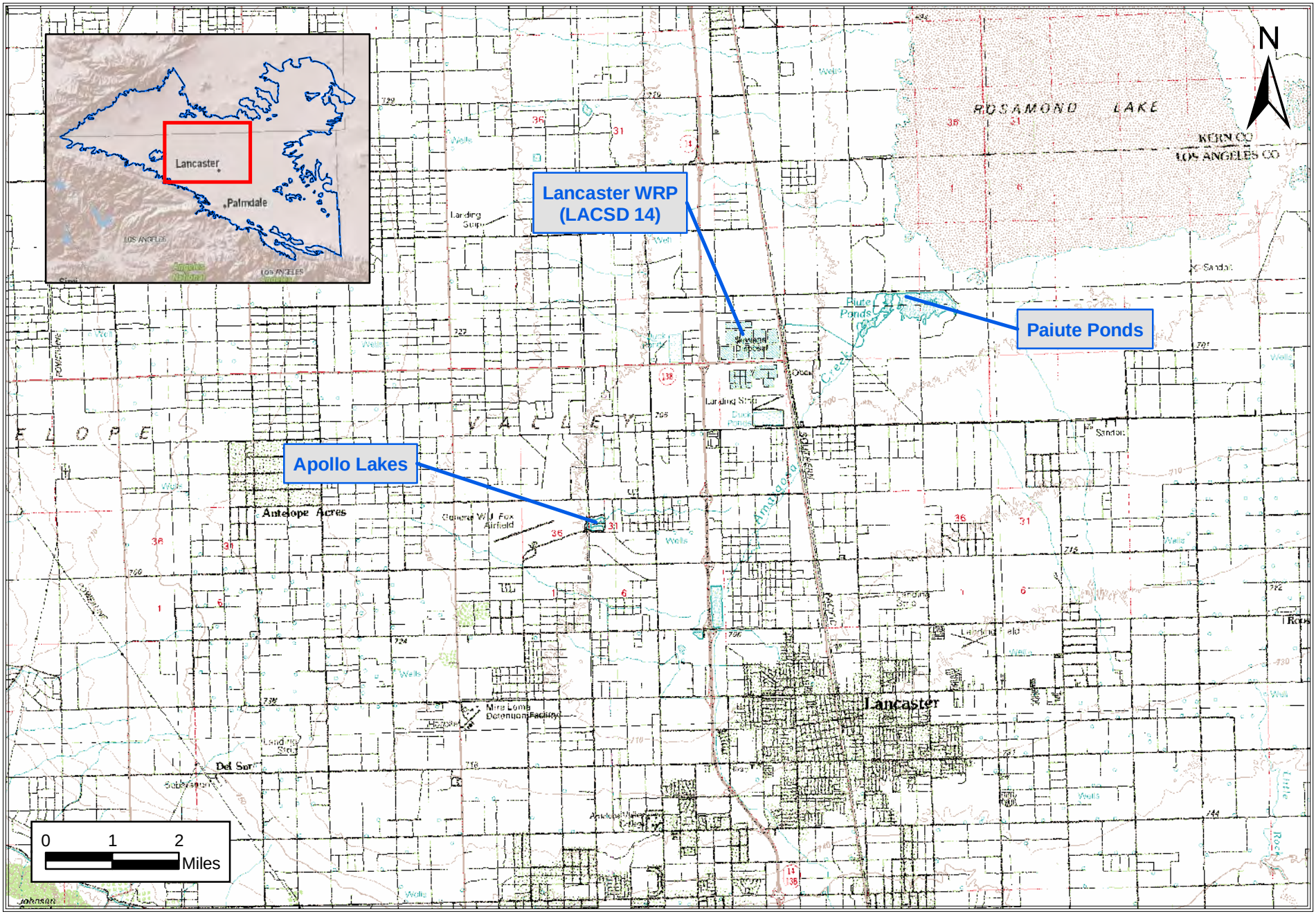

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Figure D.2-13
Environmental/Open Space Land Use Areas
Antelope Valley Area of Adjudication

Table D.3-1
Historical Agricultural Water Requirements by Investigator and Calculation Parameters
Antelope Valley Area of Adjudication
(all values in acre-feet)

	Reported Values (Snyder, 1955)[1]		Calculated from DWR Crop Acreages, DWR Crop Consumptive Use Values, and Irrigation Efficiencies of 70 - 90%[3]									Calculated from County Crop Report Acreages and CIMIS-Derived Applied Crop Water Duties (DU = 80%; Irrigation Efficiencies = 59 to 80%)												
	Total	Current Estimate[2]	Alfalfa	Other Pasture	Grain and Hay	Field	Deciduous	Truck	Vineyard	Total	Current Estimate[4]	Alfalfa/ Pasture	Grain	Carrots	Onions	Orchard	Sugar Beets	Melons and Squash	Potatoes	Grapes	Subtotal	Unreported Farms	Total	Historical Total
Applied Water Duties (af/ac)	1.4 - 7.5		3.0 (7.2)	2.8 (7.7)	0.8 (2.6)	1.5 (4.5)	2.2 (5.6)	1.4 (4.0)	2.4 (4.2)			6.5	2.6	3.9	4.5	4.9	4.6	2.8	2.8	3.7		(5% of Subtotal)		
Year																								
1919	64,200	**77,565**																						**77,565**
1920	66,600	**80,606**																						**80,606**
1925	96,600	**121,746**																						**121,746**
1927	131,400	**167,566**																						**167,566**
1929	160,000	**204,724**																						**204,724**
1930	141,800	**180,112**																						**180,112**
1935	102,600	**130,176**																						**130,176**
1940	168,400	**202,348**																						**202,348**
1945	210,800	**255,311**	90,000		13,000		4,520	1,480		**109,000**	**265,416**													**255,311**
1946	226,000	**273,960**																						**273,960**
1947	261,400	**296,757**																						**296,757**
1948	304,800	**322,497**																						**322,497**
1949	322,900	**327,685**																						**327,685**
1950	350,500	**347,676**	207,000	311	3,733	333	11,000	156	0	**222,533**	**485,310**													**347,676**
1951	366,200	**362,549**																						**362,549**
1957			138,900	20,480	16,651	4,736	4,840	2,580	0	**188,187**	**334,387**													**334,387**
1961			177,086	10,520	5,589	4,907	4,431	4,220	206	**206,959**	**357,362**													**357,362**
1970												213,415	44,170	312	4,351	11,638	11,317	2,670	0	0	287,875	14,394	**302,268**	**302,268**
1971												197,971	66,522	349	4,557	11,994	11,833	3,089	0	0	296,315	14,816	**311,131**	**311,131**
1972			147,429	6,720	1,589	5,679	4,400	1,420	206	**167,441**	**287,087**	173,080	45,500	277	3,986	10,060	10,824	2,361	0	0	246,089	12,304	**258,393**	**258,393**
1973												162,859	50,993	280	4,737	10,075	9,570	2,337	0	0	240,850	12,043	**252,893**	**252,893**
1974												154,374	65,910	305	5,113	10,036	9,238	2,769	0	0	247,746	12,387	**260,133**	**260,133**
1975												150,713	75,166	325	7,404	9,482	10,124	3,051	0	0	256,264	12,813	**269,078**	**269,078**
1976												150,579	34,053	240	8,535	7,652	11,986	3,180	0	0	216,224	10,811	**227,036**	**227,036**
1977												177,138	52,785	4,857	15,605	8,414	21,734	3,502	1,400	0	285,434	14,272	**299,706**	**299,706**
1978												174,744	46,460	299	11,563	8,226	18,956	3,163	0	0	263,411	13,171	**276,582**	**276,582**
1979												167,031	29,589	600	10,972	8,006	13,642	2,326	224	0	232,390	11,620	**244,010**	**244,010**
1980												167,062	35,975	461	5,397	8,786	21,527	2,923	0	0	242,132	12,107	**254,239**	**254,239**
1981												148,782	33,271	552	7,530	6,931	16,157	3,011	0	0	216,234	10,812	**227,045**	**227,045**
1982												122,069	36,407	915	9,234	6,865	4,579	3,381	0	0	183,451	9,173	**192,624**	**192,624**
1983												106,651	41,226	211	10,898	6,639	4,438	3,250	0	0	173,313	8,666	**181,978**	**181,978**
1984												92,383	36,049	422	8,923	6,636	3,804	3,082	0	0	151,300	7,565	**158,865**	**158,865**
1985												81,381	32,817	441	9,133	6,219	2,344	2,789	0	0	135,123	6,756	**141,879**	**141,879**
1986			37,757	4,200	1,520	129	6,191	4,760	103	**54,660**	**95,923**	65,307	27,188	468	8,313	5,339	1,929	2,133	0	0	110,676	5,534	**116,210**	**116,210**
1987												65,033	8,240	455	7,880	5,385	1,384	1,438	0	0	89,815	4,491	**94,306**	**94,306**
1988												59,929	21,912	428	9,327	5,867	1,972	2,156	0	0	101,591	5,080	**106,671**	**106,671**
1989												46,680	3,311	415	8,455	5,591	1,157	755	0	0	66,365	3,318	**69,683**	**69,683**
1990												47,263	3,927	519	8,014	5,917	1,275	822	0	0	67,738	3,387	**71,125**	**71,125**
1991												44,604	3,281	195	8,647	5,717	1,293	988	0	0	64,725	3,236	**67,961**	**67,961**
1992												45,029	16,061	155	9,193	6,208	2,002	1,502	0	0	80,151	4,008	**84,158**	**84,158**
1993												45,076	6,353	179	8,417	7,395	1,645	1,239	0	0	70,305	3,515	**73,820**	**73,820**
1994												44,782	8,460	199	7,466	8,328	1,656	1,429	0	0	72,320	3,616	**75,937**	**75,937**
1995												46,103	12,360	3,389	10,848	6,577	552	1,540	0	0	81,369	4,068	**85,438**	**85,438**
1996												46,069	11,547	13,143	12,395	6,791	828	1,047	0	0	91,820	4,591	**96,411**	**96,411**
1997												48,695	10,198	21,473	12,683	6,916	345	1,480	0	55	101,845	5,092	**106,937**	**106,937**
1998												47,453	4,953	31,742	13,417	7,874	345	908	896	90	107,678	5,384	**113,062**	**113,062**
1999												54,713	3,582	31,832	12,176	8,568	345	797	1,344	96	113,452	5,673	**119,125**	**119,125**
2000												56,681	3,774	42,069	14,867	10,407	1,877	683	2,232	122	132,712	6,636	**139,348**	**139,348**
2001												50,750	4,222	36,992	13,466	10,500	1,219	664	1,674	179	119,666	5,983	**125,649**	**125,649**
2002												51,729	4,426	55,099	10,002	7,092	184	904	1,285	201	130,922	6,546	**137,468**	**137,468**
2003												47,197	4,020	45,950	17,000	6,910	368	604	1,862	232	124,143	6,207	**130,350**	**130,350**
2004												50,068	4,635	42,721	14,797	6,988	184	606	1,103	519	121,620	6,081	**127,701**	**127,701**
2005												45,982	6,827	38,645	15,113	6,677	184	645	1,316	397	115,787	5,789	**121,576**	**121,576**
2006												43,817	7,449	31,691	14,589	8,830	0	216	1,574	418	108,583	5,429	**114,012**	**114,012**
2007												44,182	9,028	29,024	11,718	8,807	0	774	1,106	402	105,040	5,252	**110,292**	**110,292**
2008												43,707	9,132	39,285	13,388	8,919	0	465	890	488	116,275	5,814	**122,089**	**122,089**
2009												43,974	9,087	32,429	14,707	8,919	0	465	0	488	110,070	5,503	**115,573**	**115,573**

1) Calculated from Reported Crop Acreages, Crop Consumptive Use Values, and Irrigation Efficiencies (41 - 51%)
2) Calculated from Snyder Crop Acreages and CIMIS-Derived Applied Crop Water Duties (DU=70%)
3) Crop Water Values shown are Consumptive Use Values (Irrigation Efficiencies not incorporated); Calculated Water Requirements utilize Irrigation Efficiencies of 100% (1945), 90% (1950), and 70% (all other survey years)
4) Calculated from DWR Crop Acreages and CIMIS-Derived Applied Crop Water Values (DU=70%) shown in parentheses in crop column headings

Table D.3-2
Crop Water Requirements and Applied Water
Antelope Valley

Crop	Evapotranspiration of Applied Water (ET_{AW}) (inches/year)	Total Applied Water (AW_T) (inches/year)	Total Applied Water (AW_T) (feet/year)
Alfalfa	60.33	77.42	6.5
Carrots	27.47	46.83	3.9
Grain	21.52	30.90	2.6
Melons and Squash	23.91	33.88	2.8
Onions	37.57	53.96	4.5
Orchard (Deciduous)	47.38	59.22	4.9
Pasture	64.42	80.53	6.7
Potatoes	24.02	34.03	2.8
Sugar Beets	40.55	54.68	4.6
Vineyard (Grapes)	35.33	44.16	3.7

Table D.3-3
Historical M&I Water Requirements
Antelope Valley Area of Adjudication
(acre-feet per year)

Year	LACWW 40	Palmdale WD	Littlerock Ck ID	Quartz Hill WD	Rosamond CSD	Antelope Valley WC	Palm Ranch ID	Desert Lake CSD	Boron CSD	Edwards AFB	Main M&I Subtotal	Mutual and Private WCs	Rural Residential	ASR Project LACWW 40	Total
1946	600	1,792	200	480	54	98	307	0	0	2,966	6,497	325	520	0	**7,341**
1947	200	1,926	207	480	54	98	307	0	0	2,966	6,238	312	499	0	**7,049**
1948	1,227	2,060	214	729	54	98	307	0	0	2,166	6,856	343	548	0	**7,747**
1949	1,137	2,195	221	645	54	98	935	0	0	2,941	8,226	411	658	0	**9,296**
1950	585	2,329	229	480	54	98	307	0	0	2,495	6,577	329	526	0	**7,432**
1951	1,004	2,463	236	480	54	98	307	0	0	1,587	6,229	311	498	0	**7,039**
1952	1,087	2,598	243	43	54	98	307	0	0	1,367	5,797	290	464	0	**6,550**
1953	4,065	2,732	250	480	54	98	210	0	0	1,687	9,576	479	766	0	**10,821**
1954	2,130	2,867	257	28	54	98	307	0	0	4,005	9,746	487	780	0	**11,013**
1955	2,130	3,001	264	50	54	98	320	0	0	4,285	10,202	510	816	0	**11,529**
1956	3,640	4,557	271	147	54	98	56	0	0	4,902	13,726	686	1,098	0	**15,510**
1957	5,189	4,022	279	394	54	98	384	0	0	2,240	12,659	633	1,013	0	**14,305**
1958	5,236	4,958	286	447	54	98	472	160	0	1,425	13,136	657	1,051	0	**14,843**
1959	5,634	4,290	293	535	54	98	898	140	0	4,037	15,978	799	1,278	0	**18,056**
1960	5,779	3,471	300	526	54	98	483	174	0	2,496	13,381	669	1,070	0	**15,121**
1961	11,036	3,284	310	585	54	98	310	180	0	4,165	20,023	1,001	1,602	0	**22,625**
1962	11,535	8,910	320	625	54	98	418	180	0	5,464	27,604	1,380	2,208	0	**31,192**
1963	10,167	3,563	330	561	54	98	1,431	180	0	2,122	18,507	925	1,481	0	**20,912**
1964	10,033	4,240	340	545	54	98	675	180	298	3,693	20,156	1,008	1,612	0	**22,776**
1965	11,760	3,066	350	606	54	98	675	290	305	2,967	20,171	1,009	1,614	0	**22,793**
1966	10,791	3,988	360	603	54	98	466	300	347	4,357	21,364	1,068	1,709	0	**24,141**
1967	10,398	4,039	370	516	54	114	598	300	347	3,505	20,242	1,012	1,619	0	**22,873**
1968	12,536	7,437	380	622	54	128	916	367	472	3,227	26,139	1,307	2,091	0	**29,537**
1969	15,593	6,471	390	596	54	138	857	275	451	2,630	27,456	1,373	2,196	0	**31,025**
1970	14,083	5,841	400	918	54	164	815	194	509	1,350	24,328	1,216	1,946	0	**27,490**
1971	14,007	5,912	410	923	54	187	747	305	606	2,897	26,048	1,302	2,084	0	**29,434**
1972	15,893	5,962	420	1,065	54	209	850	300	621	3,566	28,941	1,447	2,315	0	**32,703**
1973	15,177	6,086	430	1,281	54	232	953	329	592	2,557	27,692	1,385	2,215	0	**31,292**
1974	14,568	6,000	440	1,167	54	220	1,021	331	620	2,369	26,790	1,339	2,143	0	**30,273**
1975	13,540	6,428	450	1,396	54	248	1,053	335	630	2,145	26,279	1,314	2,102	0	**29,696**
1976	13,553	6,026	460	1,474	54	281	1,101	318	565	2,245	26,077	1,304	2,086	0	**29,467**
1977	11,504	5,067	470	1,353	383	261	1,007	320	572	2,344	23,281	1,164	1,862	0	**26,308**
1978	11,716	6,873	480	1,483	400	271	1,032	322	605	2,444	25,625	1,281	2,050	0	**28,957**
1979	14,399	6,078	490	1,605	438	109	875	330	549	2,480	27,354	1,368	2,188	0	**30,910**
1980	14,226	5,073	500	1,744	436	297	1,102	225	580	2,515	26,697	1,335	2,136	0	**30,168**
1981	15,696	5,894	550	2,033	632	306	1,216	322	498	1,385	28,534	1,427	2,283	0	**32,243**
1982	15,347	7,209	600	1,789	640	281	904	324	290	2,060	29,444	1,472	2,356	0	**33,272**
1983	11,387	6,333	650	1,859	480	264	790	385	286	1,672	24,106	1,205	1,928	0	**27,240**
1984	18,038	8,077	700	2,394	584	328	909	252	238	2,141	33,660	1,683	2,693	0	**38,036**
1985	19,151	9,786	750	2,427	727	412	1,160	251	327	1,831	36,822	1,841	2,946	0	**41,609**
1986	23,875	10,340	800	2,553	736	517	1,163	257	323	2,041	42,604	2,130	3,408	0	**48,142**
1987	25,297	13,286	850	2,627	1,112	517	1,302	226	225	1,601	47,044	2,352	3,763	0	**53,159**
1988	28,946	12,830	900	2,842	879	594	1,204	259	233	1,597	50,283	2,514	4,023	0	**56,820**
1989	33,689	18,701	950	3,026	934	666	1,550	80	0	1,593	61,190	3,059	4,895	0	**69,145**
1990	33,538	18,935	1,000	3,149	1,244	642	1,521	30	0	1,526	61,585	3,079	4,927	0	**69,591**
1991	25,899	15,717	1,000	2,850	1,696	526	1,296	436	0	1,991	51,410	2,571	4,113	0	**58,094**
1992	28,300	15,678	1,000	2,891	1,988	570	1,361	372	0	4,794	56,954	2,848	4,556	0	**64,358**
1993	38,764	18,016	1,000	3,332	2,319	618	1,326	396	0	4,844	70,616	3,531	5,649	0	**79,796**
1994	41,331	20,598	1,000	3,747	2,504	683	1,446	527	0	5,265	77,101	3,855	6,168	0	**87,124**
1995	41,477	21,040	1,000	3,897	2,475	677	1,494	667	0	4,986	77,713	3,886	6,217	0	**87,816**
1996	46,329	23,272	1,000	4,421	2,795	747	1,979	481	0	5,410	86,433	4,322	6,915	0	**97,670**
1997	47,733	22,891	1,000	4,523	2,782	757	1,780	441	0	5,139	87,046	4,352	6,964	0	**98,362**
1998	42,187	21,258	1,000	3,955	2,556	655	1,540	444	0	4,468	78,063	3,903	6,245	0	**88,211**
1999	49,355	25,121	1,000	4,713	2,975	756	1,797	416	0	4,981	91,114	4,556	7,289	0	**102,958**
2000	52,071	25,029	1,000	4,773	3,091	827	1,705	368	0	6,436	95,301	4,765	7,624	0	**107,690**
2001	52,701	27,709	1,000	4,870	3,144	810	1,249	372	0	6,329	98,186	4,909	7,855	0	**110,950**
2002	54,680	25,936	1,000	5,428	3,279	787	1,827	388	0	5,245	98,569	4,928	7,886	0	**111,383**
2003	54,050	25,064	1,000	5,259	2,984	786	1,695	463	0	4,766	96,067	4,803	7,685	0	**108,556**
2004	57,236	26,513	1,000	5,444	3,309	870	1,691	374	0	4,888	101,324	5,066	8,106	0	**114,497**
2005	54,858	28,983	1,000	5,396	3,077	891	1,639	259	0	4,129	100,234	5,012	8,019	558	**113,822**
2006	58,905	27,597	1,000	5,650	3,515	832	1,434	188	0	4,050	103,171	5,159	8,254	1,612	**118,196**
2007	59,575	30,201	1,000	6,415	3,740	844	991	205	0	4,150	107,121	5,356	8,570	857	**121,904**
2008	55,085	26,803	1,000	6,499	3,753	768	1,650	158	0	3,152	98,867	4,943	7,909	0	**111,720**
2009	48,809	22,873	1,000	5,578	3,163	667	1,522	151	0	3,065	86,829	4,341	6,946	0	**98,116**

Table D.3-4

Environmental and Open Space Water Requirements

Antelope Valley Area of Adjudication

(acre-feet per year)

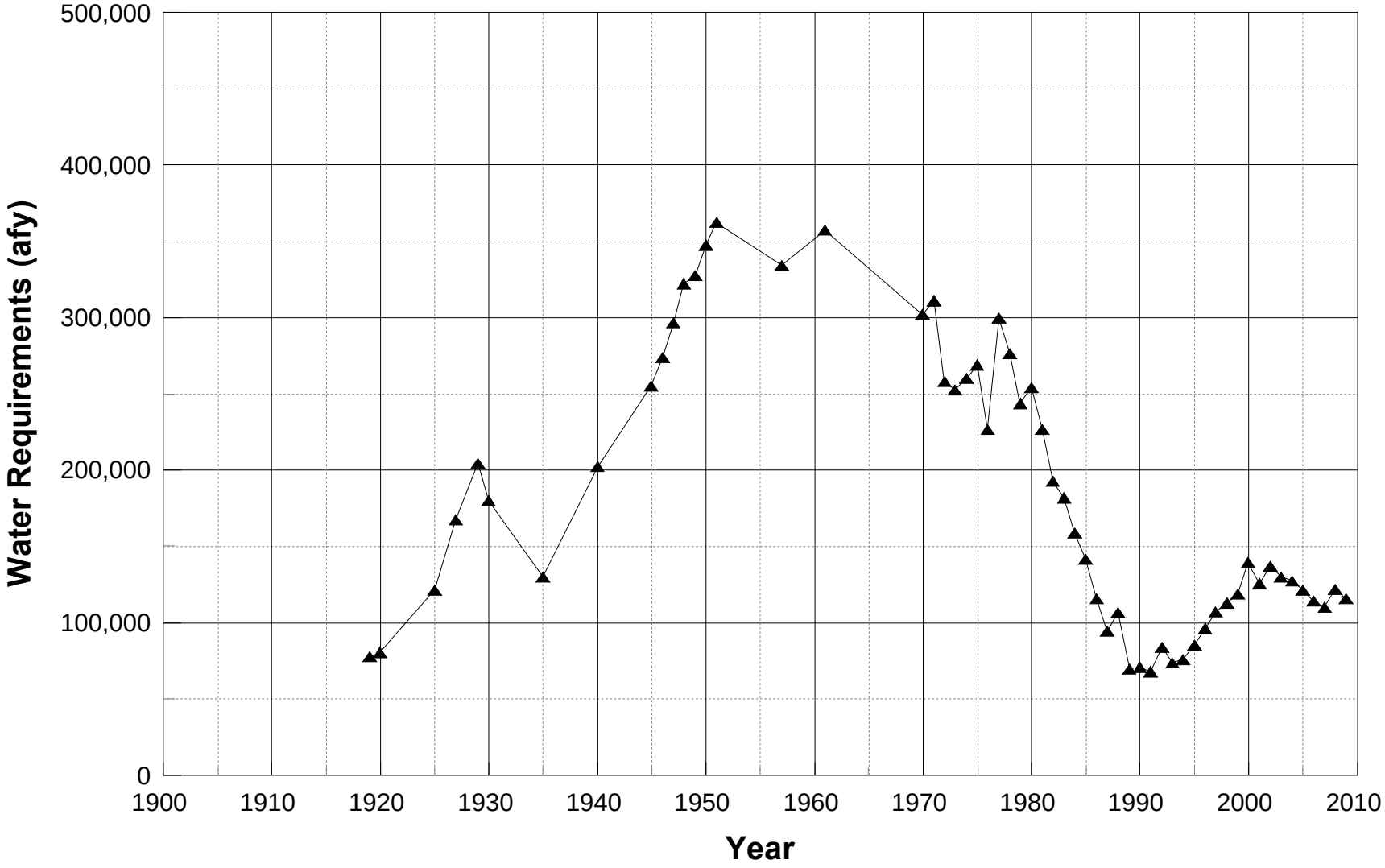
YEAR	Recycled Water from Lancaster Water Reclamation Plant Los Angeles County Sanitation District 14		
	Paiute Ponds Wildlife Refuge	Apollo Lakes Regional County Park	**Total**
1975	840	87	**927**
1976	1,277	282	**1,559**
1977	1,699	279	**1,978**
1978	2,159	297	**2,456**
1979	1,982	244	**2,226**
1980	2,172	270	**2,442**
1981	2,323	278	**2,601**
1982	2,125	211	**2,336**
1983	2,767	191	**2,958**
1984	2,588	167	**2,755**
1985	3,086	172	**3,258**
1986	4,210	146	**4,356**
1987	5,139	132	**5,271**
1988	3,664	113	**3,777**
1989	2,009	125	**2,134**
1990	2,266	185	**2,451**
1991	2,413	154	**2,567**
1992	3,399	121	**3,520**
1993	5,151	128	**5,279**
1994	4,979	130	**5,109**
1995	7,003	138	**7,141**
1996	7,402	99	**7,501**
1997	6,743	134	**6,877**
1998	8,587	119	**8,706**
1999	7,448	190	**7,638**
2000	6,960	160	**7,120**
2001	7,344	206	**7,550**
2002	7,655	184	**7,839**
2003	8,224	158	**8,382**
2004	9,033	206	**9,239**
2005	9,738	219	**9,957**
2006	9,440	170	**9,611**
2007	7,550	180	**7,730**
2008	7,815	210	**8,025**
2009	6,683	219	**6,901**

Table D.3-5
Estimated Total Historical Water Requirements
Antelope Valley Area of Adjudication
(acre-feet per year)

Year	Water Requirements by Use			Total
	Agricultural	Municipal & Industrial	Environmental & Open Space	
1919	77,565	-----	-----	77,565
1920	80,606	-----	-----	80,606
1925	121,746	-----	-----	121,746
1927	167,566	-----	-----	167,566
1929	204,724	-----	-----	204,724
1930	180,112	-----	-----	180,112
1935	130,176	-----	-----	130,176
1940	202,348	-----	-----	202,348
1945	255,311	-----	-----	255,311
1946	273,960	7,341	-----	281,302
1947	296,757	7,049	-----	303,806
1948	322,497	7,747	-----	330,244
1949	327,685	9,296	-----	336,981
1950	347,676	7,432	-----	355,108
1951	362,549	7,039	-----	369,589
1952	357,856	6,550	-----	364,406
1953	353,162	10,821	-----	363,983
1954	348,468	11,013	-----	359,481
1955	343,774	11,529	-----	355,303
1956	339,081	15,510	-----	354,591
1957	334,387	14,305	-----	348,692
1958	340,131	14,843	-----	354,974
1959	345,875	18,056	-----	363,930
1960	351,618	15,121	-----	366,739
1961	357,362	22,625	-----	379,987
1962	351,240	31,192	-----	382,432
1963	345,119	20,912	-----	366,031
1964	338,997	22,776	-----	361,774
1965	332,876	22,793	-----	355,669
1966	326,754	24,141	-----	350,896
1967	320,633	22,873	-----	343,506
1968	314,511	29,537	-----	344,049
1969	308,390	31,025	-----	339,415
1970	302,268	27,490	-----	329,759
1971	311,131	29,434	-----	340,565
1972	258,393	32,703	-----	291,097
1973	252,893	31,292	-----	284,185
1974	260,133	30,273	-----	290,406
1975	269,078	29,696	927	299,700
1976	227,036	29,467	1,559	258,062
1977	299,706	26,308	1,978	327,992
1978	276,582	28,957	2,456	307,995
1979	244,010	30,910	2,226	277,146
1980	254,239	30,168	2,442	286,848
1981	227,045	32,243	2,601	261,889
1982	192,624	33,272	2,336	228,232
1983	181,978	27,240	2,958	212,176
1984	158,865	38,036	2,755	199,656
1985	141,879	41,609	3,258	186,746
1986	116,210	48,142	4,356	168,708
1987	94,306	53,159	5,271	152,737
1988	106,671	56,820	3,777	167,268
1989	69,683	69,145	2,134	140,961
1990	71,125	69,591	2,451	143,167
1991	67,961	58,094	2,567	128,622
1992	84,158	64,358	3,520	152,036
1993	73,820	79,796	5,279	158,895
1994	75,937	87,124	5,109	168,170
1995	85,438	87,816	7,141	180,395
1996	96,411	97,670	7,501	201,582
1997	106,937	98,362	6,877	212,175
1998	113,062	88,211	8,706	209,979
1999	119,125	102,958	7,638	229,721
2000	139,348	107,690	7,120	254,158
2001	125,649	110,950	7,550	244,149
2002	137,468	111,383	7,839	256,691
2003	130,350	108,556	8,382	247,288
2004	127,701	114,497	9,239	251,437
2005	121,576	113,822	9,957	245,355
2006	114,012	118,196	9,611	241,818
2007	110,292	121,904	7,730	239,926
2008	122,089	111,720	8,025	241,833
2009	115,573	98,116	6,901	220,591

----- Data Unavailable

Figure D.3-1
Historical Agricultural Water Requirements
Antelope Valley Area of Adjudication



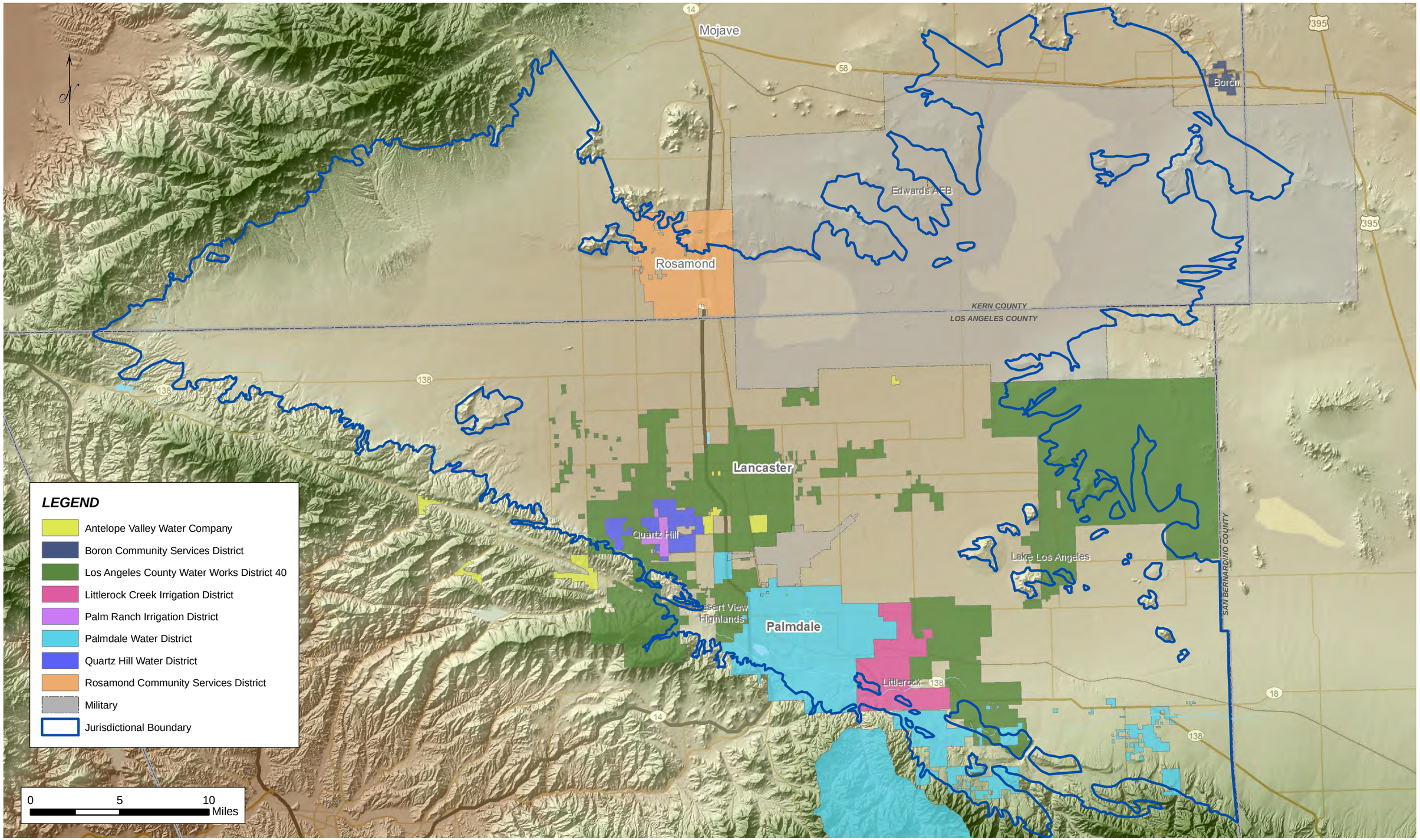


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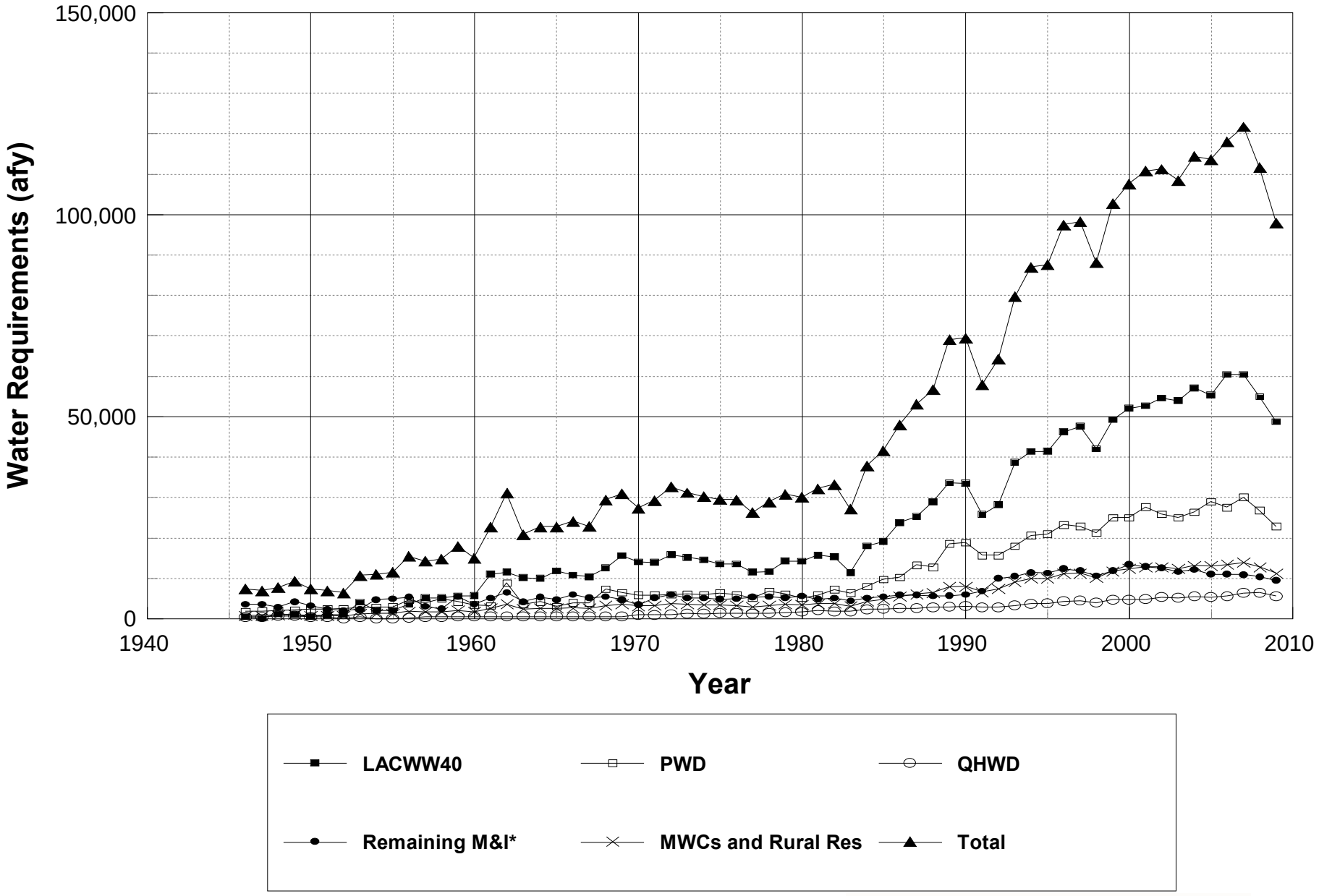
Figure D.3-2
Location Map of Service Areas of Main Water Purveyors
Antelope Valley, CA

Figure D.3-3

Historical M&I Water Requirements

Antelope Valley Area of Adjudication



**LCID, RCSD, AVWC, PRID, DLCSD, BCSD, EAFB*

Figure D.3-4
Estimated Historical Total Water Requirements

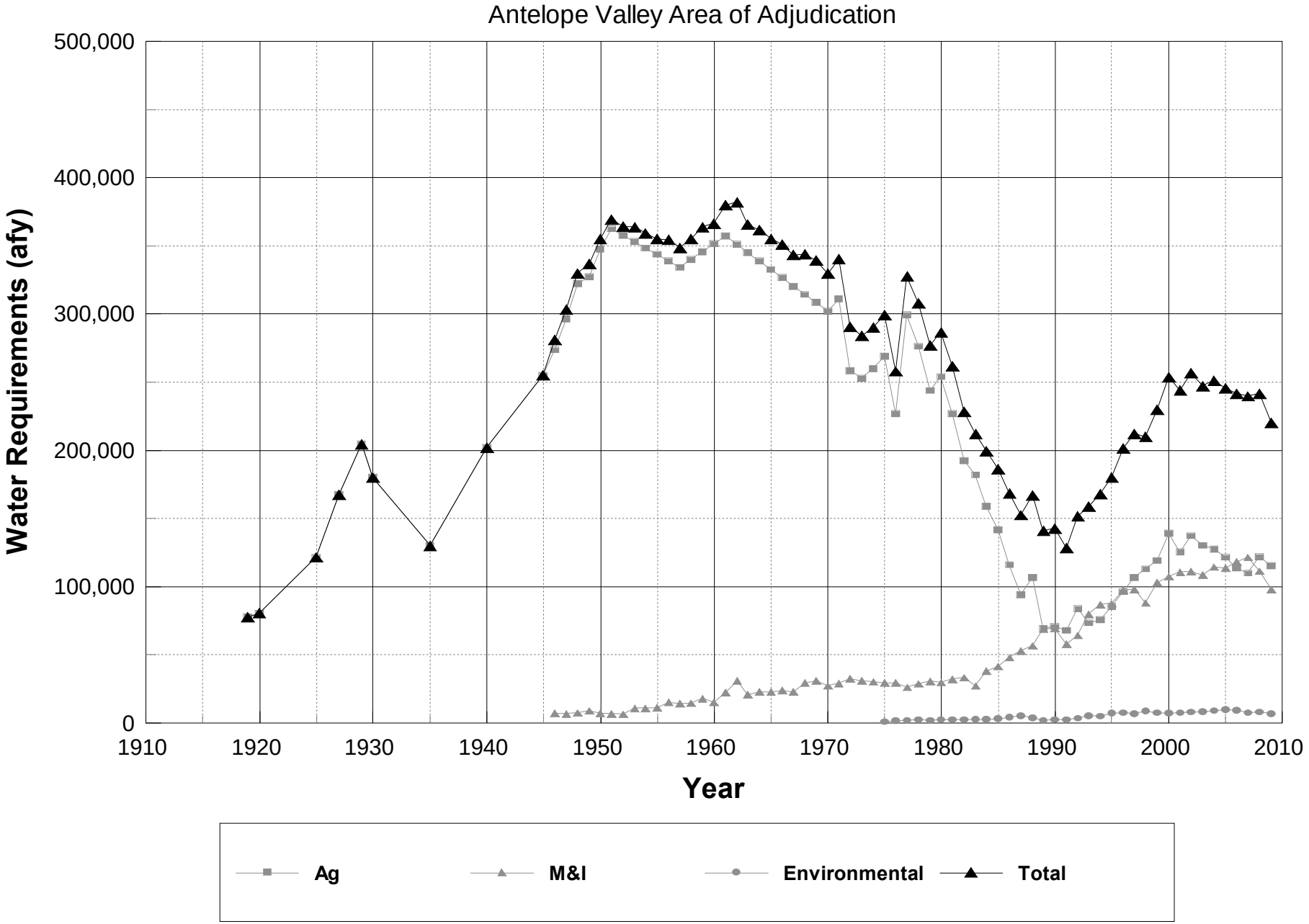


Table D.4-1
Historical Supplemental Surface Water Supplies
Antelope Valley Area of Adjudication
(Acre-Feet per Year)

Year	Source						Total Surface Water		
	Imported SWP Water			Local (Littlerock Ck) Water					
	M&I (AVEK, PWD, LCID)	Agricultural (AVEK, LCID)	Total (AVEK, PWD, LCID)	M&I (PWD, LCID)	Agricultural (LCID)	Total (PWD, LCID)	M&I (AVEK, PWD, LCID)	Agricultural (AVEK, LCID)	Total
1946	0	0	**0**	1,000	0	**1,000**	1,000	0	**1,000**
1947	0	0	**0**	1,000	0	**1,000**	1,000	0	**1,000**
1948	0	0	**0**	1,000	0	**1,000**	1,000	0	**1,000**
1949	0	0	**0**	1,000	0	**1,000**	1,000	0	**1,000**
1950	0	0	**0**	1,000	0	**1,000**	1,000	0	**1,000**
1951	0	0	**0**	1,000	0	**1,000**	1,000	0	**1,000**
1952	0	0	**0**	1,000	0	**1,000**	1,000	0	**1,000**
1953	0	0	**0**	1,000	0	**1,000**	1,000	0	**1,000**
1954	0	0	**0**	1,000	0	**1,000**	1,000	0	**1,000**
1955	0	0	**0**	1,000	0	**1,000**	1,000	0	**1,000**
1956	0	0	**0**	2,422	0	**2,422**	2,422	0	**2,422**
1957	0	0	**0**	1,752	0	**1,752**	1,752	0	**1,752**
1958	0	0	**0**	2,434	0	**2,434**	2,434	0	**2,434**
1959	0	0	**0**	1,311	0	**1,311**	1,311	0	**1,311**
1960	0	0	**0**	385	0	**385**	385	0	**385**
1961	0	0	**0**	0	0	**0**	0	0	**0**
1962	0	0	**0**	5,534	0	**5,534**	5,534	0	**5,534**
1963	0	0	**0**	136	0	**136**	136	0	**136**
1964	0	0	**0**	262	0	**262**	262	0	**262**
1965	0	0	**0**	1,318	0	**1,318**	1,318	0	**1,318**
1966	0	0	**0**	0	0	**0**	0	0	**0**
1967	0	0	**0**	0	0	**0**	0	0	**0**
1968	0	0	**0**	3,150	0	**3,150**	3,150	0	**3,150**
1969	0	0	**0**	2,105	0	**2,105**	2,105	0	**2,105**
1970	0	0	**0**	1,627	1,618	**3,245**	1,627	1,618	**3,245**
1971	0	0	**0**	1,539	1,513	**3,052**	1,539	1,513	**3,052**
1972	26	312	**338**	1,481	1,466	**2,947**	1,507	1,778	**3,285**
1973	28	262	**290**	1,682	1,513	**3,195**	1,710	1,775	**3,485**
1974	40	360	**400**	1,102	1,487	**2,589**	1,142	1,847	**2,989**
1975	56	464	**520**	1,749	1,350	**3,099**	1,805	1,814	**3,619**
1976	64	27,820	**27,884**	1,303	1,248	**2,551**	1,367	29,068	**30,435**
1977	18	32,227	**32,244**	548	420	**968**	565	32,647	**33,212**
1978	5,294	37,613	**42,907**	2,211	1,501	**3,712**	7,505	39,114	**46,619**
1979	7,262	51,053	**58,316**	1,122	1,741	**2,863**	8,385	52,794	**61,179**
1980	6,898	58,225	**65,123**	1,122	1,741	**2,863**	8,021	59,966	**67,986**
1981	9,562	64,975	**74,537**	1,793	885	**2,678**	11,354	65,860	**77,215**
1982	6,921	39,053	**45,974**	1,943	1,341	**3,284**	8,864	40,394	**49,258**
1983	6,547	23,534	**30,081**	982	931	**1,913**	7,529	24,465	**31,994**
1984	10,517	18,177	**28,694**	1,211	1,180	**2,391**	11,728	19,357	**31,085**
1985	14,485	21,583	**36,067**	1,782	1,053	**2,835**	16,266	22,636	**38,902**
1986	17,585	14,506	**32,091**	622	960	**1,582**	18,206	15,467	**33,673**
1987	21,276	14,746	**36,022**	231	769	**1,000**	21,507	15,515	**37,022**
1988	20,277	14,319	**34,596**	1,936	394	**2,330**	22,213	14,712	**36,926**
1989	30,596	16,788	**47,385**	1,604	496	**2,100**	32,200	17,285	**49,485**
1990	35,192	16,033	**51,225**	194	216	**410**	35,386	16,249	**51,635**
1991	20,883	1,284	**22,167**	516	520	**1,036**	21,399	1,804	**23,203**
1992	27,404	2,468	**29,872**	3,846	519	**4,365**	31,250	2,987	**34,237**
1993	38,926	8,580	**47,506**	2,505	459	**2,964**	41,430	9,039	**50,470**
1994	41,871	12,412	**54,283**	1,020	367	**1,387**	42,891	12,779	**55,670**
1995	36,114	13,219	**49,334**	3,725	46	**3,771**	39,839	13,265	**53,104**
1996	45,517	18,634	**64,151**	3,019	24	**3,043**	48,536	18,658	**67,194**
1997	46,768	23,994	**70,762**	2,353	9	**2,363**	49,121	24,003	**73,124**
1998	40,581	17,991	**58,572**	5,004	36	**5,040**	45,585	18,027	**63,612**
1999	52,607	25,502	**78,109**	3,033	16	**3,050**	55,640	25,518	**81,158**
2000	53,519	28,267	**81,786**	6,467	33	**6,500**	59,986	28,300	**88,287**
2001	47,941	19,824	**67,765**	6,732	119	**6,851**	54,673	19,943	**74,616**
2002	59,379	10,465	**69,843**	0	0	**0**	59,379	10,465	**69,843**
2003	58,412	6,510	**64,922**	3,462	37	**3,499**	61,874	6,547	**68,421**
2004	57,982	7,824	**65,806**	3,913	46	**3,959**	61,895	7,870	**69,765**
2005	57,671	9,434	**67,105**	6,810	90	**6,900**	64,481	9,523	**74,005**
2006	71,605	12,760	**84,365**	4,163	10	**4,173**	75,768	12,770	**88,538**
2007	71,641	17,946	**89,587**	0	0	**0**	71,641	17,946	**89,587**
2008	51,852	3,767	**55,619**	3,029	16	**3,045**	54,881	3,783	**58,664**
2009	52,213	1,916	**54,129**	78	1	**79**	52,291	1,917	**54,208**

Table D.4-2
Historical Groundwater Pumping
Antelope Valley Area of Adjudication
(Acre-Feet per Year)

Year	M&I	Agricultural	Total
1946	6,341	273,960	**280,302**
1947	6,049	296,757	**302,806**
1948	6,747	322,497	**329,244**
1949	8,296	327,685	**335,981**
1950	6,432	347,676	**354,108**
1951	6,039	362,549	**368,589**
1952	5,550	357,856 *	**363,406**
1953	9,821	353,162 *	**362,983**
1954	10,013	348,468 *	**358,481**
1955	10,529	343,774 *	**354,303**
1956	13,088	339,081 *	**352,169**
1957	12,553	334,387	**346,940**
1958	12,409	340,131 *	**352,540**
1959	16,745	345,792 *	**362,536**
1960	14,736	351,535 *	**366,271**
1961	22,625	357,279	**379,904**
1962	25,658	351,143 *	**376,801**
1963	20,776	345,022 *	**365,798**
1964	22,514	338,862 *	**361,377**
1965	21,475	332,652 *	**354,127**
1966	24,141	326,530 *	**350,672**
1967	22,873	320,209 *	**343,082**
1968	26,387	314,087 *	**340,475**
1969	28,920	307,878 *	**336,798**
1970	25,863	300,142	**326,005**
1971	27,896	308,917	**336,813**
1972	31,196	255,911	**287,108**
1973	29,582	250,227	**279,809**
1974	29,130	257,480	**286,611**
1975	27,891	266,373	**294,263**
1976	28,100	197,077	**225,177**
1977	25,743	266,118	**291,860**
1978	21,452	236,472	**257,924**
1979	22,525	190,180	**212,705**
1980	22,147	193,315	**215,462**
1981	20,889	160,637	**181,525**
1982	24,408	152,229	**176,638**
1983	19,711	157,425	**177,136**
1984	26,308	139,104	**165,412**
1985	25,343	118,844	**144,187**
1986	29,936	100,691	**130,627**
1987	31,652	78,727	**110,379**
1988	34,607	89,925	**124,532**
1989	36,944	49,673	**86,618**
1990	34,205	51,052	**85,257**
1991	36,695	77,804	**114,499**
1992	33,108	77,510	**110,618**
1993	38,366	61,654	**100,019**
1994	44,233	59,395	**103,628**
1995	47,976	68,879	**116,855**
1996	49,134	74,152	**123,285**
1997	49,240	79,095	**128,336**
1998	42,626	91,622	**134,247**
1999	47,318	89,929	**137,247**
2000	47,703	106,667	**154,370**
2001	56,278	101,109	**157,387**
2002	52,005	120,376	**172,380**
2003	46,682	116,302	**162,984**
2004	52,602	111,690	**164,291**
2005	49,341	102,054	**151,395**
2006	42,428	89,445	**131,872**
2007	50,263	79,118	**129,381**
2008	56,839	105,365	**162,204**
2009	45,825	99,084 *	**144,909**

* Approximated

Table D.4-3

Historical Recycled Water

Antelope Valley Area of Adjudication

(Acre-Feet per Year)

	Irrigation			Environmental			Other Reuse			Land Application (with and w/out crops) and Disposal			Total Recycled Water by WRP[2]				Total Recycled Water by Use				
	Lancaster	Palmdale		Lancaster			Lancaster	Palmdale		Palmdale	Rosamond[1]		Lancaster	Palmdale	Rosamond		Irrigation	Environmental	Other	Application/ Disposal	
YEAR*			Total	Paiute Ponds	Apollo Lakes	Total	Construction	Tree moving	Total			Total				Total					Total
1975	0	891	**891**	840	87	**927**	—	—	**0**	0	23	**23**	927	891	23	**1,841**	891	927	0	23	**1,841**
1976	0	891	**891**	1,277	282	**1,559**	—	—	**0**	0	23	**23**	1,559	891	23	**2,473**	891	1,559	0	23	**2,473**
1977	0	941	**941**	1,699	279	**1,978**	—	—	**0**	0	161	**161**	1,978	941	161	**3,080**	941	1,978	0	161	**3,080**
1978	0	996	**996**	2,159	297	**2,456**	—	—	**0**	0	168	**168**	2,456	996	168	**3,620**	996	2,456	0	168	**3,620**
1979	0	1,036	**1,036**	1,982	244	**2,226**	—	—	**0**	0	184	**184**	2,226	1,036	184	**3,446**	1,036	2,226	0	184	**3,446**
1980	0	958	**958**	2,172	270	**2,442**	—	—	**0**	0	183	**183**	2,442	958	183	**3,583**	958	2,442	0	183	**3,583**
1981	0	548	**548**	2,323	278	**2,601**	—	—	**0**	136	266	**402**	2,601	684	266	**3,551**	548	2,601	0	402	**3,551**
1982	0	0	**0**	2,125	211	**2,336**	—	—	**0**	1,567	269	**1,836**	2,336	1,567	269	**4,172**	0	2,336	0	1,836	**4,172**
1983	0	88	**88**	2,767	191	**2,958**	—	—	**0**	937	202	**1,139**	2,958	1,025	202	**4,185**	88	2,958	0	1,139	**4,185**
1984	0	404	**404**	2,588	167	**2,755**	—	—	**0**	1,277	245	**1,522**	2,755	1,681	245	**4,681**	404	2,755	0	1,522	**4,681**
1985	0	399	**399**	3,086	172	**3,258**	—	—	**0**	2,069	305	**2,374**	3,258	2,468	305	**6,031**	399	3,258	0	2,374	**6,031**
1986	0	52	**52**	4,210	146	**4,356**	—	—	**0**	2,585	309	**2,894**	4,356	2,637	309	**7,302**	52	4,356	0	2,894	**7,302**
1987	0	64	**64**	5,139	132	**5,271**	—	—	**0**	3,589	467	**4,056**	5,271	3,653	467	**9,391**	64	5,271	0	4,056	**9,391**
1988	1,904	129	**2,033**	3,664	113	**3,777**	0	0	**0**	3,743	369	**4,112**	5,681	3,872	369	**9,922**	2,033	3,777	0	4,112	**9,922**
1989	2,688	37	**2,725**	2,009	125	**2,134**	0	0	**0**	3,982	392	**4,374**	4,822	4,019	392	**9,233**	2,725	2,134	0	4,374	**9,233**
1990	3,809	15	**3,824**	2,266	185	**2,451**	0	0	**0**	5,448	522	**5,970**	6,260	5,463	522	**12,245**	3,824	2,451	0	5,970	**12,245**
1991	3,921	90	**4,011**	2,413	154	**2,567**	0	0	**0**	5,371	792	**6,163**	6,488	5,461	792	**12,741**	4,011	2,567	0	6,163	**12,741**
1992	3,640	21	**3,661**	3,399	121	**3,520**	0	0	**0**	6,174	819	**6,993**	7,160	6,195	819	**14,174**	3,661	3,520	0	6,993	**14,174**
1993	2,997	130	**3,127**	5,151	128	**5,279**	0	0	**0**	6,957	948	**7,905**	8,276	7,087	948	**16,311**	3,127	5,279	0	7,905	**16,311**
1994	3,711	51	**3,762**	4,979	130	**5,109**	0	0	**0**	7,427	924	**8,351**	8,820	7,478	924	**17,222**	3,762	5,109	0	8,351	**17,222**
1995	3,226	68	**3,294**	7,003	138	**7,141**	0	0	**0**	8,003	1,007	**9,010**	10,367	8,071	1,007	**19,445**	3,294	7,141	0	9,010	**19,445**
1996	3,528	74	**3,602**	7,402	99	**7,501**	0	0	**0**	8,007	1,117	**9,124**	11,029	8,081	1,117	**20,227**	3,602	7,501	0	9,124	**20,227**
1997	3,754	84	**3,838**	6,743	134	**6,877**	0	0	**0**	8,365	1,178	**9,543**	10,631	8,449	1,178	**20,258**	3,838	6,877	0	9,543	**20,258**
1998	3,324	90	**3,414**	8,587	119	**8,706**	0	0	**0**	9,075	1,178	**10,253**	12,030	9,165	1,178	**22,373**	3,414	8,706	0	10,253	**22,373**
1999	3,549	129	**3,678**	7,448	190	**7,638**	0	0	**0**	8,612	1,187	**9,799**	11,187	8,741	1,187	**21,115**	3,678	7,638	0	9,799	**21,115**
2000	3,793	588	**4,381**	6,960	160	**7,120**	0	0	**0**	8,690	1,328	**10,018**	10,913	9,278	1,328	**21,519**	4,381	7,120	0	10,018	**21,519**
2001	4,346	251	**4,597**	7,344	206	**7,550**	0	0	**0**	9,201	1,370	**10,571**	11,896	9,452	1,370	**22,718**	4,597	7,550	0	10,571	**22,718**
2002	4,493	2,135	**6,628**	7,655	184	**7,839**	0	248	**248**	6,578	1,377	**7,955**	12,332	8,961	1,377	**22,670**	6,628	7,839	248	7,955	**22,670**
2003	4,188	3,313	**7,501**	8,224	158	**8,382**	0	323	**323**	5,718	1,253	**6,971**	12,570	9,354	1,253	**23,178**	7,501	8,382	323	6,971	**23,178**
2004	4,511	3,631	**8,142**	9,033	206	**9,239**	0	0	**0**	5,693	1,390	**7,083**	13,750	9,324	1,390	**24,464**	8,142	9,239	0	7,083	**24,464**
2005	3,863	6,135	**9,998**	9,738	219	**9,957**	3	0	**3**	3,269	1,292	**4,561**	13,823	9,404	1,292	**24,519**	9,998	9,957	3	4,561	**24,519**
2006	4,224	7,573	**11,797**	9,440	170	**9,611**	52	0	**52**	1,436	1,476	**2,912**	13,887	9,009	1,476	**24,373**	11,797	9,611	52	2,912	**24,373**
2007	5,824	7,404	**13,228**	7,550	180	**7,730**	0	0	**0**	1,807	1,571	**3,377**	13,554	9,211	1,571	**24,336**	13,228	7,730	0	3,377	**24,336**
2008	5,210	7,731	**12,941**	7,815	210	**8,025**	273	0	**273**	1,648	1,576	**3,224**	13,508	9,379	1,576	**24,463**	12,941	8,025	273	3,224	**24,463**
2009	5,988	8,586	**14,573**	6,683	219	**6,901**	195	0	**195**	265	1,328	**1,593**	13,084	8,850	1,328	**23,263**	14,573	6,901	195	1,593	**23,263**

All data from Chapter 4.6, Tables 4.6-1 and 4.6-2, except: Lancaster and Palmdale WRP "other reuse" data; all Rosamond WRP data

1) RCSD data for 1975-90 and 2002-09 estimated as 42% of RCSD water demand, based on comparison of water demand and disposal data for years 1991 through 2001

2) Data for Edwards AFB unavailable

Table D.4-4
Historical Total Water Supply
Antelope Valley Area of Adjudication
(Acre-Feet per Year)

	Municipal/Industrial					Agricultural						Environmental		Combined					Total
Year	Groundwater	Imported Surface Water (AVEK,PWD,LCID)	Local Surface Water (PWD, LCID)	Surface Water (Total)	Total M&I Supply	Groundwater**	Imported Surface Water (AVEK, LCID)	Local Surface Water (LCID)	Surface Water (Total)	Recycled Water (LACSD 14 and 20)	Total Ag Supply**	Recycled Water (LACSD 14)	Total Environmental Supply	Groundwater	Imported Surface Water	Local Surface Water	Surface Water (Total)	Recycled Water (LACSD)	Antelope Valley Water Supply
1946	6,341	0	1,000	1,000	**7,341**	273,960	0	0	0	0	**273,960**	0	**0**	280,302	0	1,000	1,000	0	**281,302**
1947	6,049	0	1,000	1,000	**7,049**	296,757	0	0	0	0	**296,757**	0	**0**	302,806	0	1,000	1,000	0	**303,806**
1948	6,747	0	1,000	1,000	**7,747**	322,497	0	0	0	0	**322,497**	0	**0**	329,244	0	1,000	1,000	0	**330,244**
1949	8,296	0	1,000	1,000	**9,296**	327,685	0	0	0	0	**327,685**	0	**0**	335,981	0	1,000	1,000	0	**336,981**
1950	6,432	0	1,000	1,000	**7,432**	347,676	0	0	0	0	**347,676**	0	**0**	354,108	0	1,000	1,000	0	**355,108**
1951	6,039	0	1,000	1,000	**7,039**	362,549	0	0	0	0	**362,549**	0	**0**	368,589	0	1,000	1,000	0	**369,589**
1952	5,550	0	1,000	1,000	**6,550**	357,856 *	0	0	0	0	**357,856**	0	**0**	363,406	0	1,000	1,000	0	**364,406**
1953	9,821	0	1,000	1,000	**10,821**	353,162 *	0	0	0	0	**353,162**	0	**0**	362,983	0	1,000	1,000	0	**363,983**
1954	10,013	0	1,000	1,000	**11,013**	348,468 *	0	0	0	0	**348,468**	0	**0**	358,481	0	1,000	1,000	0	**359,481**
1955	10,529	0	1,000	1,000	**11,529**	343,774 *	0	0	0	0	**343,774**	0	**0**	354,303	0	1,000	1,000	0	**355,303**
1956	13,088	0	2,422	2,422	**15,510**	339,081 *	0	0	0	0	**339,081**	0	**0**	352,169	0	2,422	2,422	0	**354,591**
1957	12,553	0	1,752	1,752	**14,305**	334,387	0	0	0	0	**334,387**	0	**0**	346,940	0	1,752	1,752	0	**348,692**
1958	12,409	0	2,434	2,434	**14,843**	340,131 *	0	0	0	0	**340,131**	0	**0**	352,540	0	2,434	2,434	0	**354,974**
1959	16,745	0	1,311	1,311	**18,056**	345,792 *	0	0	0	83	**345,875**	0	**0**	362,536	0	1,311	1,311	83	**363,930**
1960	14,736	0	385	385	**15,121**	351,535 *	0	0	0	83	**351,618**	0	**0**	366,271	0	385	385	83	**366,739**
1961	22,625	0	0	0	**22,625**	357,279	0	0	0	83	**357,362**	—	**—**	379,904	0	0	0	83	**379,987**
1962	25,658	0	5,534	5,534	**31,192**	351,143 *	0	0	0	97	**351,240**	—	**—**	376,801	0	5,534	5,534	97	**382,432**
1963	20,776	0	136	136	**20,912**	345,022 *	0	0	0	97	**345,119**	—	**—**	365,798	0	136	136	97	**366,031**
1964	22,514	0	262	262	**22,776**	338,862 *	0	0	0	135	**338,997**	—	**—**	361,377	0	262	262	135	**361,774**
1965	21,475	0	1,318	1,318	**22,793**	332,652 *	0	0	0	224	**332,876**	—	**—**	354,127	0	1,318	1,318	224	**355,669**
1966	24,141	0	0	0	**24,141**	326,530 *	0	0	0	224	**326,754**	—	**—**	350,672	0	0	0	224	**350,896**
1967	22,873	0	0	0	**22,873**	320,209 *	0	0	0	424	**320,633**	—	**—**	343,082	0	0	0	424	**343,506**
1968	26,387	0	3,150	3,150	**29,537**	314,087 *	0	0	0	424	**314,511**	—	**—**	340,475	0	3,150	3,150	424	**344,049**
1969	28,920	0	2,105	2,105	**31,025**	307,878 *	0	0	0	512	**308,390**	—	**—**	336,798	0	2,105	2,105	512	**339,415**
1970	25,863	0	1,627	1,627	**27,490**	300,142	0	1,618	1,618	509	**302,268**	—	**—**	326,005	0	3,245	3,245	509	**329,759**
1971	27,896	0	1,539	1,539	**29,434**	308,917	0	1,513	1,513	700	**311,131**	—	**—**	336,813	0	3,052	3,052	700	**340,565**
1972	31,196	26	1,481	1,507	**32,703**	255,911	312	1,466	1,778	704	**258,393**	—	**—**	287,108	338	2,947	3,285	704	**291,097**
1973	29,582	28	1,682	1,710	**31,292**	250,227	262	1,513	1,775	891	**252,893**	—	**—**	279,809	290	3,195	3,485	891	**284,185**
1974	29,130	40	1,102	1,142	**30,273**	257,480	360	1,487	1,847	806	**260,133**	—	**—**	286,611	400	2,589	2,989	806	**290,406**
1975	27,891	56	1,749	1,805	**29,696**	266,373	464	1,350	1,814	891	**269,078**	927	**927**	294,263	520	3,099	3,619	1,818	**299,700**
1976	28,100	64	1,303	1,367	**29,467**	197,077	27,820	1,248	29,068	891	**227,036**	1,559	**1,559**	225,177	27,884	2,551	30,435	2,450	**258,062**
1977	25,743	18	548	565	**26,308**	266,118	32,227	420	32,647	941	**299,706**	1,978	**1,978**	291,860	32,244	968	33,212	2,919	**327,992**
1978	21,452	5,294	2,211	7,505	**28,957**	236,472	37,613	1,501	39,114	996	**276,582**	2,456	**2,456**	257,924	42,907	3,712	46,619	3,452	**307,995**
1979	22,525	7,262	1,122	8,385	**30,910**	190,180	51,053	1,741	52,794	1,036	**244,010**	2,226	**2,226**	212,705	58,316	2,863	61,179	3,262	**277,146**
1980	22,147	6,898	1,122	8,021	**30,168**	193,315	58,225	1,741	59,966	958	**254,239**	2,442	**2,442**	215,462	65,123	2,863	67,986	3,400	**286,848**
1981	20,889	9,562	1,793	11,354	**32,243**	160,637	64,975	885	65,860	548	**227,045**	2,601	**2,601**	181,525	74,537	2,678	77,215	3,149	**261,889**
1982	24,408	6,921	1,943	8,864	**33,272**	152,229	39,053	1,341	40,394	0	**192,624**	2,336	**2,336**	176,638	45,974	3,284	49,258	2,336	**228,232**
1983	19,711	6,547	982	7,529	**27,240**	157,425	23,534	931	24,465	88	**181,978**	2,958	**2,958**	177,136	30,081	1,913	31,994	3,046	**212,176**
1984	26,308	10,517	1,211	11,728	**38,036**	139,104	18,177	1,180	19,357	404	**158,865**	2,755	**2,755**	165,412	28,694	2,391	31,085	3,159	**199,656**
1985	25,343	14,485	1,782	16,266	**41,609**	118,844	21,583	1,053	22,636	399	**141,879**	3,258	**3,258**	144,187	36,067	2,835	38,902	3,657	**186,746**
1986	29,936	17,585	622	18,206	**48,142**	100,691	14,506	960	15,467	52	**116,210**	4,356	**4,356**	130,627	32,091	1,582	33,673	4,408	**168,708**
1987	31,652	21,276	231	21,507	**53,159**	78,727	14,746	769	15,515	64	**94,306**	5,271	**5,271**	110,379	36,022	1,000	37,022	5,335	**152,737**
1988	34,607	20,277	1,936	22,213	**56,820**	89,925	14,319	394	14,712	2,033	**106,671**	3,777	**3,777**	124,532	34,596	2,330	36,926	5,810	**167,268**
1989	36,944	30,596	1,604	32,200	**69,145**	49,673	16,788	496	17,285	2,725	**69,683**	2,134	**2,134**	86,618	47,385	2,100	49,485	4,859	**140,961**
1990	34,205	35,192	194	35,386	**69,591**	51,052	16,033	216	16,249	3,824	**71,125**	2,451	**2,451**	85,257	51,225	410	51,635	6,275	**143,167**
1991	36,695	20,883	516	21,399	**58,094**	77,804	1,284	520	1,804	4,011	**83,619**	2,567	**2,567**	114,499	22,167	1,036	23,203	6,578	**144,280**
1992	33,108	27,404	3,846	31,250	**64,358**	77,510	2,468	519	2,987	3,661	**84,158**	3,520	**3,520**	110,618	29,872	4,365	34,237	7,181	**152,036**
1993	38,366	38,926	2,505	41,430	**79,796**	61,654	8,580	459	9,039	3,127	**73,820**	5,279	**5,279**	100,019	47,506	2,964	50,470	8,406	**158,895**
1994	44,233	41,871	1,020	42,891	**87,124**	59,395	12,412	367	12,779	3,762	**75,937**	5,109	**5,109**	103,628	54,283	1,387	55,670	8,871	**168,170**
1995	47,976	36,114	3,725	39,839	**87,816**	68,879	13,219	46	13,265	3,294	**85,438**	7,141	**7,141**	116,855	49,334	3,771	53,104	10,435	**180,395**
1996	49,134	45,517	3,019	48,536	**97,670**	74,152	18,634	24	18,658	3,602	**96,411**	7,501	**7,501**	123,285	64,151	3,043	67,194	11,103	**201,582**
1997	49,240	46,768	2,353	49,121	**98,362**	79,095	23,994	9	24,003	3,838	**106,937**	6,877	**6,877**	128,336	70,762	2,363	73,124	10,715	**212,175**
1998	42,626	40,581	5,004	45,585	**88,211**	91,622	17,991	36	18,027	3,414	**113,062**	8,706	**8,706**	134,247	58,572	5,040	63,612	12,120	**209,979**
1999	47,318	52,607	3,033	55,640	**102,958**	89,929	25,502	16	25,518	3,678	**119,125**	7,638	**7,638**	137,247	78,109	3,050	81,158	11,316	**229,721**
2000	47,703	53,519	6,467	59,986	**107,690**	106,667	28,267	33	28,300	4,381	**139,348**	7,120	**7,120**	154,370	81,786	6,500	88,287	11,501	**254,158**
2001	56,278	47,941	6,732	54,673	**110,950**	101,109	19,824	119	19,943	4,597	**125,649**	7,550	**7,550**	157,387	67,765	6,851	74,616	12,147	**244,149**
2002	52,005	59,379	0	59,379	**111,383**	120,376	10,465	0	10,465	6,628	**137,468**	7,839	**7,839**	172,380	69,843	0	69,843	14,467	**256,691**
2003	46,682	58,412	3,462	61,874	**108,556**	116,302	6,510	37	6,547	7,501	**130,350**	8,382	**8,382**	162,984	64,922	3,499	68,421	15,883	**247,288**
2004	52,602	57,982	3,913	61,895	**114,497**	111,690	7,824	46	7,870	8,142	**127,701**	9,239	**9,239**	164,291	65,806	3,959	69,765	17,381	**251,437**
2005	49,341	57,671	6,810	64,481	**113,822**	102,054	9,434	90	9,523	9,998	**121,576**	9,957	**9,957**	151,395	67,105	6,900	74,005	19,955	**245,355**
2006	42,428	71,605	4,163	75,768	**118,196**	89,445	12,760	10	12,770	11,797	**114,012**	9,611	**9,611**	131,872	84,365	4,173	88,538	21,408	**241,818**
2007	50,263	71,641	0	71,641	**121,904**	79,118	17,946	0	17,946	13,228	**110,292**	7,730	**7,730**	129,381	89,587	0	89,587	20,958	**239,926**
2008	56,839	51,852	3,029	54,881	**111,720**	105,365	3,767	16	3,783	12,941	**122,089**	8,025	**8,025**	162,204	55,619	3,045	58,664	20,966	**241,833**
2009	45,825	52,213	78	52,291	**98,116**	99,084 *	1,916	1	1,917	14,573	**115,573**	6,901	**6,901**	144,909	54,129	79	54,208	21,474	**220,591**

*** Approximated**
**** 1991 Ag Groundwater Pumpage and Total Ag Supply includes an additional 15,658 af pumped to export to the California Aqueduct**
--- designates unknown amount

Figure D.4-1a

Historical Supplemental Surface Water

Antelope Valley Area of Adjudication

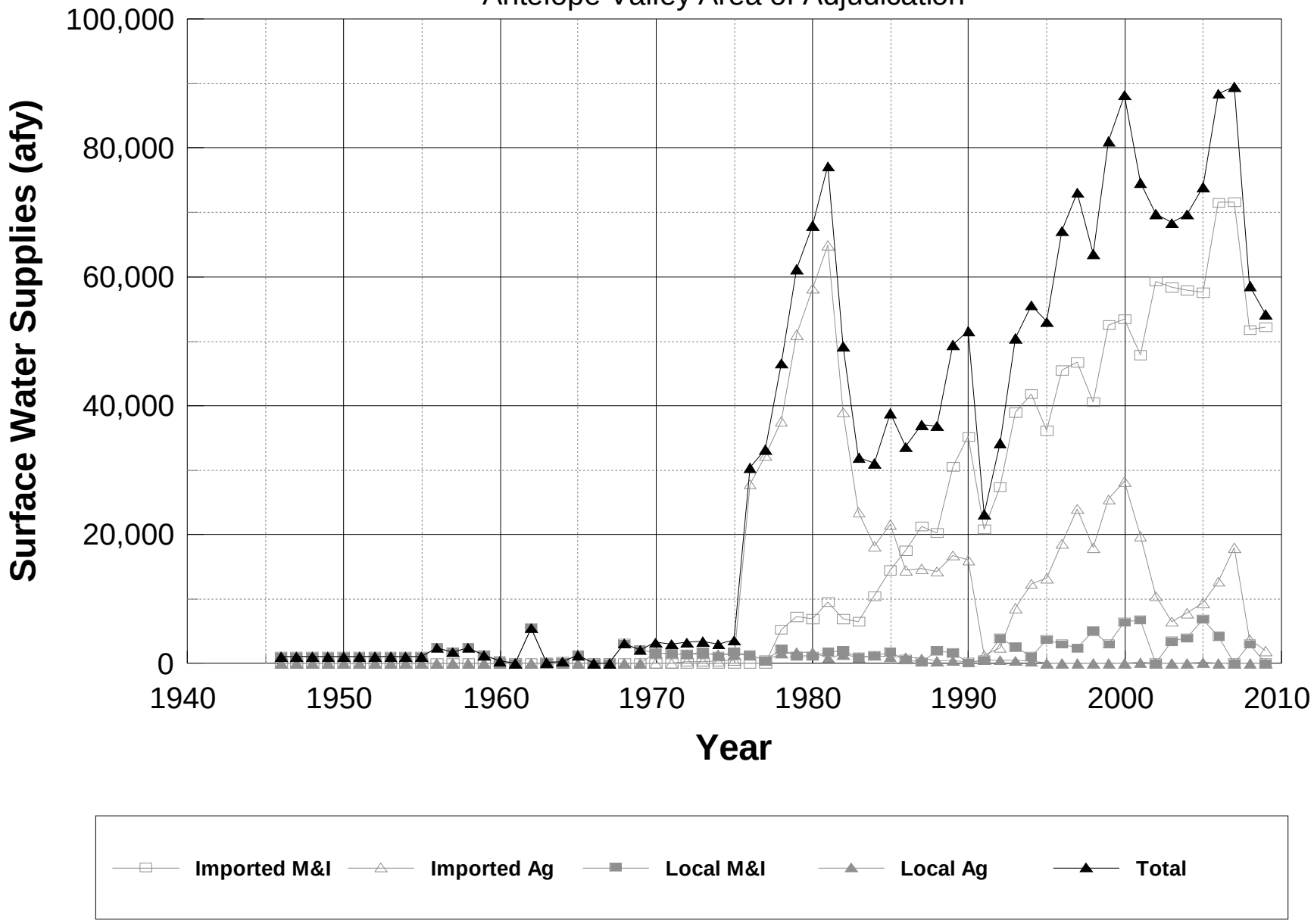


Figure D.4-1b
Historical Supplemental Surface Water by Source

Antelope Valley Area of Adjudication

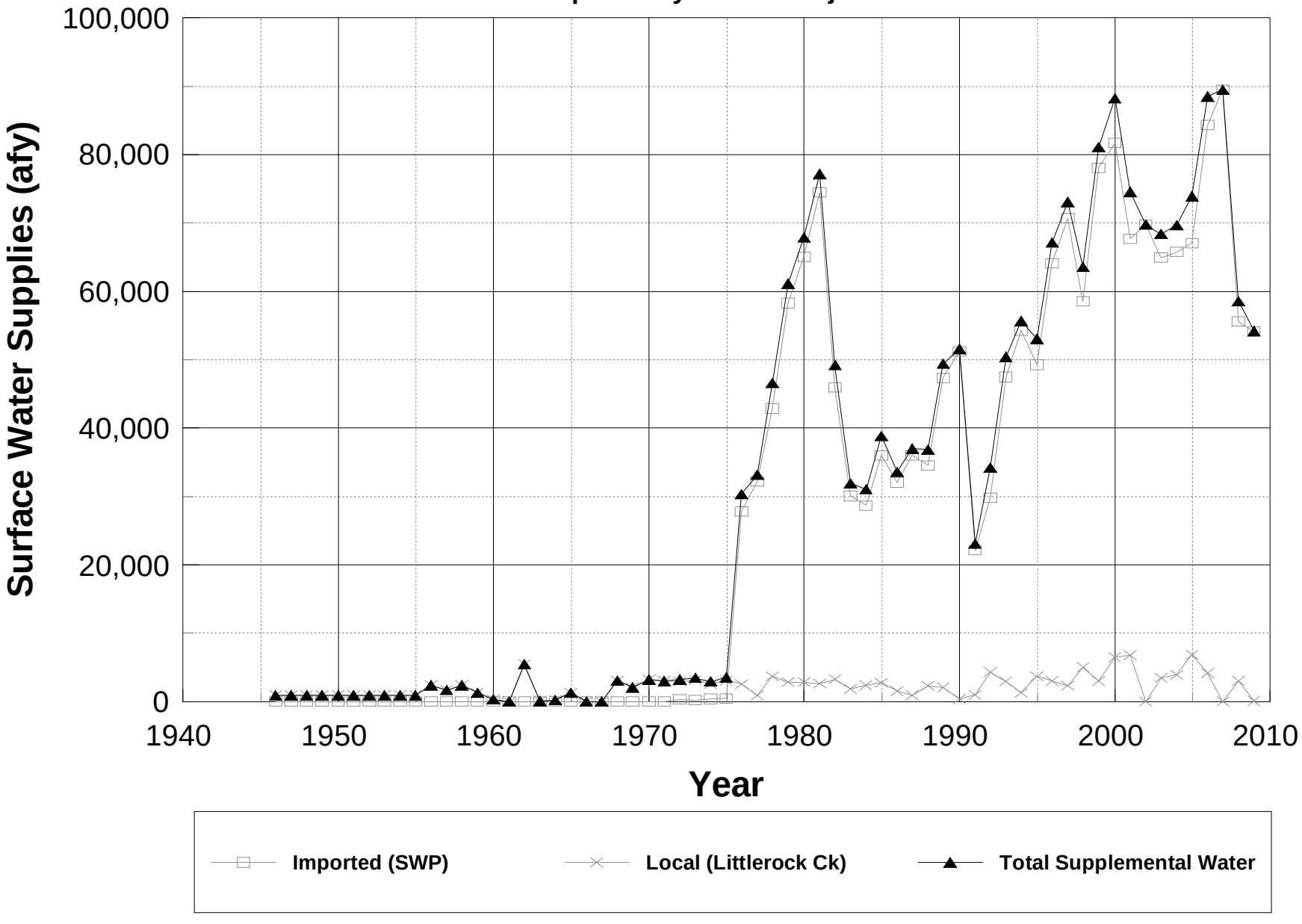


Figure D.4-2
Estimated Historical Groundwater Pumping
Antelope Valley Area of Adjudication

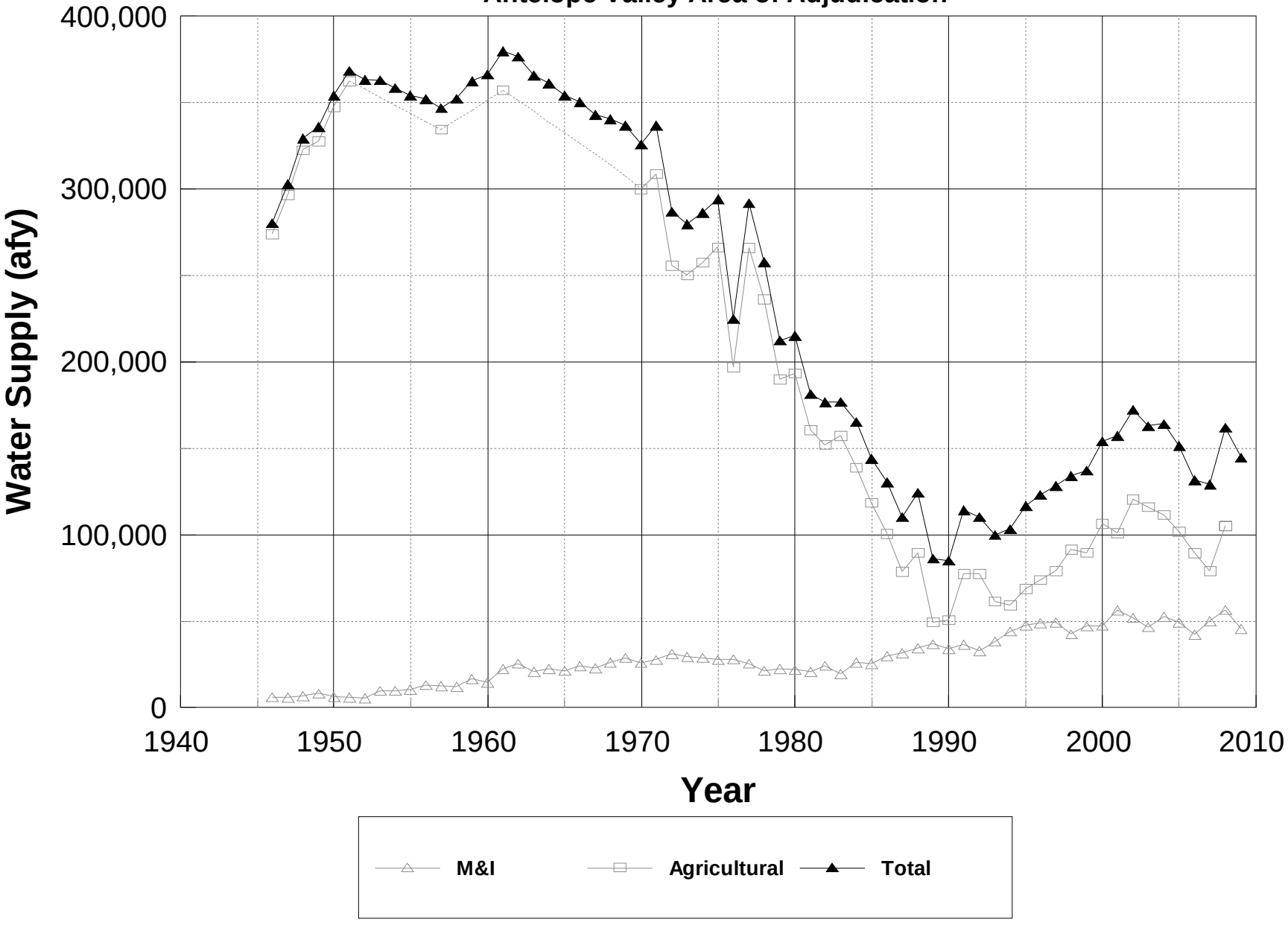
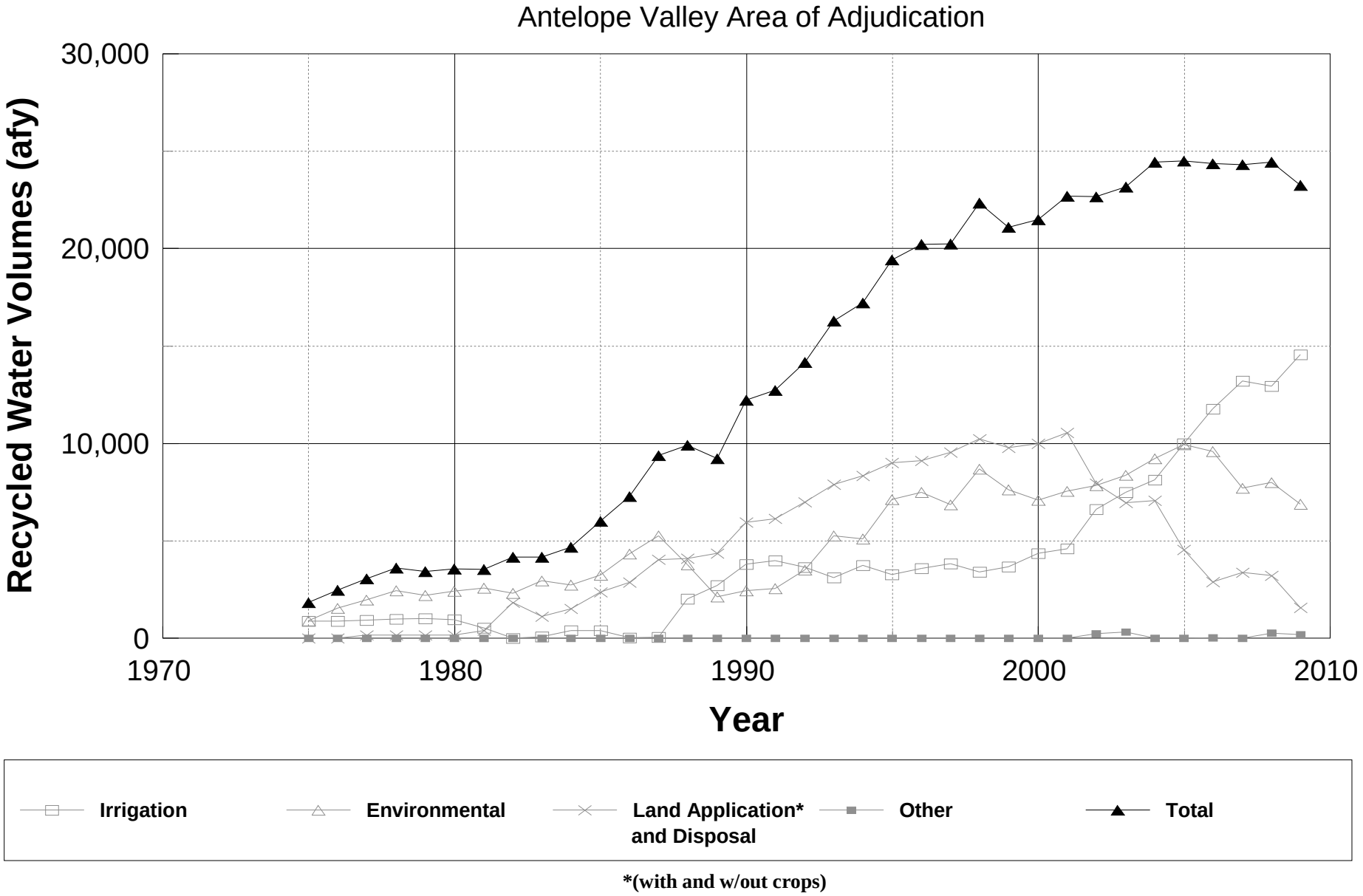


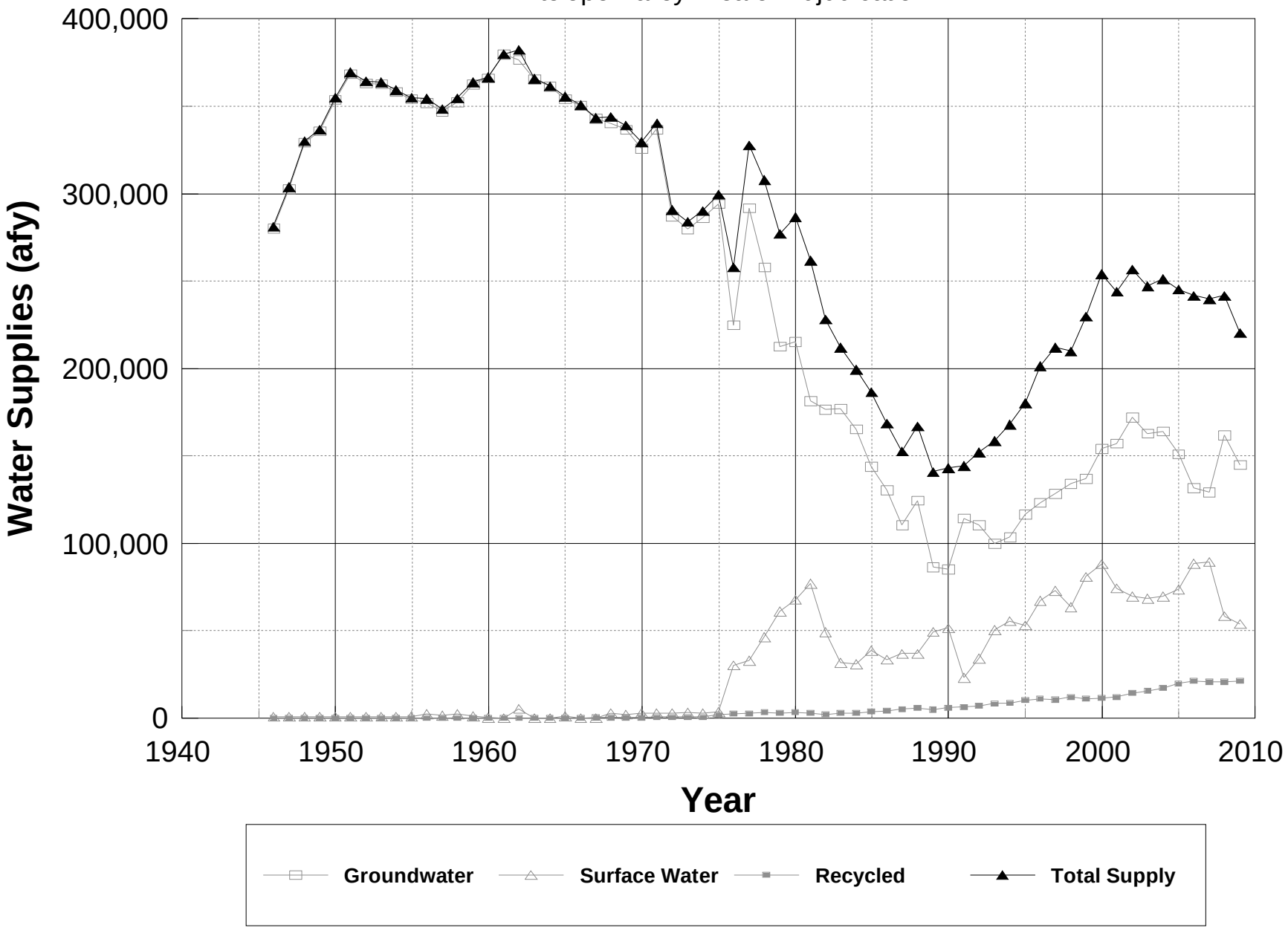
Figure D.4-3
Recycled Water Supply



*(with and w/out crops)

Figure D.4-4
Estimated Historical Water Supplies

Antelope Valley Area of Adjudication



Appendix D-1

Individual Crop Acreages, Los Angeles County Portion of Antelope Valley

Appendix D-1: Table 1

Individual Crop Acreages for the Los Angeles County Portion of the Antelope Valley

Extracted from Los Angeles County Annual Crop Reports: Specific to the Los Angeles County Portion of Antelope Valley (1970-83) or County-wide (1984-2008)

Los Angeles County Crop Report Acreages

	LA County Portion of Antelope Valley														LA County-wide (showing only those crops grown in Antelope Valley)																									
Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981*	1982*	1983*	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009*
Data Source	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1,2)	(1,2)	(1,2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
Fruit and Nut																																								
Almonds	1,169	1,169	901	900	800	650	410	410	400	400	395	100	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Apples	24	24	29	29	29	29	32	32	32	32	-------	35	36	36	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	70	70	71	75	301	321	320	71	150	150	150	145	130	131	131
Cherries	23	24	30	30	35	35	39	39	43	49	50	50	50	70	-------	-------	-------	-------	-------	-------	-------	140	140	140	140	140	140	140	150	150	150	150	130	130	140	150	155	155	150	150
Nectarines	14	-------	-------	-------	-------	-------	-------	-------	-------	15	-------	35	-------	20	-------	misc	misc	-------	-------	-------	-------	-------	misc	misc	110	110	110	110	110	110	misc	misc	misc	misc	orchard	orchard	orchard	orchard	orchard	orchard	orchard
Peaches	328	339	329	329	360	363	365	365	383	420	500	500	500	520	600	652	600	700	700	800	815	705	728	738	720	732	650	651	901	1,000	1,201	1,300	841	720	orchard	orchard	orchard	orchard	orchard	orchard
Pears	286	284	277	277	290	290	290	290	290	260	260	260	260	230	220	200	104	misc	misc	misc	misc	-------	-------	-------	-------	-------	-------	40	40	30	25	misc	misc	misc	misc	orchard	orchard	orchard	orchard	orchard	orchard
Plums	6	6	-------	-------	-------	-------	-------	-------	-------	8	-------	-------	-------	15	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	28	28	28	misc	-------	misc	misc	misc	misc	orchard	orchard	orchard	orchard	orchard	orchard
Grapes	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	45	74	79	100	147	165	190	225	325	341	329	400	400
Misc.	5	21	25	25	26	26	26	26	32	35	144	35	200	113	568	353	396	590	663	512	606	424	408	486	594	197	220	246	201	125	291	281	317	378	27	30	28	47	82	82
Orchard Fruit	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	1,072	1,073	1,088	1,080	1,075	1,075
Total	1,855	1,867	1,591	1,590	1,540	1,393	1,162	1,162	1,180	1,219	1,349	1,015	1,046	1,004	1,388	1,205	1,100	1,290	1,363	1,312	1,421	1,269	1,276	1,364	1,564	1,277	1,218	1,331	1,551	1,795	2,088	2,198	1,524	1,568	1,614	1,728	1,757	1,741	1,838	1,838
Field																																								
Alfalfa	27,700	25,400	22,400	21,400	19,800	19,000	20,000	23,000	23,000	22,800	22,500	20,000	16,200	13,757	12,176	10,671	8,413	8,895	7,620	6,300	6,211	5,768	5,222	5,532	5,565	5,480	5,566	5,465	5,270	6,056	6,165	5,709	5,200	5,500	5,746	5,521	5,455	5,804	5,698	5,698
Corn (Milo)	100	-------	-------	-------	-------	-------	700	200	100	400	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Grain - Barley	5,000	5,000	4,500	6,000	5,500	7,500	3,000	7,600	5,840	4,525	5,450	4,500	7,500	6,700	8,835	7,515	7,215	1,495	4,715	250	486	misc	3,402	672	1,387	2,890	2,887	1,997	misc	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Grain - Wheat	6,500	13,800	8,000	7,900	14,000	15,500	5,000	7,600	6,310	5,109	6,945	6,600	4,930	6,512	4,104	4,000	2,200	500	2,700	0	-------	-------	1,500	misc	misc	misc	misc	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Grain - Hay	3,500	4,400	3,000	3,500	3,000	3,200	3,000	3,100	2,000	-------	-------	250	300	1,405	1,355	1,655	1,620	1,290	1,200	1,100	900	950	1,374	1,779	2,450	2,958	1,900	2,742	2,717	1,800	1,900	2,100	2,400	2,600	2,370	2,694	3,500	3,002	3,504	3,504
Pasture	1,500	1,000	1,000	400	400	400	375	375	400	-------	100	100	100	200	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc
Sudan Hay	-------	-------	-------	700	1,200	-------	100	-------	-------	-------	-------	150	120	100	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc	misc
Silage/Sorghum	200	500	500	-------	-------	950	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Sugar Beets	1,500	1,500	1,500	1,220	1,070	1,200	1,868	3,700	3,200	2,200	3,860	2,775	340	317	260	0	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Safflower	-------	-------	-------	-------	-------	-------	-------	-------	2,000	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Misc.	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	1,082	1,080	1,727	1,200	1,045	450	1,086	1,756	1,306	1,922	886	1,097	982	1,191	1,210	1,060	988	879	858	569	774	1,381	1,680	1,395	1,385	1,385
Total	46,000	51,600	40,900	41,120	44,970	47,750	34,043	45,575	42,850	35,034	38,855	34,375	29,490	28,991	27,812	24,921	21,175	13,380	17,280	8,100	8,683	8,474	12,804	9,905	10,288	12,425	11,335	11,395	9,197	8,916	9,053	8,688	8,458	8,669	8,890	9,596	10,635	10,201	10,587	10,587
Vegetables																																								
Canteloupes	20	30	35	40	40	40	40	40	-------	-------	-------	20	120	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Watermelons	50	100	50	-------	100	60	160	65	-------	150	-------	350	435	415	-------	-------	-------	vine	vine	vine	vine	vine	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	vine	vine	vine	vine	vine	vine
Melons-Other (squash, pumpkin)	20	10	-------	-------	-------	-------	-------	155	150	-------	265	20	40	140	vine	vine	vine	vine	vine	vine	vine	vine	vine	vine	vine	vine	vine	vine	vine	vine	vine	vine	vine	vine	vine	vine	vine	vine	vine	vine
Onion	60	-------	80	240	250	700	1,200	2,500	1,700	1,715	425	977	1,433	1,810	1,477	1,580	1,481	1,497	1,702	1,675	1,550	1,690	1,665	1,564	1,346	1,669	1,523	1,932	2,425	2,210	2,310	1,732	1,720	2,814	2,891	2,677	1,875	1,900	2,290	2,290
Misc. Veg.	10	10	-------	30	15	100	280	80	161	0	50	30	30	30	2,909	2,806	2,068	633	818	645	299	342	88	69	123	174	174	331	259	343	350	306	414	192	160	384	168	680	205	205
Carrots	-------	-------	-------	-------	-------	-------	-------	1,160	-------	90	50	80	180	-------	root	root	root	root	root	root	root	root	root	root	root	root	2,324	3,811	root	root	root	root	root	root	root	root	root	root	root	root
Potatoes	-------	-------	-------	-------	-------	-------	-------	500	-------	80	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	(root)	(root)	(root)	(root)	(root)	(root)	(root)	(root)	(root)	(root)	(root)
Vine (melon, squash)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	757	687	491	320	508	53	59	133	198	166	254	240	248	270	239	286	172	156	304	181	175	134	103	147	111	111
Root (carrots)	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	122	141	170	183	148	171	220	53	7	16	21	549	5	11	5,252	5,508	8,132	7,417	9,964	8,555	7,403	5,361	3,754	3,803	4,582	4,582
Total	160	150	165	310	405	900	1,680	4,500	2,011	2,035	790	1,477	2,238	2,395	5,265	5,214	4,210	2,633	3,176	2,544	2,128	2,218	1,958	1,815	1,744	2,632	4,274	6,355	8,175	8,347	10,964	9,611	12,402	11,742	10,629	8,556	5,900	6,530	7,188	7,188
Total All Crops	48,015	53,617	42,656	43,020	46,915	50,043	36,885	51,237	46,041	38,288	40,994	36,867	32,774	32,390	34,465	31,340	26,485	17,303	21,819	11,956	12,232	11,961	16,038	13,084	13,596	16,334	16,827	19,081	18,923	19,058	22,105	20,497	22,384	21,979	21,133	19,880	18,292	18,472	19,613	19,613

Acreages within Los Angeles County Portion of Antelope Valley

	LA County Portion of Antelope Valley (above)												Extracted from LA County-wide Acreages																											
Year	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009*
Fruit and Nut																																								
Almonds	1,169	1,169	901	900	800	650	410	410	400	400	395	100	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Apples	24	24	29	29	29	29	32	32	32	32	-------	35	36	36	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	70	70	71	75	301	321	320	71	150	150	150	145	130	131	131
Cherries	23	24	30	30	35	35	39	39	43	49	50	50	50	70	-------	-------	-------	-------	-------	-------	-------	140	140	140	140	140	140	140	150	150	150	150	130	130	140	150	155	155	150	150
Nectarines	14	-------	-------	-------	-------	-------	-------	-------	-------	15	-------	35	-------	20	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	110	110	110	110	110	110	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Peaches	328	339	329	329	360	363	365	365	383	420	500	500	500	520	600	652	600	700	700	800	815	705	728	738	720	732	650	651	901	1,000	1,201	1,300	841	720	-------	-------	-------	-------	-------	-------
Pears	286	284	277	277	290	290	290	290	290	260	260	260	260	230	220	200	104	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	40	40	30	25	-------	-------	-------	-------	-------	-------	-------	-------	-------
Plums	6	6	-------	-------	-------	-------	-------	-------	-------	8	-------	-------	-------	15	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	28	28	28	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Grapes	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	15	24	26	33	49	54	63	74	107	113	109	132	132
Misc.	5	21	25	25	26	26	26	26	32	35	144	35	200	113	227	141	158	236	265	205	242	170	163	437	535	177	198	221	181	113	262	253	285	340	989	993	1,004	1,014	1,041	1,041
Total	1,855	1,867	1,591	1,590	1,540	1,393	1,162	1,162	1,180	1,219	1,349	1,015	1,046	1,004	1,047	993	862	936	965	1,005	1,057	1,015	1,031	1,315	1,505	1,257	1,196	1,276	1,481	1,730	1,992	2,071	1,382	1,403	1,353	1,400	1,417	1,408	1,454	1,454
Field																																								
Alfalfa	27,700	25,400	22,400	21,400	19,800	19,000	20,000	23,000	23,000	22,800	22,500	20,000	16,200	13,757	11,932	10,458	8,245	8,717	7,468	6,174	6,087	5,653	5,118	5,421	5,454	5,370	5,455	5,356	5,165	5,935	6,042	5,595	5,096	5,390	5,631	5,411	5,346	5,688	5,584	5,584
Corn (Milo)	100	-------	-------	-------	-------	-------	700	200	100	400	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Grain - Barley	5,000	5,000	4,500	6,000	5,500	7,500	3,000	7,600	5,840	4,525	5,450	4,500	7,500	6,700	7,952	6,764	6,494	1,346	4,244	225	437	146	3,062	605	1,248	2,601	2,598	1,797	101	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Grain - Wheat	6,500	13,800	8,000	7,900	14,000	15,500	5,000	7,600	6,310	5,109	6,945	6,600	4,930	6,512	4,104	4,000	2,200	500	2,700	0	-------	-------	1,500	160	74	91	82	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Grain - Hay	3,500	4,400	3,000	3,500	3,000	3,200	3,000	3,100	2,000	-------	-------	250	300	1,405	678	828	810	645	600	550	450	475	687	890	1,225	1,479	950	1,371	1,359	900	950	1,050	1,200	1,300	1,185	1,347	1,750	1,501	1,752	1,752
Pasture	1,500	1,000	1,000	400	400	400	375	375	400	-------	100	100	100	200	135	135	216	150	131	56	136	146	163	160	74	91	82	149	101	133	124	110	107	71	97	173	210	174	173	173
Sudan Hay	-------	-------	-------	700	1,200	-------	100	-------	-------	-------	-------	150	120	100	135	135	216	150	131	56	136	146	163	160	74	91	82	149	101	133	124	110	107	71	97	173	210	174	173	173
Silage/Sorghum	200	500	500	-------	-------	950	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Sugar Beets	1,500	1,500	1,500	1,220	1,070	1,200	1,868	3,700	3,200	2,200	3,860	2,775	340	317	260	0	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Safflower	-------	-------	-------	-------	-------	-------	-------	-------	2,000	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Total	46,000	51,600	40,900	41,120	44,970	47,750	34,043	45,575	42,850	35,034	38,855	34,375	29,490	28,991	25,196	22,319	18,180	11,508	15,272	7,062	7,246	6,567	10,693	7,396	8,148	9,725	9,248	8,822	6,826	7,100	7,239	6,865	6,511	6,832	7,010	7,103	7,516	7,538	7,682	7,682
Vegetables																																								
Canteloupes	20	30	35	40	40	40	40	40	-------	-------	-------	20	120	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Watermelons	50	100	50	-------	100	60	160	65	-------	150	-------	350	435	415	-------	-------	-------	120	191	20	22	50	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	68	66	50	39	55	42	42
Melons-Other (squash, pumpkin)	20	10	-------	-------	-------	-------	-------	155	150	-------	265	20	40	140	568	515	368	120	191	20	22	50	149	125	191	180	186	203	179	215	129	117	228	68	66	50	39	55	42	42
Onion	60	-------	80	240	250	700	1,200	2,500	1,700	1,715	425	977	1,433	1,810	1,447	1,548	1,451	1,467	1,668	1,642	1,519	1,656	1,632	1,533	1,319	1,636	1,493	1,893	2,377	2,166	2,264	1,697	1,686	2,758	2,833	2,623	1,838	1,862	2,244	2,244
Misc. Veg.	10	10	-------	30	15	100	280	80	161	-------	50	30	30	30	29	28	21	6	8	6	3	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carrots	-------	-------	-------	-------	-------	-------	-------	1,160	-------	90	50	80	180	-------	61	71	85	92	74	86	110	27	4	16	21	549	2,324	3,811	5,252	5,508	8,132	7,417	9,964	8,555	7,403	5,361	3,754	3,803	4,582	4,582
Potatoes	-------	-------	-------	-------	-------	-------	-------	500	-------	80	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
Total	160	150	165	310	405	900	1,680	4,500	2,011	2,035	790	1,477	2,238	2,395	2,105	2,162	1,925	1,805	2,131	1,773	1,676	1,786	1,785	1,673	1,531	2,365	4,003	5,907	7,808	7,888	10,525	9,231	11,878	11,448	10,367	8,085	5,669	5,775	6,909	6,909
Total All Crops (LA Co Portion)	48,015	53,617	42,656	43,020	46,915	50,043	36,885	51,237	46,041	38,288	40,994	36,867	32,774	32,390	28,348	25,474	20,968	14,248	18,369	9,840	9,979	9,367	13,509	10,385	11,184	13,347	14,447	16,005	16,115	16,718	19,755	18,167	19,770	19,684	18,730	16,588	14,602	14,721	16,046	16,046

Data Sources: 1, Antelope Valley-specific reports and 2, county-wide reports (*both reports available for years 1981, 1982, 1983).

*Los Angeles County acreages for 2009 are assumed to equal to those from 2008; 2009 annual crop report unavailable.

"-------" denotes no crop classification provided in report.
"misc" denotes individual crop acreage unreported but specified as included in a Miscellaneous grouping of crops.
"vine" denotes individual crop acreage unreported but specified as included in a grouping of vine crops.
"root" denotes individual crop acreage unreported but specified as included in a grouping of root crops.

Acreages for "Carrots" and "Root Vegetables" in 1996 specified in the 1997 Annual Report.
Acreages for "Pears" and "Misc. Fruit and Nut" in 1997 specified in the 1998 Annual Report.
Acreages for Carrots and Onions in 2006 from reported "Root Vegetables" (5,629 ac total; 2005 percentages = Onions, 33%; Carrots, 67%)

Fruit and Nut
- Grape reduced to 33% (based on LA County staff estimation)
- Fruit and Nut Misc. reduced to 40% (based on 1981-83 report comparison)
- Fruit and Nut Misc. reduced to 90% (based on LA County staff estimation)
- Orchard Fruit added to Fruit and Nut Misc., and sum reduced to 90% (based on LA County staff estimation)

Field
- Alfalfa reduced to 98% (based on 1981-83 report comparison)
- Barley reduced to 90% (based on 1981-83 report comparison)
- Grain Hay reduced to 50% (based on 1981-83 report comparison)
- Field Misc. reduced to 25% and allocated evenly between pasture and sudan hay (and barley or wheat) (based on 1981-83 report comparison)

Vegetables
- Onions reduced to 98% (based on 1981-83 report comparison)
- Vegetable Misc. reduced to 1% (based on 1981-83 report comparison)
- Vegetable Misc. reduced to zero (based on LA County staff estimation)
- Vine reduced to 75% and allocated to Melon-other, squash, and pumpkin (and watermelon) (based on 1981-83 report comparison)
- Root reduced to 50% and allocated to Carrots (based on 1981-83 report comparison)
- Root allocated entirely to Carrots (based on LA County staff estimation)

Appendix D-2

Land Use Satellite Imagery Methodology

Appendix D-2
Satellite Imagery Analytical Methodology and its Application to Historical Land Use Determination in the Antelope Valley

Introduction

An analysis was conducted of historical satellite imagery of the Antelope Valley in order to augment historical land use information compiled by the California State Department of Water Resources (DWR) and the Counties of Los Angeles and Kern. Land use surveys conducted by DWR provided crop acreages and areal extents for numerous years, but only through 1986. Crop and pesticide reports prepared by the Counties have summarized annual crop acreages since 1970 (Los Angeles) and 1994 (Kern) but without areal extent in Los Angeles County. Satellite imagery analysis provided a way to determine the extent of agricultural lands in the Valley corresponding to the crop acreages reported by the Counties. It was particularly useful because it allowed evaluation of the entire Antelope Valley back to the 1980's; also, extensive analysis and classification of historical land use in the valley was recently completed (Dr. Hong-lie Qiu, CSULA, 2005, unpublished), the results of which are utilized in the current investigation. Described herein is the analytical methodology used, including data availability and technical approach, the land use analysis, and results.

Analytical Methodology

In 1972, the federal government agencies NASA, NOAA, and USGS implemented the Landsat satellite program utilizing a Multi-Spectral Scanner (MSS) sensor to record images of Earth. Later generations of the Landsat satellites, specifically Landsat 5 and Landsat 7 launched in 1984 and 1999, respectively, record images across the globe 185 km wide that are referenced to the Landsat World Reference System. The Landsat 5 carries the Thematic Mapper (TM) sensor and the Landsat 7 carries the Enhanced Thematic Mapper Plus (ETM+) sensor, with the latter carrying the highest resolution capabilities.

Satellite imagery analysis has been employed in land use studies by numerous researchers. The USGS and USDA have extensively utilized satellite images for purposes of mapping agricultural land in semi-arid locations such as the High Plains region of the Midwest (Qi *et al.*, 2002; Thelin and Heimes, 1987) and Idaho (Heller and Johnson, 1979). Ongoing government projects such as AgRISTARs, the National Land Cover Dataset, and the Farmland Mapping and Monitoring Program map agricultural lands on a state and national scale utilizing satellite imagery from the Landsat and other lower resolution high altitude satellites. In addition, satellite imagery analysis has been utilized to map agricultural land in the arid/semi-arid regions of Turkey (Ozdogan *et al.*, 2006), Egypt (Pax-Lenney *et al.*, 1996), Argentina (Guerschman *et al.*, 2003), and Spain (Martinez-Beltran and Belmonte, 2001).

Data Availability

For over twenty-five years, images of the Antelope Valley have been captured by a Landsat satellite approximately twice a month. The presence of cloud cover over the Valley is infrequent due to the arid/semi-arid climate, so satellite images are typically clear and of high quality. The Landsat World Reference System completely covers the Valley with a geographic span from latitude 33.7 to 35.7 degrees North and longitude 117.2 to 119.4 degrees West (specifically path 41 and row 36). A total of 41 Landsat images or "scenes" of the Valley dating from 1986 through 2009 was acquired from the USGS Center for Earth Resources Observation & Science (EROS), Dr. Qiu, and other sources for the specific dates and image types identified in *Appendix D-2: Table 1*.

Technical Approach

Digital Preparation

The Landsat sensor captures and compiles light reflected from the Earth's surface into digital images that show individual bands of light wavelengths including blue, green, and red bands from the visible portion of the spectrum, the near-infrared band, and three longer wavelength bands that include thermal and short wave-infrared wavelengths. Each band image is composed of an array of pixels representing a 30 x 30 meter square area, and each pixel has a corresponding digital number (DN) or relative brightness of reflected light along a gray scale numbered from 0 (black) to 255 (white). Specifically, a pixel with a DN value of 0 measures minimum reflectance while a pixel with a DN value of 255 measures maximum reflectance. The various images were processed using either ERDAS software (by Dr. Qiu) or ESRI ArcInfo GIS software, including its Spatial Analyst Extension (in the current investigation).

The contrast in band images may be seen in a Landsat scene of the Antelope Valley captured September 20, 1999, that specifically focuses on the south-central portion of the Valley near the cities of Lancaster and Palmdale (*Appendix D-2: Figure 1*). Various large-scale features can be detected including Lake Palmdale and the California Aqueduct to the southwest, Littlerock Creek wash to the southeast, and agricultural fields, airports, and roads throughout. Most important to the current investigation, the images also show how different materials on the Earth's surface like water, soil, and vegetation are visualized in a composite band image (blue, green, and red, bands 1,2, and 3, respectively) compared to two single band images (RED band 3 and NIR band 4). Typically, vegetation displays a unique spectral signature due to its low reflectance (high absorption) of incident sunlight in the visible red portion (RED, 0.63-0.69 micron wavelength) and its high reflectance (low absorption) in the near-infrared portion (NIR, 0.76-0.90 micron wavelength) (Wiegand, 1991). This is the case in *Appendix D-2: Figure 1*, where vegetation appears black to gray in color in the band 3 (RED) image and white in the band 4 (NIR) image.

To enhance the various features in a scene, a technique is utilized to normalize the RED and NIR data; specifically, a band ratio called the Normalized Difference Vegetation Index (NDVI) (Lillesand, Kiefer & Chipman, 2004; Aronoff, 2005) is calculated from the following formula:

$$NDVI = (NIR-RED)/(NIR + RED)$$

In this technique, the RED and NIR band images are manipulated as raster layers in a GIS using map algebra tools that calculate the index from the formula utilizing the respective DN values of each corresponding pixel between bands. Each step in calculating the NDVI involves the creation of a new image raster beginning with the individual RED and NIR band image rasters referenced above. Each pixel DN of Band 3 (RED) is subtracted from the corresponding pixel DN of Band 4 (NIR) to create a Difference Raster where the resulting pixel DN has a value between –255 and +255. Then the pixel DN of Band 3 is added to the corresponding pixel DN of Band 4 to create a Summation Raster with resulting pixel DN values between 0 and 510. Finally, the Difference Raster is divided by the Summation Raster to create the NDVI image raster with each resulting pixel DN value between –1 and 1.

In each of the images shown in *Appendix D-2: Figure 1*, the spectral signatures of vegetation, water, and earth materials can be seen. For example, in the Band 4 image, center-pivot irrigation circles and vegetated areas have the highest DN values (appearing white); in the Band 3 image, these areas have the lowest DN values (appearing dark). Bodies of water, such as Lake Palmdale, and the CA Aqueduct are dark in both images. Airport runways and bare rock are both relatively light in each image. However, in the NDVI image with pixel DNs shaded along a gray scale, better definition is provided of the vegetated areas (shown in bright white) including agricultural lands, golf courses, and landscaping within urban areas (DN values >0). In contrast, bodies of water, pavement, and soil appear dark (DN values <0).

In this investigation, the NDVI technique was particularly useful in identifying irrigated agricultural land in the Antelope Valley because the NDVI values for irrigated lands differed from those for the Valley's vast areas of sparse native vegetation. As described herein, visual interpretation of NDVI raster images was performed on multiple images from different seasons within each given year to identify temporal cropping patterns in the NDVI raster images and, thus, improve accuracy of the methodology.

Visual Interpretation

Land use interpretation through basic digital preparation of NDVI raster images is enhanced by the process of visual interpretation, which involves developing a recognition of agricultural features by shape, patterns, and associations, supported by an average NDVI over the parcel that indicates the presence of irrigated crops. NDVI raster images are evaluated with context, examining the average value over a parcel, the range of values in each parcel, and identifying patterns in cropped lands. Further, evaluation of multiple images and knowledge of typical cropping practices through the year are essential to the accurate identification of crop land because the "visibility" of any given crop depends on

the timing of its growth stages (Thelin and Heims, 1987, and Pax-Lenney, *et al.*, 1996). As can be seen in *Appendix D-2: Table 2*, which summarizes typical timing of agricultural production in the Antelope Valley, year-round cropping is common in the Valley. However, agricultural fields can present as fallow or barren in images taken in the spring but be visible in those from the fall when crops come into full production.

Appendix D-2: Table 2
Agricultural Production in the Antelope Valley

Year-Round	Spring-Fall	Winter-Spring
Alfalfa and irrigated pasture	Orchard	Grains
Carrots	Vineyards	Melons and squash
Sugar Beets	Potatoes	Onions

A multi-temporal approach was utilized in a recent study of historical land use in the Antelope Valley (Dr. Hong-lie Qiu, CSULA, 2005, unpublished). Multiple images from several years, specifically 1974-75, 1980, 1986, 1989, 1996, 1999, and 2000 through 2005, were evaluated and the spatial extent of irrigated agriculture in the Valley was determined for those years. In addition to creating NDVI raster and false color images in order to identify the extent of agricultural land for those years, field visits were conducted to verify the results.

In this investigation, visual interpretation was conducted of the images created for those periods listed in *Appendix D-2: Table 1*. Images from the months of December through March were purposefully excluded due to the abundance of native vegetation (supported by seasonal precipitation), which greatly complicated distinguishing irrigated from non-irrigated parcels. Instead, optimal images for the identification of irrigated agricultural land included May through July for early season crops and August through November for late season crops. This analysis of land use was augmented through the visual inspection of images from 2009.

Land Use Analysis

The Public Land Surveyor System (PLSS) delineates Township/Range/Sections for the entire state of California as a polygon vector dataset with each polygon representing one Section at approximately 640 acres. This dataset has been used extensively with the USGS topographic maps (1:24k, 1:100k, and 1:250k series), other transportation and political datasets in the GIS environment, and georeferenced by various state and federal entities, all of which have excellent spatial agreement. In the current investigation, a portion of the PLSS dataset was clipped and incorporated into a GIS for use as a grid covering the Antelope Valley. Within non-surveyed areas (former Land Grant areas), the T/R/S lines were 'projected' to create a continuous grid. The PLSS dataset was also selected as the grid/base layer for this land use analysis because of the conceptual correlation between Section lines and parcel boundaries, to which agricultural fields typically extend.

Background and agricultural subarea classes were designated utilizing the PLSS dataset (*Appendix D-2: Figure 2)*. The subarea classes were based on NIR/RED spectral qualities of the physical landscape present in the satellite images; they are identifiable in the NDVI raster as well as normal color images. Water (Lake Palmdale), bedrock, and playa lakebeds are constant features taken from physical maps. These subarea classes characteristically have small deviation in the NDVI value within their designated area. Some background subareas have both a high and low component due to the general trend in decreasing NDVI values from the southwest to the northeast (toward the central lower part of the valley). A partition between high and low background areas in the Valley was designated based on this apparent trend in background NDVI values (*Appendix D-2: Figure 3*). The native vegetation subareas were based on the Section polygons that did not show any disruption from a native state between 1985 and 1999 (32 'high' Sections and 75 'low' Sections). Urban subareas are the Section polygons within Lancaster, Palmdale, Littlerock and Lake Los Angeles that have been urban since the mid-1980s (30 'high' and 30 'low' Sections). Two non-specific high and low background classes make up the remainder of the non-agricultural portion of the Valley.

The agricultural subareas were not fixed in spatial extent for any year. There were at least two images interpreted for each year to capture a late spring/summer crop and a late summer/fall crop. Active agriculture was designated where a parcel (Section or portion of) had relatively high, consistent NDVI values (indicative of vegetation) in a particular image. On a systematic basis, parcels were cut within the Section to match the extent of the cropped field and indicated with a '1' for that scene as a new parcel polygon. The non-agricultural area within that Section polygon was classified by its appropriate background class for the tabulation of acreage. Since multiple images were reviewed in any given year, a parcel polygon may be identified as agricultural land in both summer and fall images; however, it was counted only once in the determination of the composite acreage for the year. For example, June 1986 was calculated to have 9,000 acres under cultivation, August with 12,200 acres, and September with 9,800 acres. Agricultural land in specific parcels was present in all three moths for 6,400 acres and some parcels were active in only June and September, while others were active in June and August. The composite agricultural acreage, whereby each acre was counted one time whether actively cropped in every image or in only one, was approximately 14,000 acres in 1986.

The 10 subarea classes shown in *Appendix D-2: Figure 2* were used to collect and summarize NDVI pixel values from each NDVI raster image reviewed for the more than 2,000 parcel polygons within the Antelope Valley Area of Adjudication. Statistics were calculated using the Zonal Statistics tool in ArcGIS, providing a minimum, maximum, range, standard deviation and average pixel value for each parcel polygon for the images from June 1986 through October 1999. The post-2000 images processed by Dr. Qui, CSULA, were not available for inclusion in the statistical summary. For each image, a plot of the parcel mean NDVI value vs. total acreage shows the relative comparison of different earth materials and land uses (*Appendix D-2: Figures 4a through 4i*). Parcel mean NDVI values were rounded to the nearest tenth for grouping into discreet levels, so that parcels with values from 0.15 to 0.24 were rounded off to the nearest tenth and grouped at the 0.2 level.

The parcel mean NDVI plots demonstrate how parcels classified as agricultural land compare with other subarea classes. Water bodies have the lowest NDVI values, with dry lakebeds and bedrock areas having the next lowest values. The urban subareas are centered around a zero on the NDVI typically with higher deviation in values due to the nature of the urban landscape; i.e., with a mix of buildings, paved areas, lawn areas, and trees. The Native Vegetation subareas show corresponding higher or lower values depending on the high/low designation of the subarea. The Native classes were used as the threshold for comparison to agricultural classes, with parcels classified as agricultural land having equal or higher mean NDVI values. The accuracy in estimating agricultural acreage by the NDVI technique can be affected by the misclassification of parcels due to similar NDVI values (e.g., areas of forest, riparian vegetation, or urban landscaping) and the incomplete designation of agricultural parcels (e.g., edge effects of a polygon not perfectly matched to the corresponding pixels). In this type of statistical review of results, it is necessary to plot each image result separately due to absolute differences in the NDVI value between scenes (e.g., in July 1996, water bodies have an average NDVI value of –0.48, while in July 1999, they average –0.26).

Results

The satellite imagery analysis of multi-temporal composite and NDVI images yielded estimated agricultural acreages for ten years between 1986 and 2005 and for 2009, and the estimates compare well with agricultural acreages tallied from the County crop and pesticide reports. As seen in a graph of the estimated and reported annual acreages (*Appendix D-2: Figure 5*), acreages follow the same trend over time, showing a decline through the late 1980s, a gradual increase through roughly 2002, followed by a slight decline in 2004 and 2005, and small increase through 2009. The greatest differences came from the 1986 and 1996 results, with 44 and 31%, respectively, less acreage identified by satellite imagery interpretation. However, for all other years, the differences ranged from 0.1 to 18.7% and averaged around 11%.

The statistical results (available for the acreage estimates for years 1986, 1989, 1996, and 1999) are described herein. In addition, the estimated acreages from this investigation are compared to those from two land use programs, namely the National Land Cover Dataset (NLCD) and the Federal Mapping and Monitoring Program (FMMP).

Statistical Results

1986: The June image was calculated as having 9,000 acres under cultivation; August had 12,200 acres; and September had 9,800 acres. The composite tabulation was approximately 14,000 acres of agricultural land. Parcels in the High Non-specific NDVI subarea with mean NDVI values >=0.15 (rounded to 0.2 and greater than the maximum High Native Vegetation subarea values) that were not identified as agriculture in June, August or September totaled 5,300 acres and are situated high around the perimeter of the Valley near forest boundaries. Parcels in the Low Non-specific NDVI subarea with

NDVI values >=0.05 (greater than the maximum Low Native Vegetation subarea values) that were not identified as agriculture in June, August or September totaled 13,300 acres.

The total acreage reported from a land use survey conducted in 1986 (DWR, 1990) is very similar to the estimate from this investigation. However, the spatial extents of agricultural acreage differ. While the agricultural areas of the eastern side of the valley are similar, the areas west of Rosamond do not correspond well. Additional information on the range of dates analyzed by DWR would be required to resolve the spatial differences; however, for purposes of this investigation, the extents reported by DWR for 1986, which were derived from more detailed land use interpretation, are utilized (Appendix D, Figure D.2-8).

1989: Images from June and November were calculated as having 9,800 and 8,200 acres, respectively, with a composite of 11,100 acres of agricultural land. Approximately 7,600 acres in the High Non-specific NDVI subarea are shown with a mean NDVI value >=0.05 (greater than the maximum High Native Vegetation subarea values), but 6,700 of those acres may be high due to the presence of forest, riparian, or urban vegetation. Approximately 15,300 acres in the Low Non-specific NDVI subarea have a mean NDVI value >=-0.04 (greater than the maximum Low Native Vegetation subarea values). It should be noted that approximately 3,200 acres around Littlerock and south of the AVEK service boundary could not be reviewed but may encompass additional agricultural acreage. For this investigation, the spatial extents determined by satellite imagery analysis for 1989 are utilized (Appendix D, Figure D.2-9).

1996: Images from July and October were calculated as approximately 11,200 and 8,700 acres, respectively, with a composite of roughly 13,500 acres of agricultural land. Approximately 9,900 acres in the High Non-specific NDVI subarea are shown with a mean NDVI value greater than the High Native Vegetation subarea (>=0.05), of which 9,000 of those acres are either forested or urban. Parcels in the Low Non-specific NDVI subarea with mean NDVI values >=-0.04 that were not identified as agriculture in July or October total 77,100 acres. Within this total, parcels totaling 15,700 acres contain smaller distinct agricultural fields that, once interpreted further, may yield additional agricultural land. It should be noted that approximately 3,100 acres around Littlerock and south of the AVEK service boundary could not be reviewed but may encompass additional agricultural land.

1999: Images from July and October were calculated as having approximately 15,100 and 17,000 acres, respectively, with a composite of around 23,300 acres of agricultural land. 9,300 acres of the High Non-specific NDVI areas have an average NDVI pixel value of >=0.05, and 23,300 acres of Low Non-specific NDVI areas have an average NDVI pixel value of >=-0.04. Of these high and low areas, 1,000 acres near Littlerock contain small agricultural fields that may yield additional agricultural land. For this investigation, the spatial extents determined by satellite imagery analysis for 1999 are utilized (Appendix D, Figure D.2-10).

Comparison to Land Use Programs

As further assessment of the satellite imagery analytical methodology, the estimated agricultural acreages and spatial extents from this investigation were compared to those from two land use programs.

National Land Cover Dataset (NLCD)

The NLCD was designed and implemented to provide a national level land cover dataset, specifically created under contract by the USGS to provide consistent and seamless 30-meter coverage of the coterminous United States from Landsat TM imagery and other sources of digital data (Vogelmann *et al.*, 2001). The dataset for 1992 was created by two or more TM images representing different parts of the growing season (leaf-on and leaf-off) and several other ancillary datasets incorporating information on elevation, population, wetlands, soils and other preexisting land use work. The NLCD classification system contains 21 classes of land cover across the U.S. initially based on automatic computer designations followed by manual interpretation and refinement. The accuracy of the dataset at the local level is reported as unknown and users are advised to not use it for local scale analysis unless qualification of the dataset at that local scale is done based on a previous good understanding of the land cover for that area. The dataset was updated in 2001 and land use determined for that year is shown on a map of the Antelope Valley Area of Adjudication with the PLSS grid (*Appendix D-2: Figure 6*).

Acreages of the individual agricultural classes in the Valley for 1992 and 2001 are summarized in the inset table of the map. Total acreages are basically unchanged between 1992 and 2001, accounting more than 167,000 acres of agricultural land in both years. In comparison to the results of this investigation, specifically from County crop and pesticide reports, agricultural acreage was reported as approximately 17,500 and 25,200 acres, respectively. Of the four specific agricultural classes designated by the NLCD for Antelope Valley, subtotals exceed County crop/pesticide report totals by as little as 200% for deciduous and vineyard classes, and as much as one order of magnitude for pasture,/hay and small grains classes. Due to the consistency in agricultural acreages between County crop/pesticide reports and satellite imagery analysis conducted as part of this investigation, the results from the NLCD are assumed to be inaccurate at a Valley-wide scale.

Farmland Mapping and Monitoring Program (FMMP)

The FMMP was established in 1982 to produce national agricultural resource maps, which are based on soil surveys and land use information interpreted from aerial infrared imagery, when possible, and classified according to published land inventory and monitoring criteria (CA Department of Conservation, 2004). The first maps by county became available in 1984 and 1988 for Los Angeles and Kern Counties, respectively. They are produced biannually and have been acquired through 2004 as part of this investigation.

Under the FMMP, irrigated agricultural lands in Kern and Los Angeles County are subdivided into the following three classes: 'Prime Farmland', 'Farmland of Statewide Importance' and 'Unique Farmland.' Inclusion of land in one of the classes, which are distinguished by soil characteristics, require that it was used for irrigated agricultural production at some time during the four years prior to the mapping date. Land included in a fourth agricultural class (not utilized in the Kern County dataset), 'Farmland of Local Importance,' has the same soil characteristics as 'Prime Farmland' or 'Farmland of Statewide Importance', but was generally not cultivated or irrigated during the prior four years.

The reported type and spatial extent of farmland in 2000 (incorporating land use from 1996 through 2000) are shown on a map of the Antelope Valley Area of Adjudication with the PLSS grid (*Appendix D-2: Figure 7*). The acreages of individual irrigated agricultural lands in the Valley for biennial years since 1984 are summarized in the inset table of the map. The acreages designated under the FMMP are on average 50% higher than those reported in the respective County crop/pesticide annual reports. For some years, including 1990 and 1994, the FMMP acreages are more than 90% higher than those from County crop/pesticide reports. Due to the consistency in agricultural acreages between the County reports and satellite imagery analysis conducted under this investigation, the results from the FMMP are assumed to be inaccurate.

Summary

The satellite imagery analysis provided qualification of the agricultural acreages from County crop and pesticide reports and established the spatial extent of agricultural lands in the Valley for numerous years beginning in 1986. It was determined that the most accurate approach to satellite imagery analysis for purposes of this investigation involved digital preparation of composite and NDVI images, with visual interpretation of multiple images from any given year, specifically at least the spring and fall. In contrast, the results from the NLCD and FMMP programs were much less reliable, likely due to their respective national- and state-level approaches to land use interpretation.

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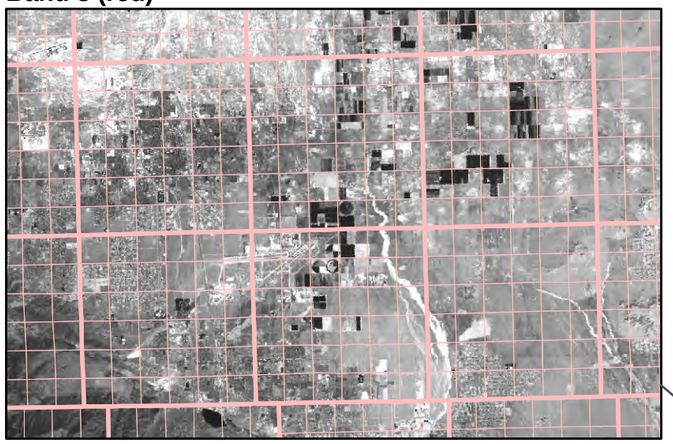
Appendix D-2: Table 1
Landsat Scenes used in Historical Agriculture Interpretation
Antelope Valley Area of Adjudication

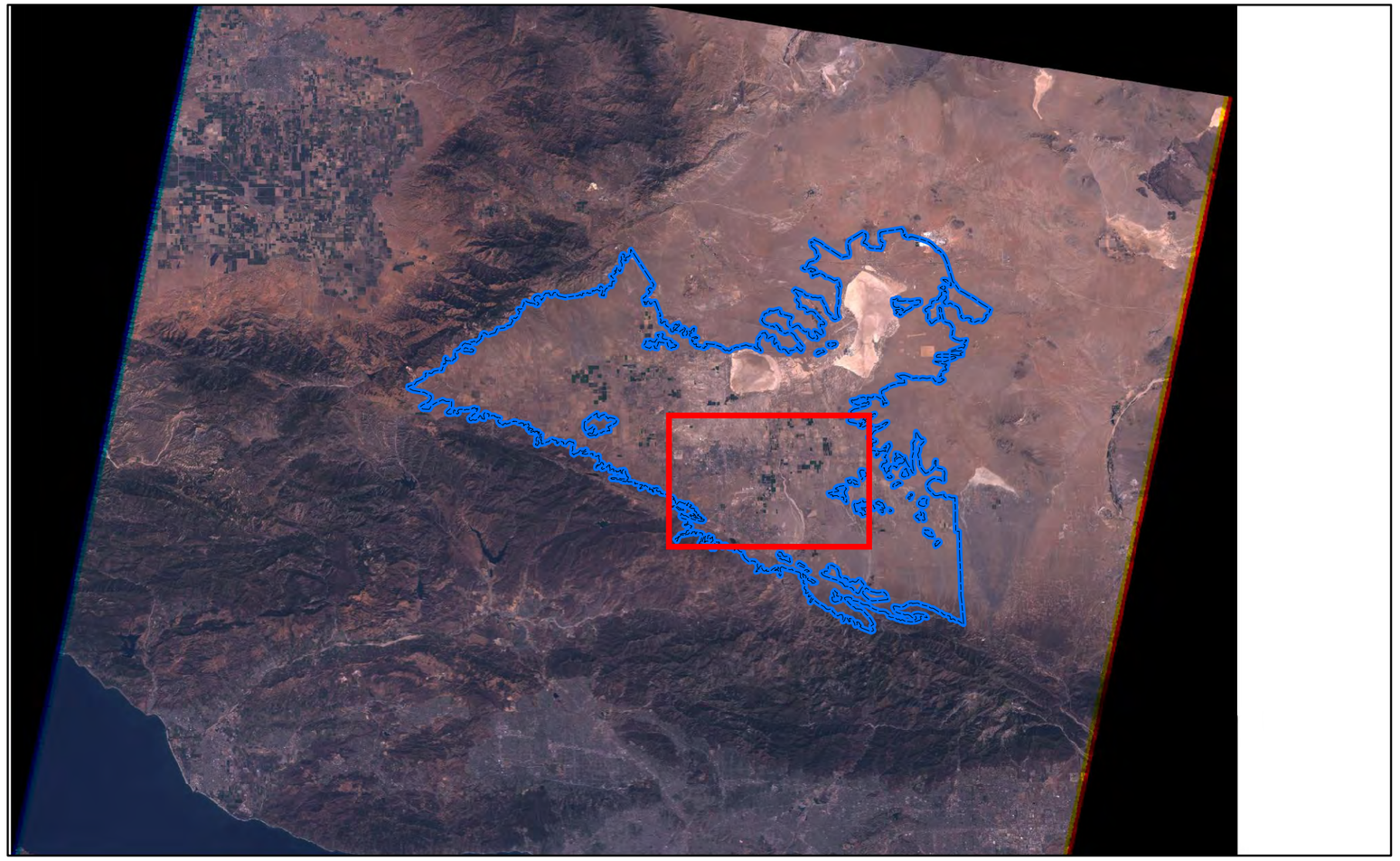
LandsatID	Actual Date	Image Type
5041036008617110	June 20, 1986	TM
5041036008623510	August 23, 1986	TM
5041036008625110	September 8, 1986	TM
5041036008916310	June 12, 1989	TM
5041036008932310	November 19, 1989	TM
5041036009618310	July 1, 1996	TM
5041036009629510	October 21, 1996	TM
7041036009919950	July 18, 1999	ETM+
7041036009929550	October 22, 1999	ETM+
7041036000012250	May 1, 2000	ETM+
7041036000015450	June 2, 2000	ETM+
7041036000018650	July 4, 2000	ETM+
7041036000021850	August 5, 2000	ETM+
7041036000025050	September 6, 2000	ETM+
7041036000029850	October 24, 2000	ETM+
7041036000033050	November 25, 2000	ETM+
7041036000112451	May 4, 2001	ETM+
7041036000115650	June 5, 2001	ETM+
7041036000117250	June 21, 2001	ETM+
7041036000120450	July 23, 2001	ETM+
7041036000123650	August 24, 2001	ETM+
7041036000126850	September 25, 2001	ETM+
7041036000211150	April 21, 2002	ETM+
7041036000214350	May 23, 2002	ETM+
7041036000220750	July 26, 2002	ETM+
5041036000226310	September 20, 2002	TM
5041036000227910	October 6, 2002	TM
5041036000313810	May 18, 2003	TM
5041036000318610	July 5, 2003	TM
7041036000322651	August 14, 2003	ETM+SLC-off
7041036000413351	May 12, 2004	ETM+SLC-off
7041036000422952	August 16, 2004	ETM+SLC-off
7041036000515150	May 31, 2005	ETM+SLC-off
7041036000518350	July 2, 2005	ETM+SLC-off
7041036000521550	August 3, 2005	ETM+SLC-off
50410362009106	April 16, 2009	TM
50410362009170	June 19, 2009	TM
50410362009186	July 5, 2009	TM
50410362009218	August 6, 2009	TM
50410362009250	September 7, 2009	TM
50410362009282	October 9, 2009	TM

"SLC-off" indicates where the imagery was captured by the Landsat 7 satellite without the Scan Line Corrector due to a hardware failure in May 2003. The SLC compensates for the forward movement of the satellite, and without the correction, wedge-shaped gaps appear between successive scan lines. With the SLC-off, the image has a 'zig-zag' effect, however 75 percent of the data for a scene is captured.

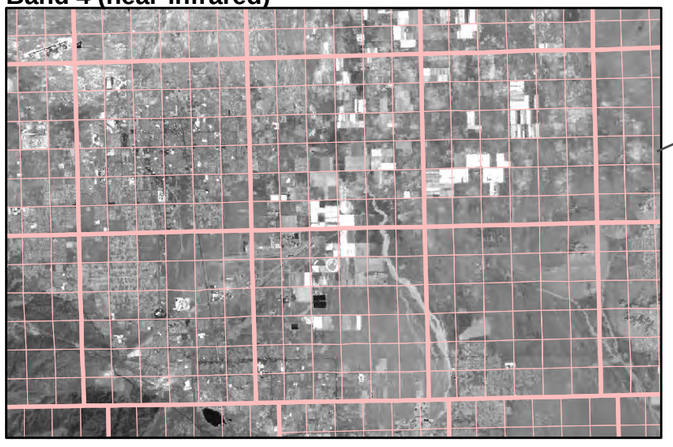
Band 1,2, and 3 Composite (visible red, green & blue)

Band 3 (red)

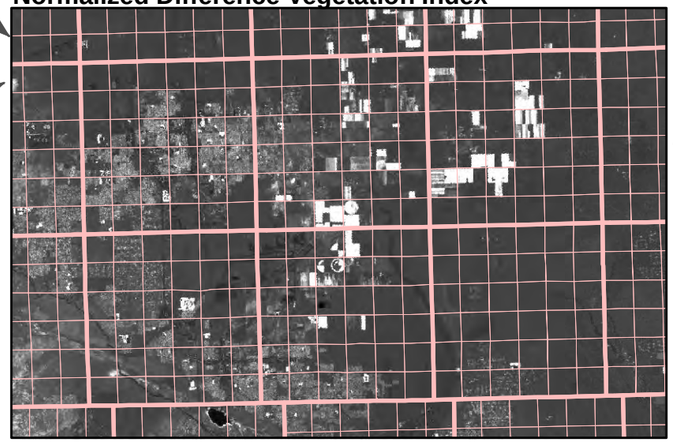




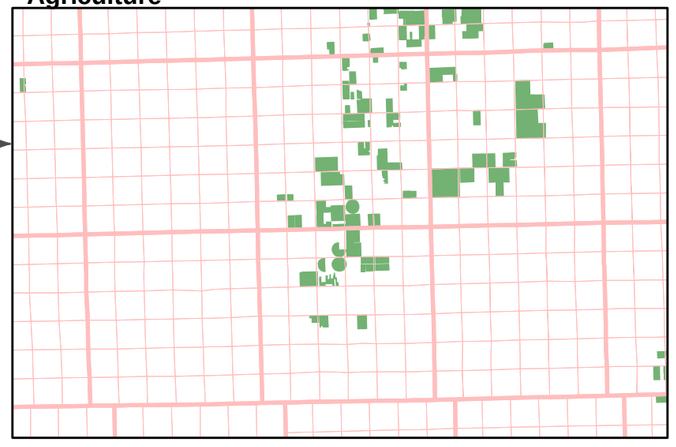
Band 4 (near-infrared)



Normalized Difference Vegetation Index



Agriculture



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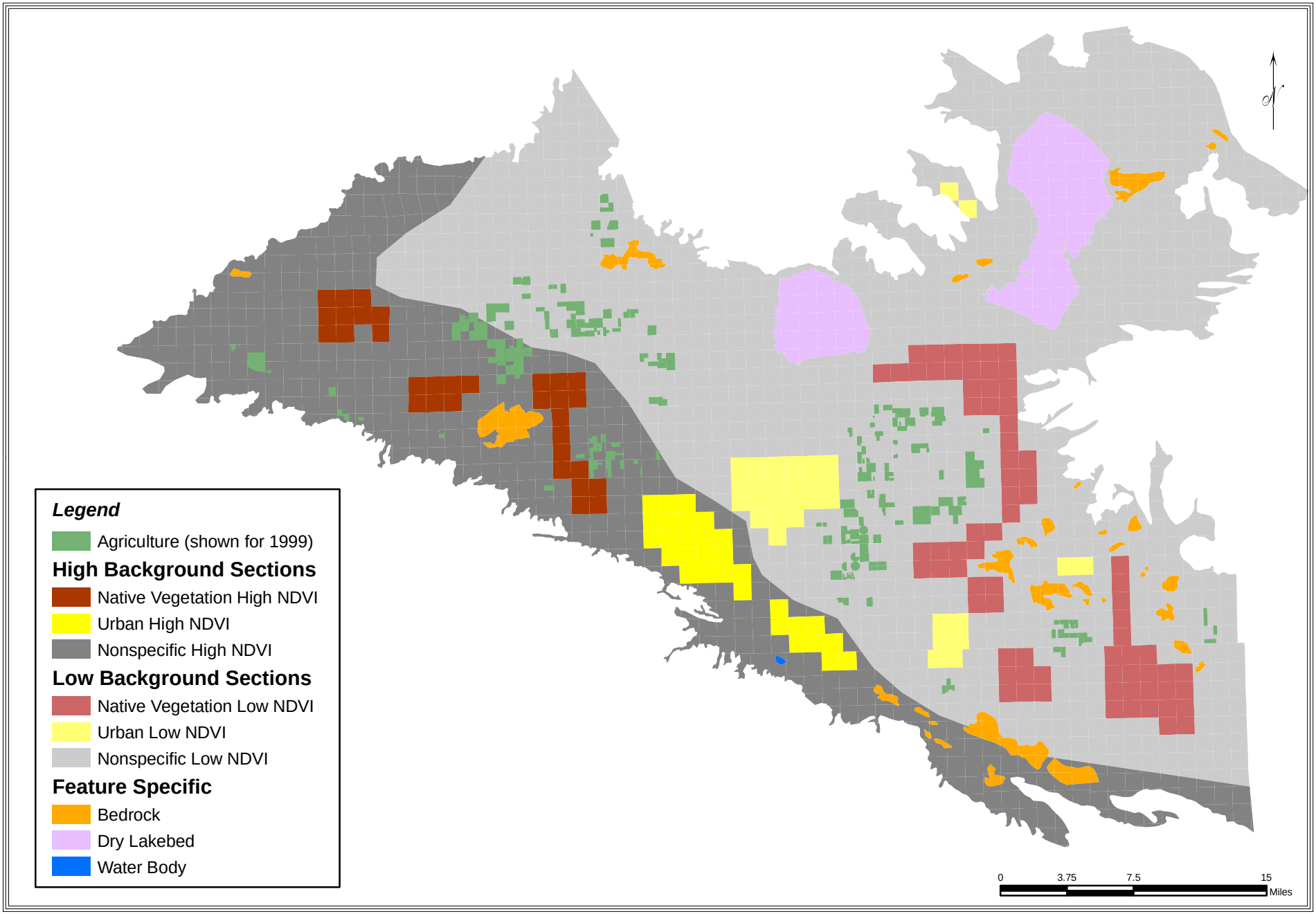
Appendix D-2: Figure 1
September 20, 1999 Landsat TM Scene
Antelope Valley Area of Adjudication



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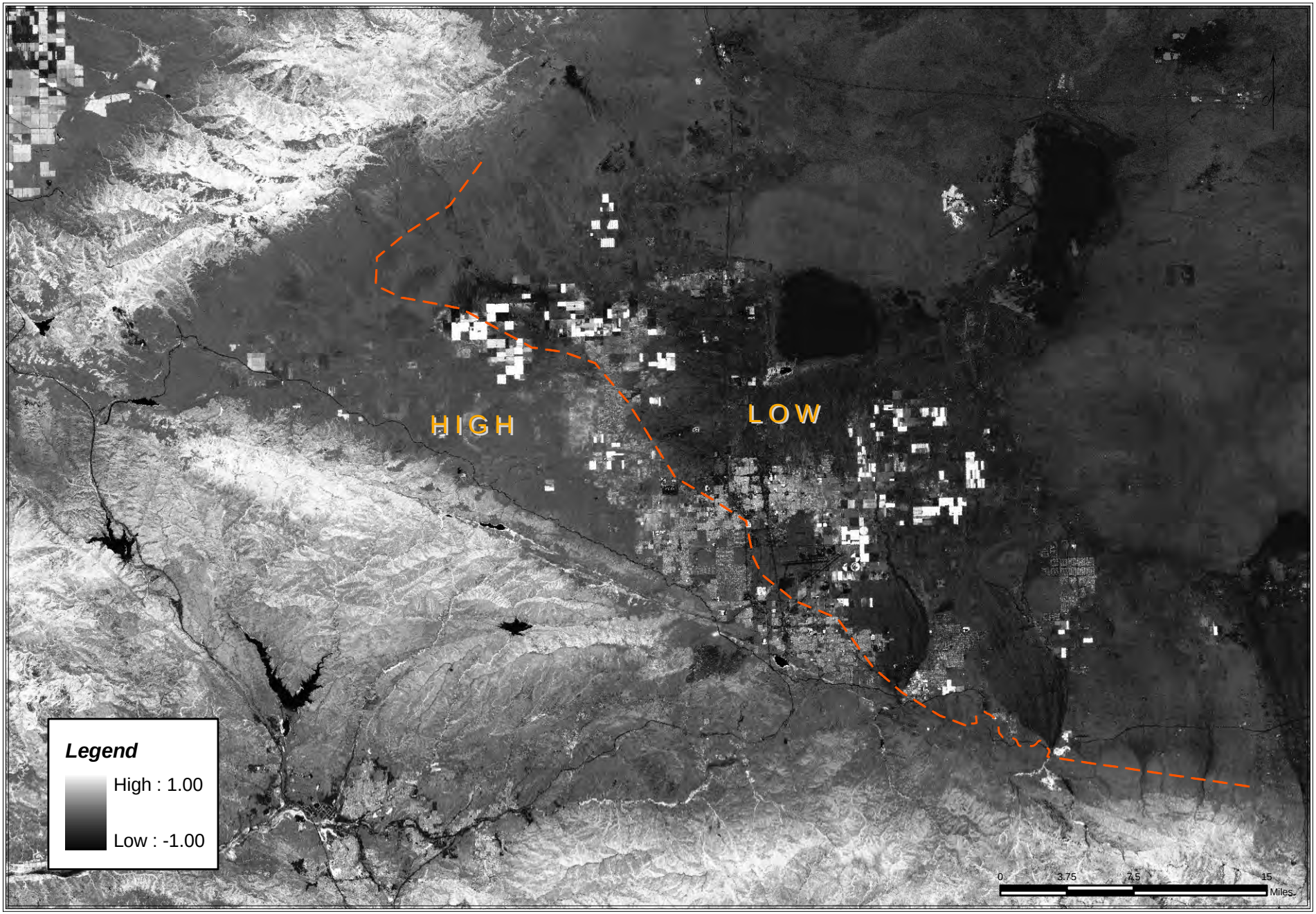
Appendix D-2: Figure 2
NDVI Subareas in Antelope Valley



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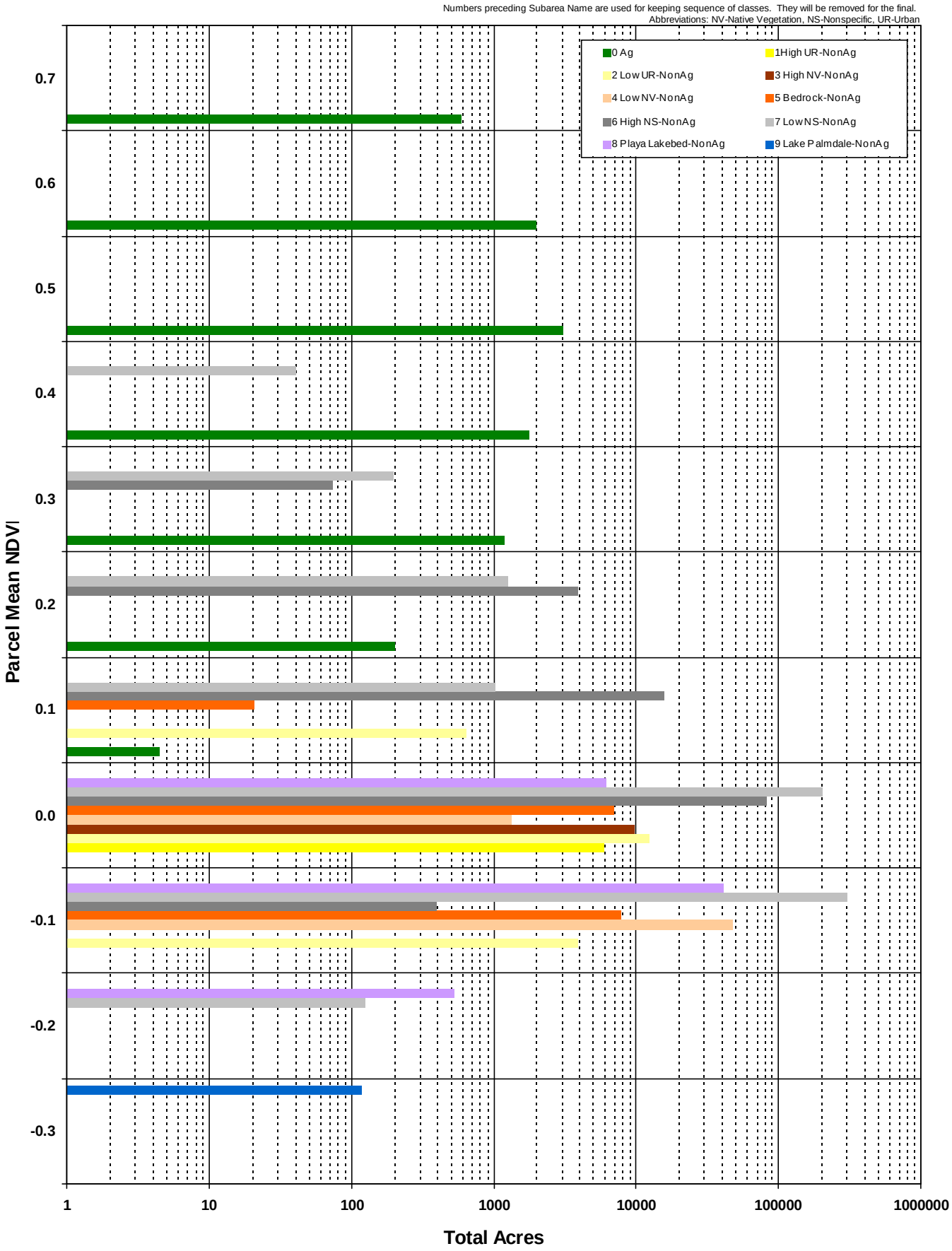
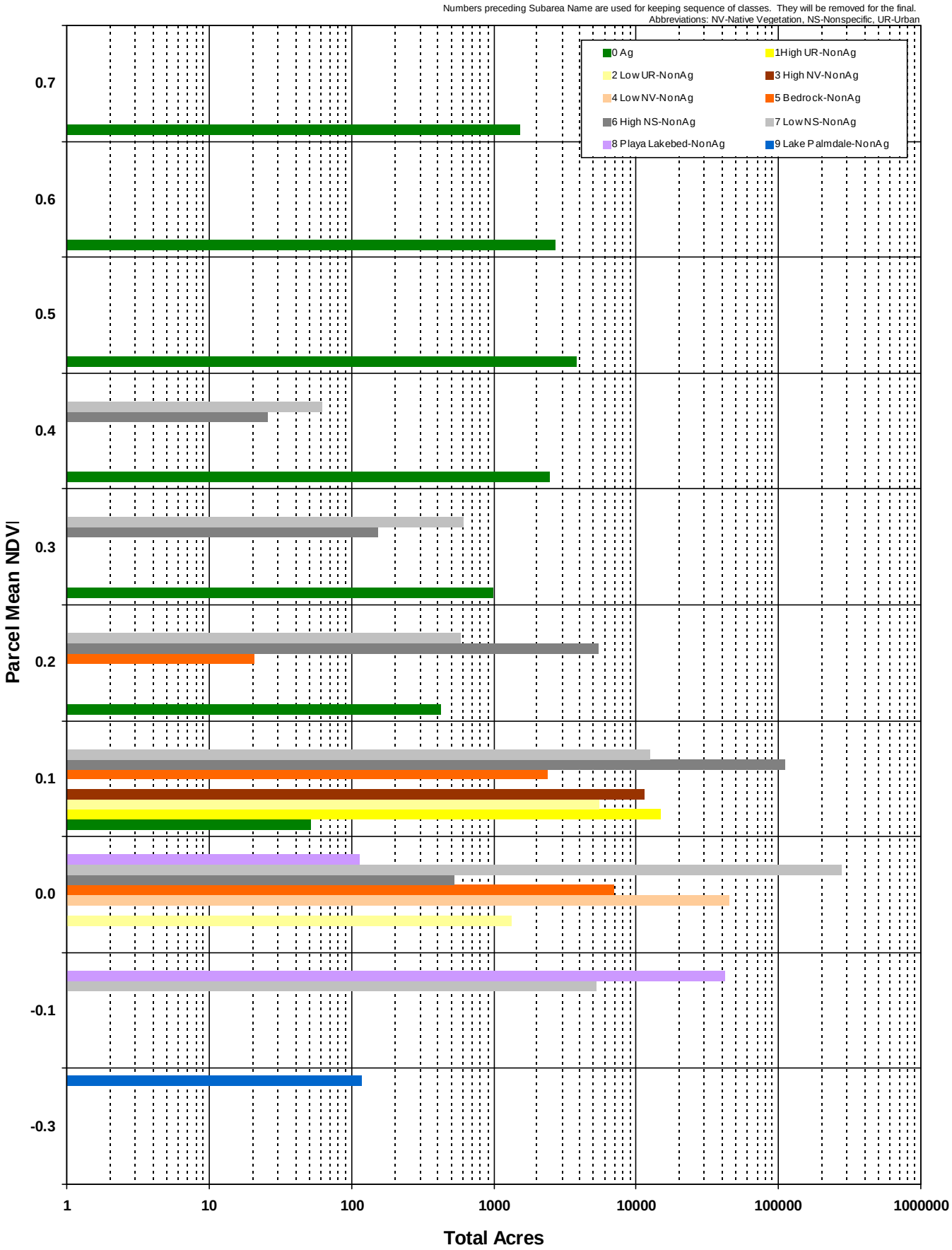
Appendix D-2: Figure 3
September 20, 1999 NDVI Raster Image
Antelope Valley Area of Adjudication



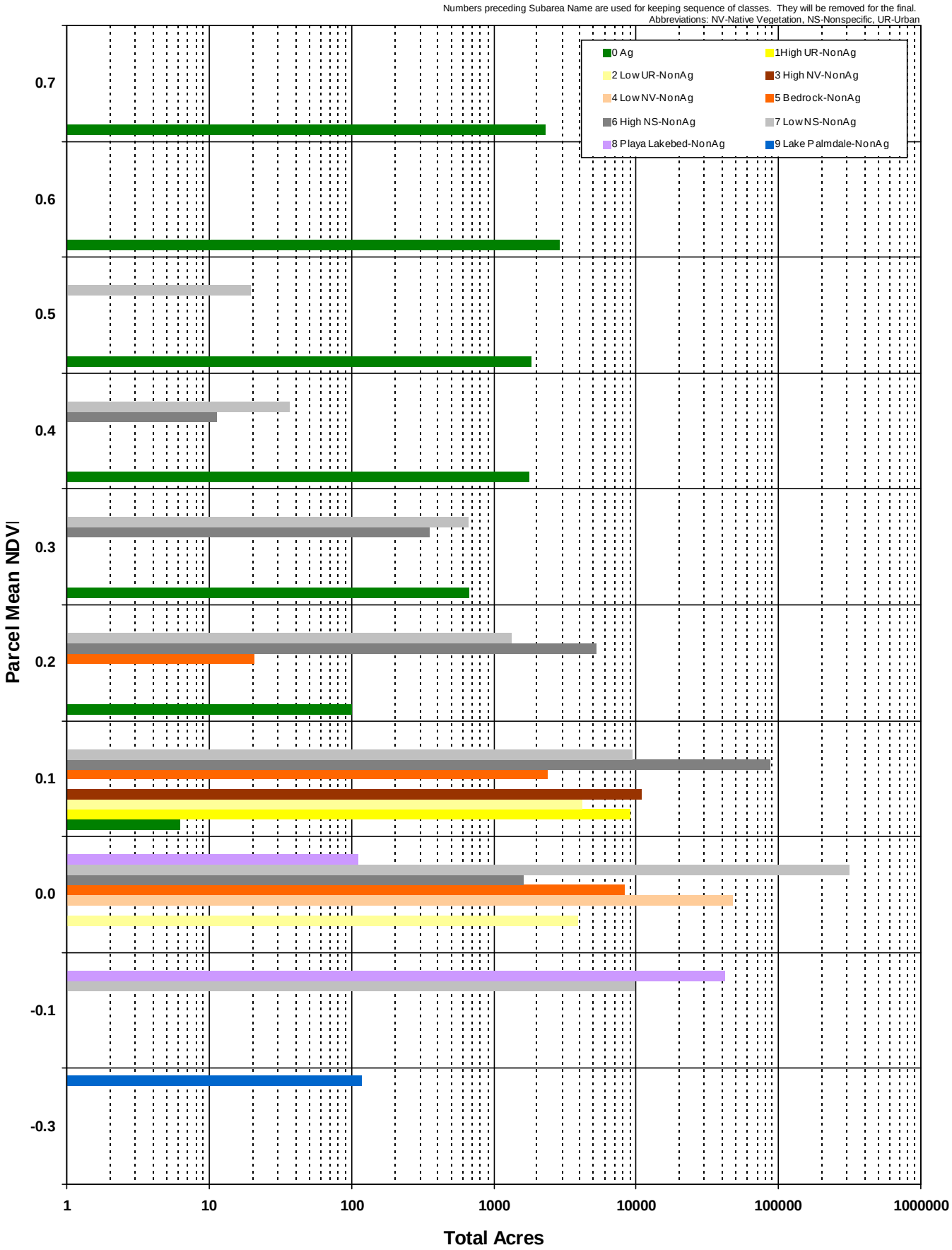
Appendix D-2: Figure 4a

Jun-1986 Parcel Mean NDVI



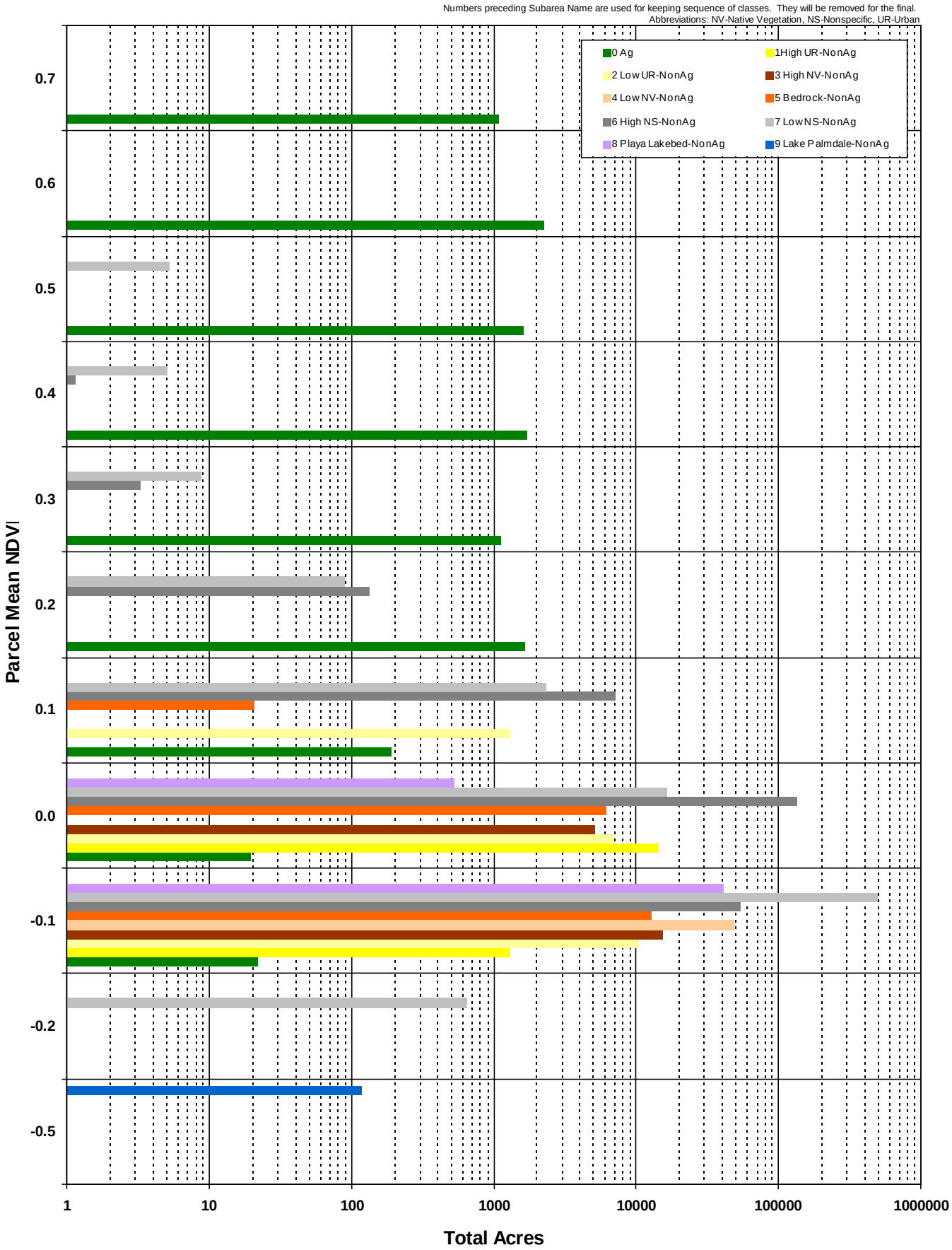
Appendix D-2: Figure 4b

Aug-1986 Parcel Mean NDVI



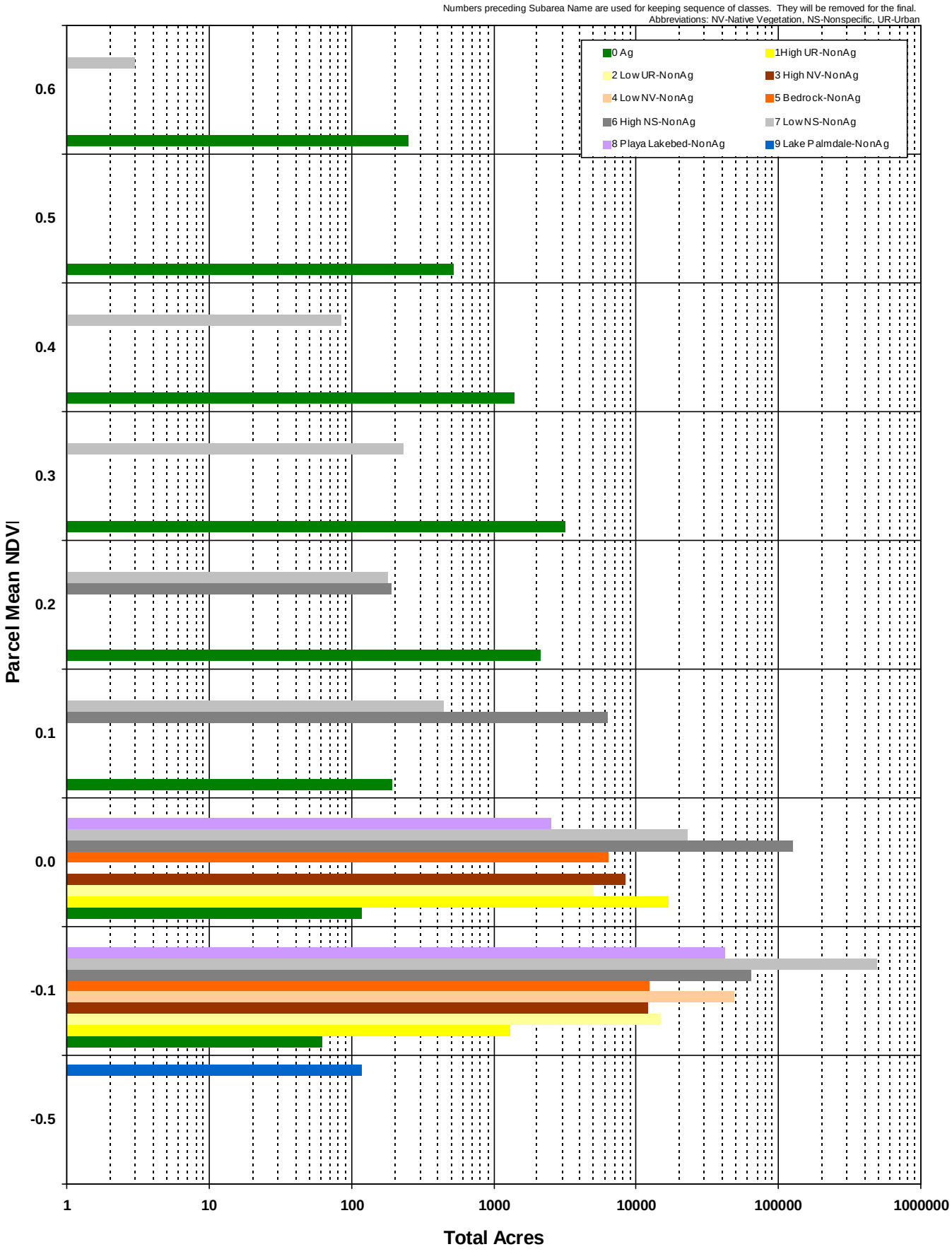
Appendix D-2: Figure 4c

Sep-1986 Parcel Mean NDVI



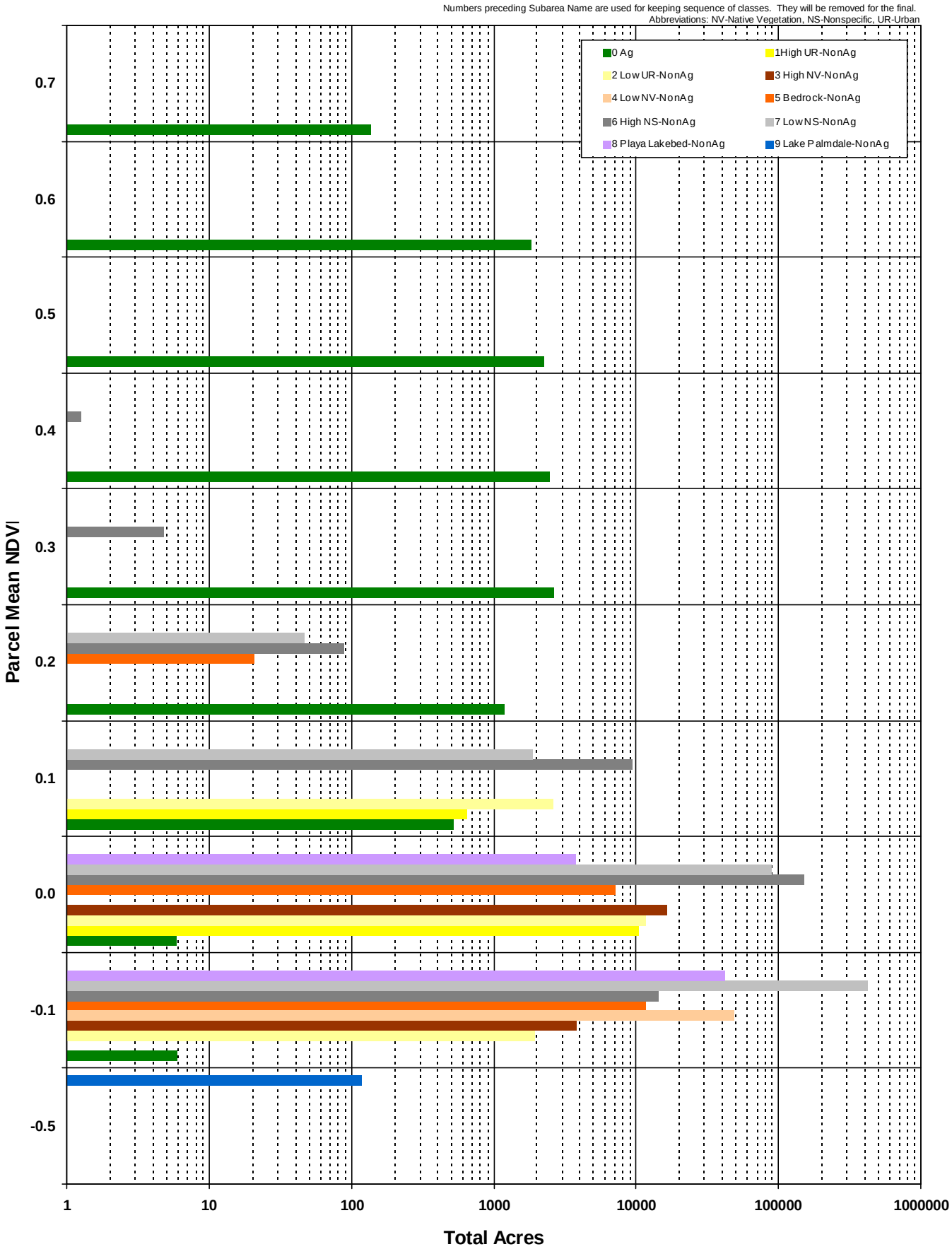
Appendix D-2: Figure 4d

Jun-1989 Parcel Mean NDVI



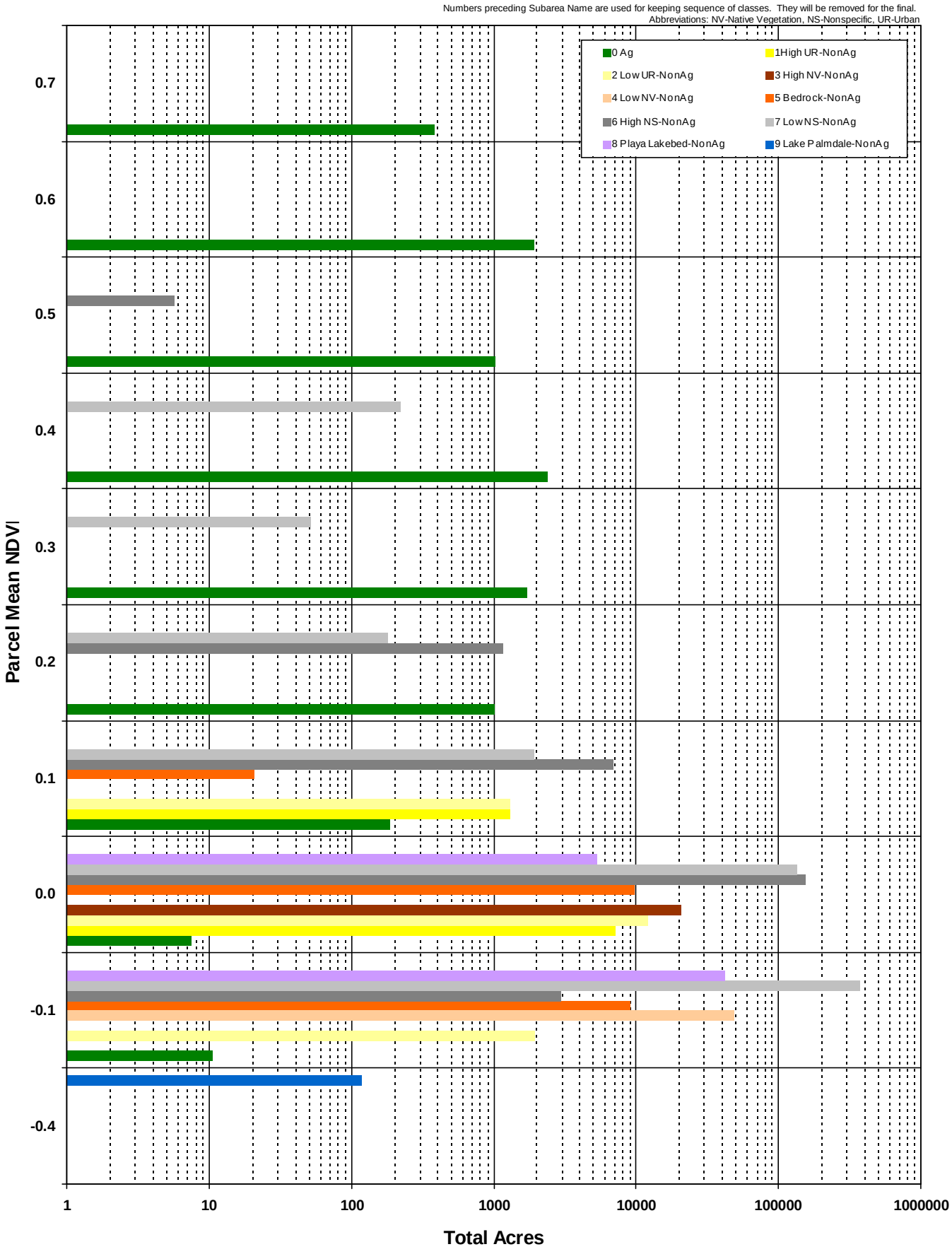
Appendix D-2: Figure 4e

Nov-1989 Parcel Mean NDVI



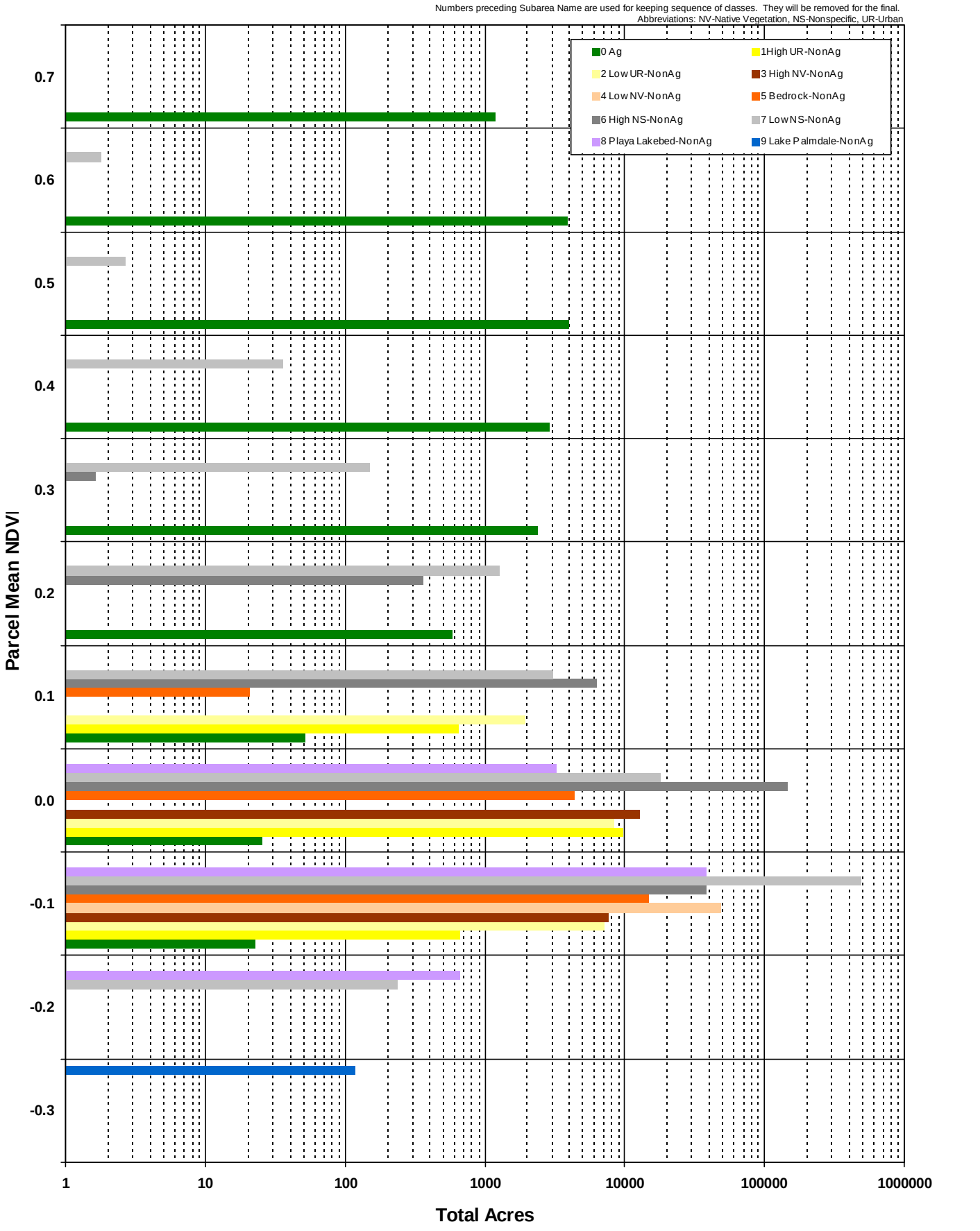
Appendix D-2: Figure 4f

Jul-1996 Parcel Mean NDVI



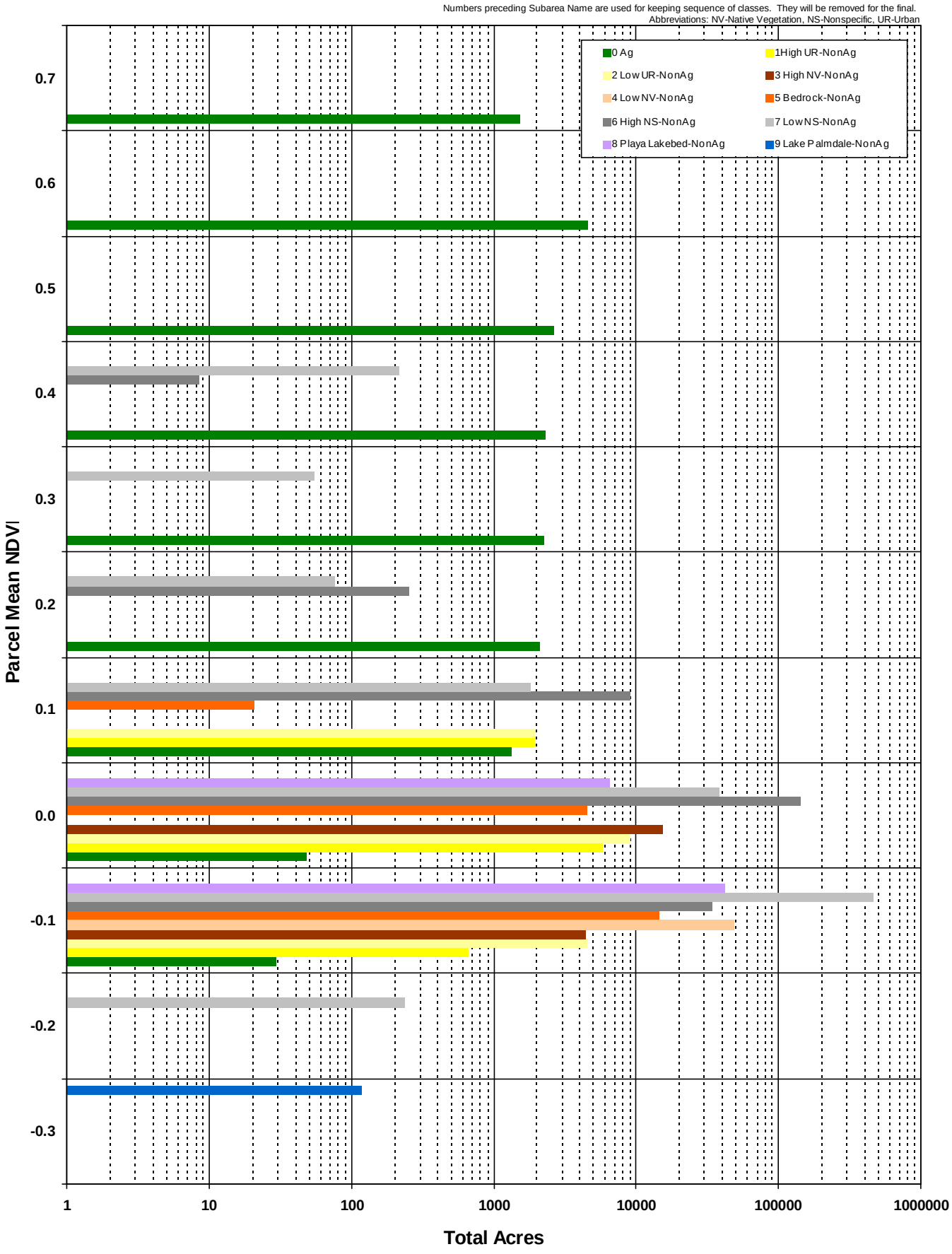
Appendix D-2: Figure 4g

Oct-1996 Parcel Mean NDVI



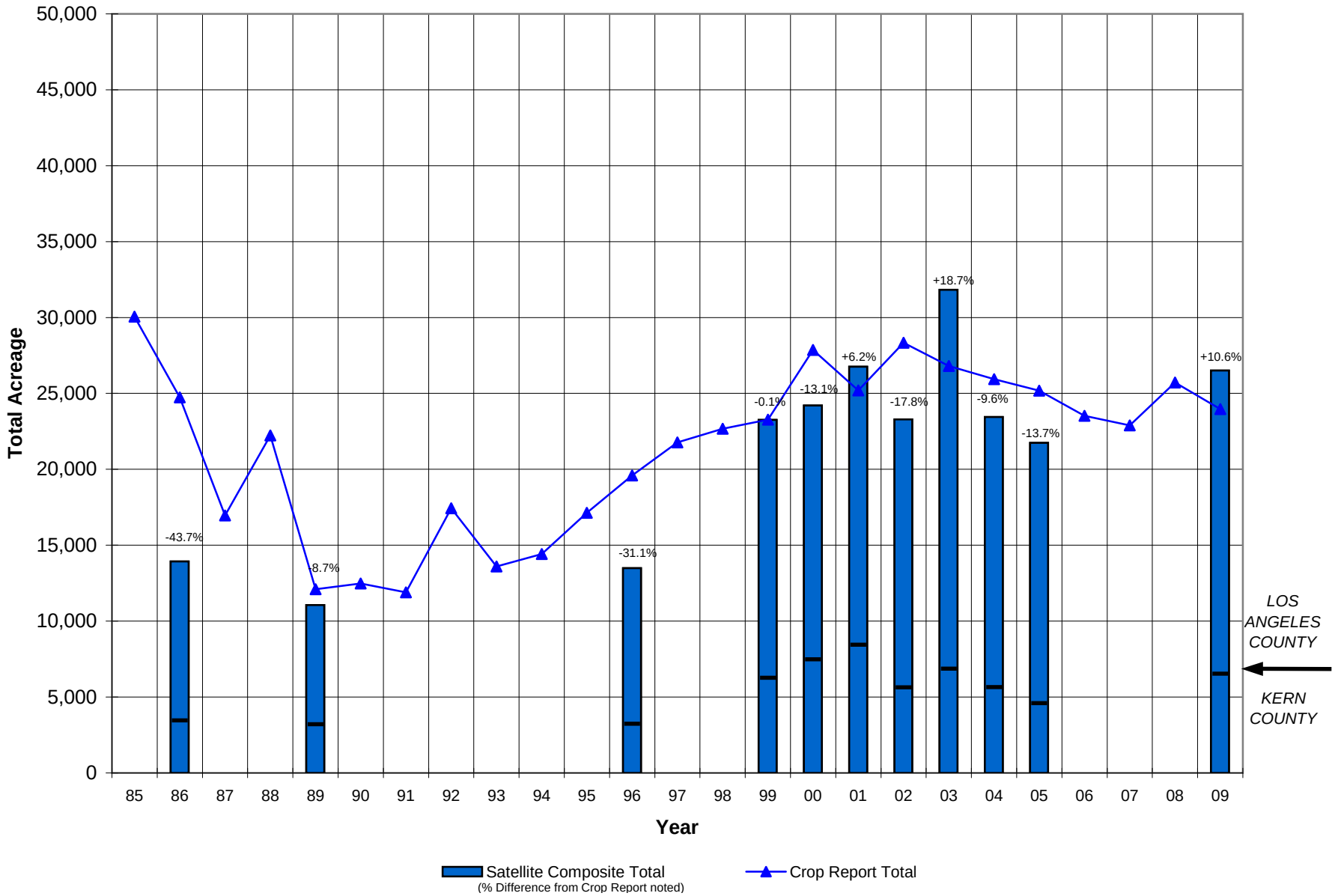
Appendix D-2: Figure 4h

Jul-1999 Parcel Mean NDVI



Appendix D-2: Figure 4i

Oct-1999 Parcel Mean NDVI



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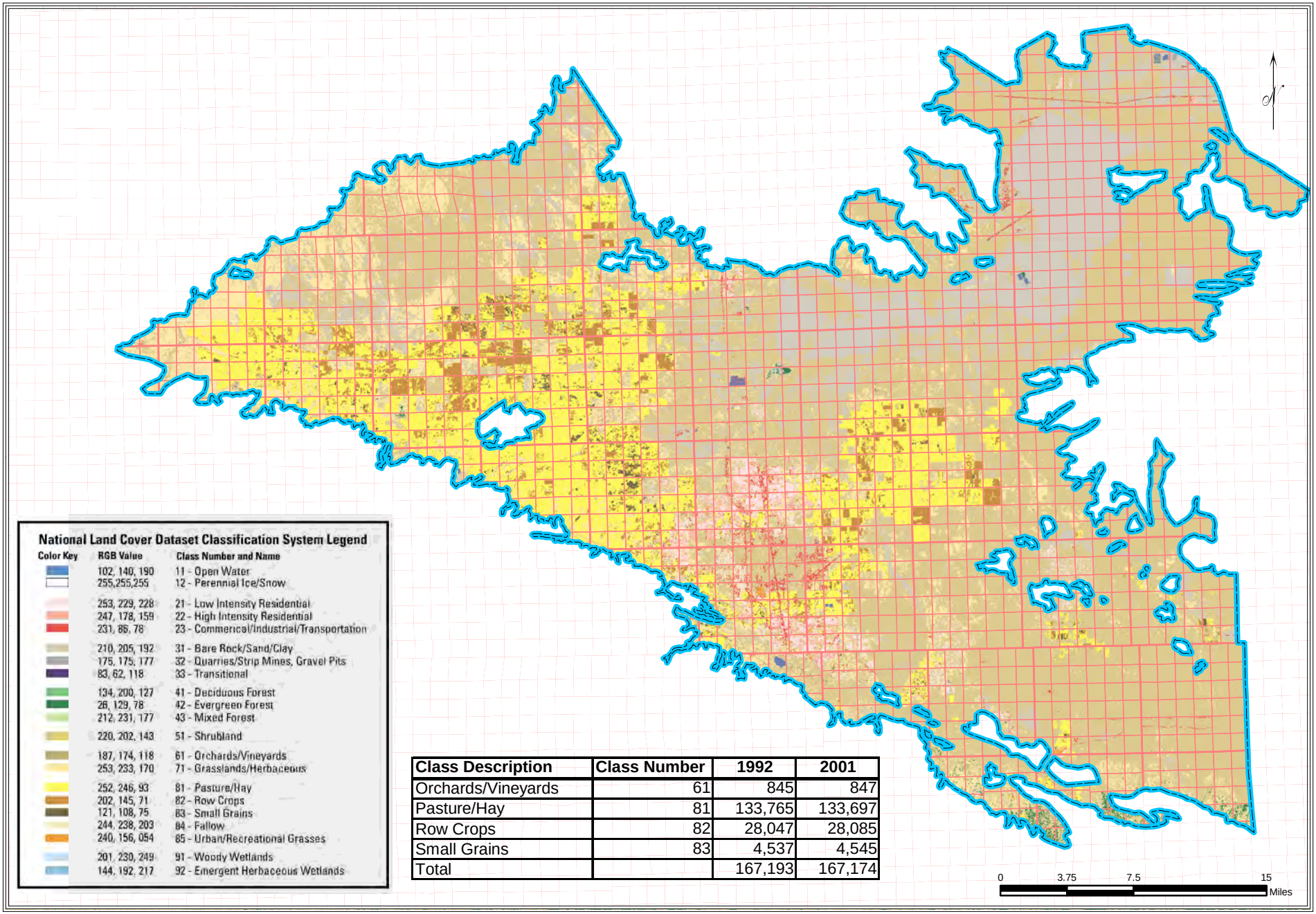
Appendix D-2: Figure 5
Satellite Image Interpretation and County Crop Report Comparison
Antelope Valley Area of Adjudication



Class Description	Class Number	1992	2001
Orchards/Vineyards	61	845	847
Pasture/Hay	81	133,765	133,697
Row Crops	82	28,047	28,085
Small Grains	83	4,537	4,545
Total		167,193	167,174

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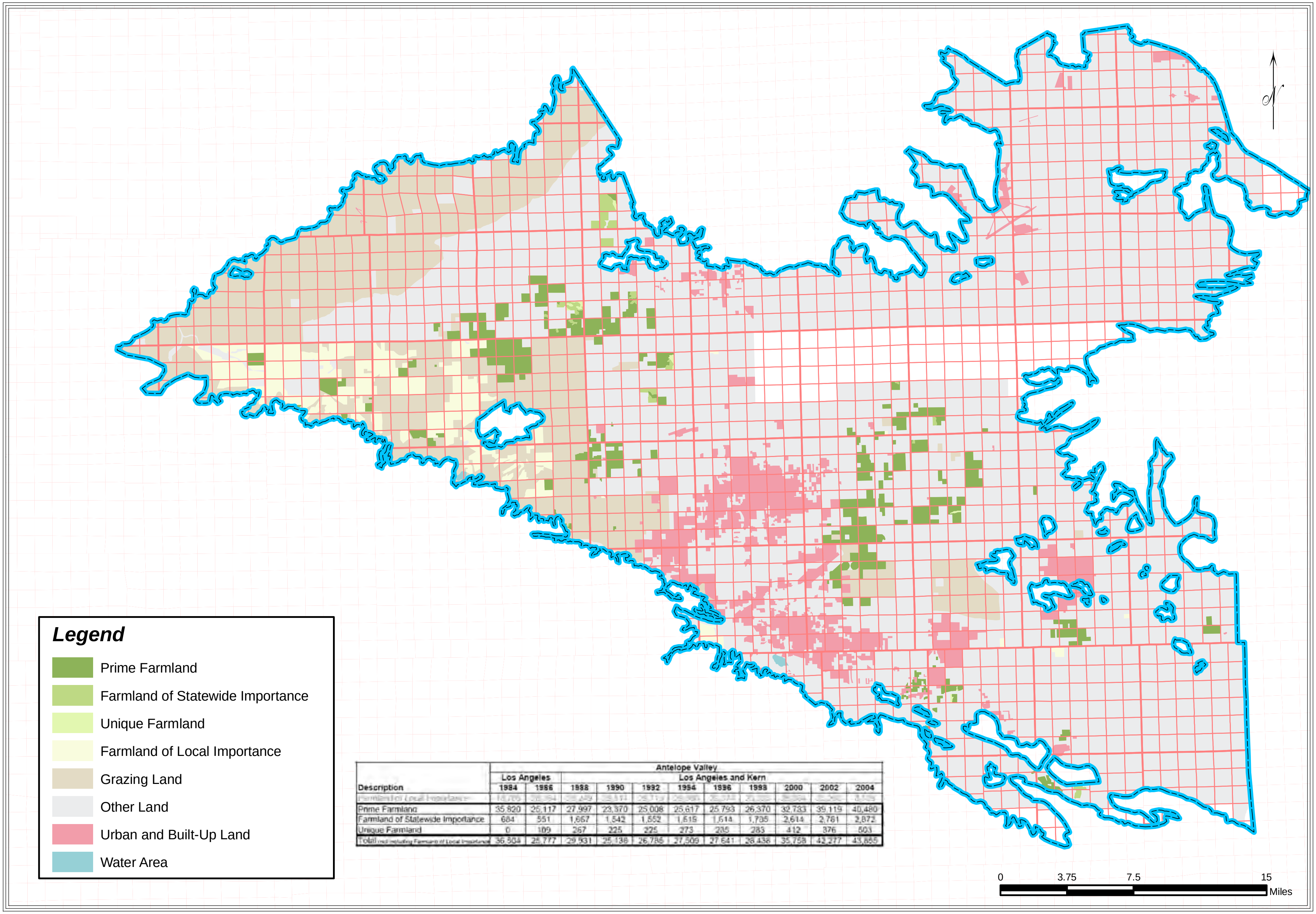
Appendix D-2: Figure 6
2001 Landuse in Antelope Valley
National Land Cover Dataset



Description	Antelope Valley										
	Los Angeles		Los Angeles and Kern								
	1984	1986	1988	1990	1992	1994	1996	1998	2000	2002	2004
Farmland of Local Importance	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Prime Farmland	35,820	25,117	27,997	23,370	25,008	25,617	25,793	26,370	32,733	39,119	40,480
Farmland of Statewide Importance	684	551	1,667	1,542	1,552	1,619	1,614	1,735	2,614	2,781	2,872
Unique Farmland	0	109	267	225	225	273	235	283	412	376	503
Total (not including Farmland of Local Importance)	36,504	25,777	29,931	25,136	26,785	27,509	27,641	28,438	35,758	42,277	43,855

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Appendix D-2: Figure 7
2000 Land Inventory and Monitoring in Antelope Valley
Farmland Mapping and Monitoring Program

Appendix D-3

Applied Crop Water Duties, Irrigation Efficiencies, and Agricultural Return Flows

Appendix D-3

Applied Crop Water Duties, Irrigation Efficiencies, and Agricultural Return Flows

In order to estimate water requirements for agricultural irrigation in some detail over recent time (since 1970), and as a basis for assessing historical as well as current agricultural water requirements, applied water duties for individual crops were developed and utilized as follows. As part of the development and utilization of crop water duties, it was recognized that irrigation practices and other farming practices require the application of more water than is simply required for plant growth. Of the additional applied water, some of it deep percolates and thus contributes to groundwater recharge as so-called return flow, while some of it is lost to evaporation and does not contribute to recharge. The fate of water applied in excess of plant water requirements was tracked as part of the overall development of crop water duties, primarily to estimate the amounts of applied water that contribute to groundwater recharge.

Applied Crop Water Duties

Included within the Los Angeles County annual crop reports and the Kern County annual pesticide use reports are crop acreage subdivisions applicable to the Antelope Valley for vegetable crops (notably onions and root vegetables), field crops (notably alfalfa), and fruit and nut crops. Those annual land use and crop acreage data were converted to water requirements using a CIMIS-based (California Irrigation Management Information System) approach where reference evapotranspiration data were coupled with various crop coefficients to first estimate the total annual evapotranspirative water requirements of the various crops grown in the Valley. Those requirements were then factored to consider any effective precipitation that would have reduced the need for applied water to meet the respective evapotranspirative water requirements. The resultant crop evapotranspirative water requirements were then converted to applied crop water requirements by considering irrigation system distribution uniformity values. Finally, applied water for cultural practices that involve the application of water for field preparation, pre-irrigation, and erosion control was added to the applied water for consumption of the crops to develop applied crop water duties (AW_T).

In sequential equation form, the preceding approach to estimating applied crop water requirements can be expressed as follows. The results are summarized in Appendix D-3: Tables 1 through 5.

Crop Water Requirement

$$ET_C = K_C * ET_O$$

where

ET_C = crop evapotranspirative requirement

K_C = crop coefficient

ET_O = reference evapotranspiration

Crop Evapotranspiration of Applied Water

$$ET_{AW} = ET_C - P_e$$

where

ET_{AW} = evapotranspiration of applied water

P_e = effective precipitation

Total Applied Water

$$AW_T = \frac{ET_{AW}}{DU} + AW_{er} + AW_{pr}$$

where

AW_T = total applied crop water duty

DU = distribution uniformity of irrigation system[1]

AW_{er} = applied water for erosion control

AW_{pr} = applied water for field preparation and pre-irrigation

The crops grown in the Antelope Valley, as reported by the Los Angeles and Kern County Agricultural Commissioners, were grouped into the following crop categories for purposes of estimating annual applied water requirements: alfalfa and irrigated pasture, carrots, deciduous orchard, grain (barley, wheat, hay, sorghum, sudan), melons and squash, onions, potatoes, sugar beets, and grapes. The daily reference evapotranspiration (ET_o) data reported for the nearest CIMIS station, at Victorville, shows only small fluctuation from year to year, so they were utilized to develop average ET_o values for each bimonthly and monthly period of the growth stages for each crop grown in the Antelope Valley. These values were calculated as the average of the daily data within each of the growth stage periods from each year of available data at the Victorville CIMIS station. The resultant bimonthly (and monthly) average ET_o values are tabulated in Appendix D-3: Table 1.

Crop coefficients (K_c) specific to the high desert of California for each of the growth stage periods of each crop category were derived from the University of California Cooperative Extension as listed in Appendix D-3: Table 5. Those crop coefficients were then combined with

[1] *DU is a term relating to the evenness of water application to plants throughout a field and is defined as:*

$$\frac{\text{Minimum depth of water applied to plants in a field}}{\text{Average amount of water applied to plants}} \times 100$$

where the minimum equals the average of the lowest quarter of the values. (ITRC, California Polytechnic State University, 1994).

the corresponding average ET_o values to estimate crop water requirements in the Antelope Valley. Specifically, the products of the K_c value and average ET_o for each bimonthly growth stage period were summed to estimate the total annual evapotranspirative water requirements (ET_c) of the various crops grown in the Valley (Appendix D-3: Table 2). Crop coefficients and growth stage periods for vineyard (grape crops) grown in California's high desert were not available; available monthly coefficients and growth stage periods specific to Yolo and Solano Counties were utilized with the Victorville ET_o values to estimate the annual crop water requirement ET_c for grapes grown in the Valley.

Interpretation of the seasonal variation in the relative amounts of precipitation and evaporation in the Valley indicated that, typically, evaporative losses exceed the amount of precipitation in all months from March through November so rainfall during those months was considered to be lost to evaporation and thus not available for uptake by the crops. Consequently, only the precipitation occurring in December through February would be available for the crops and approximately one-half of that was considered to be "effective precipitation" (P_e) that contributed to meeting ET_c of the various crops, and thus reduce applied water requirements. After allowing for effective precipitation (P_e) (up to the ET_c value), the remainder is the average amount of applied water required to directly meet crop evapotranspirative requirements (ET_{AW}), as summarized in Appendix D-3: Table 3.

The amount of total applied water needed to meet crop water requirements (ET_{AW}), specifically to accommodate irrigation distribution uniformities (DU) and cultural practices in the Valley, was then calculated. Published information suggests DU values are in the range of 80 percent and, for purposes of converting the applied water needed to meet crop water requirements (ET_{AW}) to applied crop water requirements (AW_c), the irrigation system DU was assumed to be 80 percent for all crops. Ultimately, that value was checked by computing overall irrigation efficiencies as described below, and then assessing the resultant values in the context of generally reported values in the Valley. For those crops where water is used for field preparation and pre-irrigation (all except pasture, orchard, and grapes) and/or are subject to damage from soil erosion in the Valley (carrots and onions), respective amounts of water were added to that applied at the estimated distribution uniformity for irrigation systems in the Valley. Published and anecdotal information suggests that, for alfalfa, carrot, grain, melon/squash, onion, potato, and sugar beet crops grown in the Antelope Valley, an additional 2 to 6.5 inches of water are applied for field preparation and pre-irrigation purposes (AW_{pr}); and for carrot and onion crops, an additional 3 to 6 inches of water are applied for erosion control (AW_{er}). Accordingly, the applied water requirements for those crops were increased by these amounts to arrive at estimates of total applied water (applied crop water duties, AW_T) as summarized in Appendix D-3: Table 4. Overall, the resultant values of total applied water in Appendix D-3: Table 4 are within ranges typically reported for crops and irrigation practices in the Antelope Valley.

Irrigation Efficiency

Historically, the term "irrigation efficiency" has been used to describe the fraction of total applied water that was consumptively used by a crop. With time, the definition of the term has been broadened to recognize that other uses of water associated with the growing and harvesting of crops are also beneficial. Thus, a modern definition of "irrigation efficiency" can be considered to be the ratio of that portion of applied water that is beneficially used for farming operations divided by total applied water, expressed as a percentage. In the Antelope Valley setting, the application of water for cultural practices that include field preparation, pre-irrigation, and erosion control can be considered a beneficial use of water. Thus, in this analysis, irrigation efficiency is defined as the fraction of total applied water that is consumptively used by a crop plus water used for field preparation, pre-irrigation, and erosion control.

In equation form, the preceding can be expressed as follows, where ET_{AW}, ET_{er} and ET_{pr} are as defined above.

Overall Irrigation Efficiency

$$E_{irr} = \frac{ET_{AW} + AW_{er} + AW_{pr}}{AW_T}$$

where

E_{irr} = overall efficiency of irrigation

Utilizing the preceding definition, the total beneficial use of water results in irrigation efficiency values in the range of 80 to 85 percent for the crops grown and the associated farming practices in the Antelope Valley, as delineated in Appendix D-3: Table 4.

Return Flows

As introduced above, most of the applied water in crop irrigation is consumptively used in plant growth. Additional water is applied for beneficial purposes such as field preparation, pre-irrigation, and erosion control. Some of the applied water not consumptively used by crops deep percolates and ultimately becomes groundwater recharge, while other of the additional applied water evaporates. Since the main focus of tracking the fate of applied water in excess of plant consumptive use was to estimate return flow contributions to groundwater recharge, the return flow component was estimated by first recognizing that applied irrigation in excess of plant water requirements contributes to return flow, and then separately considering the individual components of additional water applied to irrigated areas. Respectively, in the Antelope Valley, those components are for the purposes of erosion control, field preparation, and pre-irrigation.

Erosion Control – As delineated in Appendix D-3: Table 4, about 3 to 6 inches of water are applied during certain stages of plant growth for carrots and onions to resist the sand-blasting

effects of wind and the granular soils in the area. Over the course of overall plant growth cycles, those amounts of water are quite small since they are for the purpose of wetting only the uppermost soil profile to keep seedlings from being damaged by wind. Thus, that applied water is not expected to infiltrate to a sufficient depth to contribute to soil moisture that ultimately deep percolates. Consequently, water applied for erosion control is considered to be lost to evaporation from the uppermost soil profile, and not part of return flow.

Field Preparation and Pre-Irrigation – As delineated in Appendix D-3: Table 4, for certain crops, between 2 and 6.5 inches of additional water are applied for some combination of field preparation and pre-irrigation. In the one case of alfalfa, where soil moisture is maintained near field capacity throughout the year, the application of any water above crop water requirements is considered to contribute to an increase in soil moisture that, in turn, precipitates deep percolation past the crop root zone. Thus, all additional applied water is considered to be part of return flows that ultimately become groundwater recharge. For all other crops where additional water is applied for field preparation or pre-irrigation outside the period of active plant growth, all water is considered to contribute to soil moisture which can be later captured by the plants, or can be deep percolated as a result of subsequent application of water during the plant growing season. However, recognizing that the application of water outside the plant growing season results in shallow soil moisture being susceptible to evaporation, water in the uppermost 6 inches of soil is considered to be lost to evaporation and thus not part of the return flows that ultimately become groundwater recharge. For average Antelope Valley soil conditions, field capacity is about one inch per foot of depth. Thus, the application of 4 to 6 inches of water for field preparation and pre-irrigation of certain crops will tend to wet several feet of soil; of that, evaporation will consume water stored in the uppermost half-foot of soil profile (about one-half inch of water) and the balance is in the soil profile from which it can ultimately deep percolate as return flow to groundwater recharge.

Derivations of individual quantities of return flows on a per-crop basis, following the methodology described above, are delineated in Appendix D-3: Table 6. Total amounts of agricultural return flows, for selected years prior to 1970 (when the preceding level of detail was not available, and for which return flows were estimated to be 30 percent of total applied water) and for each year since 1970, are summarized in Appendix D-3: Table 7 and illustrated in Appendix D-3: Figure 1.

References

California Department of Water Resources, CIMIS Program, 1994-2003. Records of Reference Evapotranspiration, Victorville Station, California.

California Polytechnic State University, Irrigation Training and Research Center, 1994. *Drip and Microirrigation for Trees, Vines, and Row Crops,* 261 pp.

Kern County Agricultural Commissioner, 1994-2009. Annual Pesticide Use Reports (available online).

Los Angeles County Agricultural Commissioner, 1970-2009. Annual Crop and Livestock Reports.

Univ. of California, Cooperative Extension Program, 2004. *Table 2: "Normal Year" grass potential evapotranspiration (ETo), forage crop coefficients and ET for the High Desert.*

Appendix D-3: Table 1
Reference Evapotranspiration and Crop Coefficients by Growth Stage
Antelope Valley Area of Adjudication

		Reference Evapotranspiration*		Crop Coefficients**												
Growth Stage Periods		Monthly	Bimonthly	Alfalfa	Pasture	Deciduous	Grain	Fall Silage	Sugar Beets	Melons	Onions	Spring Carrots	Summer Carrots	Potatoes	Grapes***
		ET_o (in)	ET_o (in)	K_c	K_c	K_c	K_c	K_c	K_c	K_c	K_c	K_c	K_c	K_c	K_c
January	1	2.02	0.91	0.40	1.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2		1.11	0.40	1.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
February	1	2.61	1.18	0.40	1.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2		1.43	1.00	1.00	0.00	0.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
March	1	4.55	2.05	1.15	1.00	0.25	0.66	0.00	0.00	0.00	0.30	0.31	0.00	0.55	0.35
	2		2.50	1.15	1.00	0.54	0.92	0.00	0.15	0.18	0.30	0.55	0.00	0.61	
April	1	6.19	2.89	0.95	1.00	0.60	1.00	0.00	0.15	0.18	0.30	0.82	0.00	0.88	0.55
	2		3.30	0.95	1.00	0.66	1.00	0.00	0.37	0.34	0.53	1.03	0.00	1.16	
May	1	7.30	3.45	0.95	1.00	0.72	1.15	0.00	0.61	0.72	0.83	1.11	0.00	1.21	0.73
	2		3.85	0.95	1.00	0.79	1.10	0.00	0.88	1.11	1.14	1.13	0.31	1.19	
June	1	8.85	4.29	0.95	1.00	0.84	0.78	0.14	1.11	1.11	1.14	1.05	0.53	0.87	0.82
	2		4.56	0.95	1.00	0.86	0.00	0.25	1.11	1.11	1.14	1.00	0.82	0.55	
July	1	9.77	4.90	0.95	1.00	0.92	0.00	0.56	1.11	0.78	1.04	0.00	1.03	0.00	0.82
	2		4.87	0.95	1.00	0.94	0.00	1.00	1.07	0.29	0.92	0.00	1.11	0.00	
August	1	8.99	4.61	0.95	1.00	0.94	0.00	1.15	1.04	0.00	0.80	0.00	1.13	0.00	0.72
	2		4.38	0.95	1.00	0.94	0.00	1.20	1.00	0.00	0.68	0.00	1.05	0.00	
September	1	6.52	3.48	0.95	1.00	0.94	0.00	1.20	0.97	0.00	0.00	0.00	0.00	0.00	0.50
	2		3.04	0.95	1.00	0.91	0.00	1.06	0.00	0.00	0.00	0.00	0.00	0.00	
October	1	4.66	2.51	0.95	1.00	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2		2.15	0.95	1.00	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
November	1	2.68	1.64	0.95	1.00	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2		1.04	0.95	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
December	1	2.05	1.06	0.95	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2		0.99	0.95	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Total (inches)		66.19	66.19												
Total (feet)		5.52	5.52												

* Avg ET_o for specified periods, based on available historical and daily data at the Victorville CIMIS Station, 1994 - 2003

** Crop growth stages and coefficients from Univ. California Cooperative Extension; values for the California High Desert.

*** Crop coefficients for grapes from Univ. California Cooperative Extension; monthly values for Yolo and Solano Counties (High Desert value not available)

Appendix D-3: Table 2
Evapotranspiration of Crops
Antelope Valley Area of Adjudication

		Evapotranspiration of Crops											
Growth Stage Periods		Alfalfa	Pasture	Deciduous	Grain	Fall Silage	Sugar Beets	Melons	Onions	Spring Carrots	Summer Carrots	Potatoes	Grapes
		ET_c (in)	ET_c (in)	ET_c (in)	ET_c (in)	ET_c (in)	ET_c (in)	ET_c (in)	ET_c (in)	ET_c (in)	ET_c (in)	ET_c (in)	ET_c (in)
January	1	0.36	0.91	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2	0.44	1.11	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
February	1	0.47	1.18	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2	1.43	1.43	0.00	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
March	1	2.36	2.05	0.51	1.35	0.00	0.00	0.00	0.62	0.64	0.00	1.13	1.59
	2	2.88	2.50	1.35	2.30	0.00	0.38	0.45	0.75	1.38	0.00	1.53	
April	1	2.75	2.89	1.73	2.89	0.00	0.43	0.52	0.87	2.37	0.00	2.54	3.40
	2	3.14	3.30	2.18	3.30	0.00	1.22	1.12	1.75	3.40	0.00	3.83	
May	1	3.28	3.45	2.48	3.97	0.00	2.10	2.48	2.86	3.83	0.00	4.17	5.33
	2	3.66	3.85	3.04	4.24	0.00	3.39	4.27	4.39	4.35	1.19	4.58	
June	1	4.08	4.29	3.60	3.35	0.60	4.76	4.76	4.89	4.50	2.27	3.73	7.26
	2	4.33	4.56	3.92	0.00	1.14	5.06	5.06	5.20	4.56	3.74	2.51	
July	1	4.66	4.90	4.51	0.00	2.74	5.44	3.82	5.10	0.00	5.05	0.00	8.01
	2	4.63	4.87	4.58	0.00	4.87	5.21	1.41	4.48	0.00	5.41	0.00	
August	1	4.38	4.61	4.33	0.00	5.30	4.79	0.00	3.69	0.00	5.21	0.00	6.47
	2	4.16	4.38	4.12	0.00	5.26	4.38	0.00	2.98	0.00	4.60	0.00	
September	1	3.31	3.48	3.27	0.00	4.18	3.38	0.00	0.00	0.00	0.00	0.00	3.26
	2	2.89	3.04	2.77	0.00	3.22	0.00	0.00	0.00	0.00	0.00	0.00	
October	1	2.38	2.51	2.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2	2.04	2.15	1.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
November	1	1.56	1.64	1.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2	0.99	1.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
December	1	1.01	1.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2	0.94	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Total (inches)		62.10	66.19	47.38	22.94	27.31	40.55	23.91	37.57	25.02	27.47	24.02	35.33
Total (feet)		5.18	5.52	3.95	1.91	2.28	3.38	1.99	3.13	2.09	2.29	2.00	2.94

Appendix D-3: Table 3
Evapotranspiration of Applied Water
Antelope Valley Area of Adjudication

					Evapotranspiration of Applied Water											
Growth Stage Periods		Monthly Precipitation (in)	Bimonthly Precipitation (in)	Effective Precipitation P_e (in)	Alfalfa ET_{AW} (in)	Pasture ET_{AW} (in)	Deciduous ET_{AW} (in)	Grain ET_{AW} (in)	Fall Silage ET_{AW} (in)	Sugar Beets ET_{AW} (in)	Melons ET_{AW} (in)	Onions ET_{AW} (in)	Spring Carrots ET_{AW} (in)	Summer Carrots ET_{AW} (in)	Potatoes ET_{AW} (in)	Grapes ET_{AW} (in)
January	1	1.05	0.47	0.24	0.13	0.68	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2		0.58	0.29	0.15	0.82	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
February	1	1.95	0.88	0.44	0.03	0.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2		1.07	0.54	0.90	0.90	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
March	1	0.8	0.44	0.00	2.36	2.05	0.51	1.35	0.00	0.00	0.00	0.62	0.64	0.00	1.13	1.59
	2		0.36	0.00	2.88	2.50	1.35	2.30	0.00	0.38	0.45	0.75	1.38	0.00	1.53	
April	1	0.48	0.26	0.00	2.75	2.89	1.73	2.89	0.00	0.43	0.52	0.87	2.37	0.00	2.54	3.40
	2		0.22	0.00	3.14	3.30	2.18	3.30	0.00	1.22	1.12	1.75	3.40	0.00	3.83	
May	1	0.12	0.06	0.00	3.28	3.45	2.48	3.97	0.00	2.10	2.48	2.86	3.83	0.00	4.17	5.33
	2		0.06	0.00	3.66	3.85	3.04	4.24	0.00	3.39	4.27	4.39	4.35	1.19	4.58	
June	1	0.05	0.03	0.00	4.08	4.29	3.60	3.35	0.60	4.76	4.76	4.89	4.50	2.27	3.73	7.26
	2		0.02	0.00	4.33	4.56	3.92	0.00	1.14	5.06	5.06	5.20	4.56	3.74	2.51	
July	1	0.12	0.06	0.00	4.66	4.90	4.51	0.00	2.74	5.44	3.82	5.10	0.00	5.05	0.00	8.01
	2		0.06	0.00	4.63	4.87	4.58	0.00	4.87	5.21	1.41	4.48	0.00	5.41	0.00	
August	1	0.04	0.02	0.00	4.38	4.61	4.33	0.00	5.30	4.79	0.00	3.69	0.00	5.21	0.00	6.47
	2		0.02	0.00	4.16	4.38	4.12	0.00	5.26	4.38	0.00	2.98	0.00	4.60	0.00	
September	1	0.16	0.08	0.00	3.31	3.48	3.27	0.00	4.18	3.38	0.00	0.00	0.00	0.00	0.00	3.26
	2		0.08	0.00	2.89	3.04	2.77	0.00	3.22	0.00	0.00	0.00	0.00	0.00	0.00	
October	1	0.16	0.08	0.00	2.38	2.51	2.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2		0.08	0.00	2.04	2.15	1.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
November	1	0.37	0.14	0.00	1.56	1.64	1.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2		0.23	0.00	0.99	1.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
December	1	0.54	0.26	0.13	0.88	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2		0.28	0.14	0.80	0.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Total (inches)		5.84	5.84	1.77	60.33	64.42	47.38	21.52	27.31	40.55	23.91	37.57	25.02	27.47	24.02	35.33
Total (feet)		0.49	0.49	0.15	5.03	5.37	3.95	1.79	2.28	3.38	1.99	3.13	2.09	2.29	2.00	2.94

Appendix D-3: Table 4

Applied Crop Water Duties and Irrigation Efficiency Values

(DU = 80%)

Antelope Valley Area of Adjudication

Crop	ET_c[1] (in)	P_e[2] (in)	ET_{AW}[3] (in)	DU[4] (%)	AW_c[5] (in)	AW_{er}[6] (in)	AW_{pr}[7] (in)	AW_T[8] (in)	(ft)	E_{irr}[9] (%)
Alfalfa	62.10	1.77	60.33	80	75.42	0	2.0	77.42	6.5	81
Carrots	27.47	0.00	27.47	80	34.33	6	6.5	46.83	3.9	85
Grain	22.94	1.42	21.52	80	26.90	0	4.0	30.90	2.6	83
Melons/Squash	23.91	0.00	23.91	80	29.88	0	4.0	33.88	2.8	82
Onions	37.57	0.00	37.57	80	46.96	3	4.0	53.96	4.5	83
Orchard (Deciduous)	47.38	0.00	47.38	80	59.22	0	0.0	59.22	4.9	80
Pasture	66.19	1.77	64.42	80	80.53	0	0.0	80.53	6.7	80
Potatoes	24.02	0.00	24.02	80	30.03	0	4.0	34.03	2.8	82
Silage	27.31	0.00	27.31	80	34.14	0	4.0	38.14	3.2	82
Sugar Beets	40.55	0.00	40.55	80	50.68	0	4.0	54.68	4.6	81
Vineyard (Grapes)	35.33	0.00	35.33	80	44.16	0	0.0	44.16	3.7	80

[1] $ET_c = K_c * ET_o$ where ET_o = average ET_o for specified periods, based on data from Victorville CIMIS Station, 1994-2003); K_c values from Univ. California Cooperative Extension

[2] P_e = effective precipitation offsetting ET_c, up to 1/2 of the average precipitation, in Dec. - Feb., inclusive

[3] ET_{AW} = evapotranspiration of applied water = $ET_c - P_e$

[4] DU = irrigation distribution uniformity

[5] AW_c = applied water for crop requirement = $ET_{AW} \div DU$

[6] AW_{er} = applied water for erosion control

[7] AW_{pr} = applied water for field preparation and pre-irrigation

[8] AW_T = applied crop water duty = $AW_c + AW_{er} + Aw_{pr}$

[9] E_{irr} = overall irrigation efficiency for beneficial uses = $(ET_{AW} + AW_{er} + AW_{pr}) \div AW_T$

Appendix D-3: Table 5
Crop Coefficients and Growth Stages
California High Desert

UC CE University of California Cooperative Extension

Table 2. "Normal Year" grass potential evapotranspiration (ETo), forage crop coefficients and ET for the High Desert.

		Crop Coefficients (Kc) Values in the High Desert[1]														Crop Water Use estimates (ETc in inches) in the High Desert near Lancaster, CA.											
DATE	Pasture ETo	[2]Alfalfa	Silage 4/1-8/25	Silage 8/15-10/15	[3]Sudan	Cereal Forage	Sugar Beets	Peas/Beans	Onions	Carrots	Carrots	Potatoes	Deciduous Fruit Trees[4]	Melons	Sod	Pasture/ Sod	[2]Alfalfa	Silage 4/1-8/25	8/15-10/15	[3]Sudan	Cereal Forage	Sugar Beets	Peas/Beans	Onions	Carrots	Carrots	Potatoes	Deciduous Fruit Trees	Melons
1/1	0.87	0.40				0.30									1.00	0.87	0.35				0.26								
1/15	1.07	0.40				0.30									1.00	1.07	0.43				0.32								
2/1	1.19	0.40				0.30				2					1.00	1.19	0.48				0.36				2.38				
2/15	1.45	1.00				0.41				2					1.00	1.45	1.45				0.60				2.90				
3/1	2.08	1.15				0.56			2.00	0.31		0.55	0.25		1.00	2.08	2.39				1.37			4.15	0.64		1.14	0.52	
3/15	2.54	1.15				0.92	0.15	0.14	0.30	0.55		0.61	0.54	0.18	1.00	2.54	2.92				2.34	0.38	0.36	0.76	1.40		1.55	1.37	0.46
4/1	2.80	0.95	0.14			1.00	0.15	0.14	0.30	0.82		0.88	0.60	0.18	1.00	2.80	2.66	0.35			2.80	0.42	0.39	0.84	2.30		2.46	1.68	0.50
4/15	3.20	0.95	0.18			1.00	0.37	0.46	0.53	1.03		1.16	0.66	0.24	1.00	3.20	3.04	0.56			3.20	1.18	1.47	1.70	3.30		3.71	2.11	1.09
5/1	3.60	0.95	0.31			1.15	0.61	1.11	0.83	1.11	2	1.21	0.72	0.72	1.00	3.60	3.42	1.13			4.14	2.20	4.00	2.99	4.00	7.20	4.36	2.59	2.59
5/15	4.01	0.95	0.94			1.10	0.88	1.15	1.14	1.13	0.31	1.19	0.79	1.11	1.00	4.01	3.91	3.76			4.41	3.53	4.61	4.57	4.53	1.24	4.77	3.17	4.45
6/1	4.25	0.95	1.14	0.14		0.79	1.11	1.16	1.14	1.06	0.55	0.87	0.84	1.11	1.00	4.25	4.04	4.83	0.68		3.32	4.72	4.89	4.86	4.46	2.34	3.70	3.57	4.72
6/15	4.52	0.95	1.18	0.25	0.30		1.11	0.93	1.14	1.00	0.82	0.55	0.86	1.11	1.00	4.52	4.29	5.33	1.13	1.36		5.02	4.20	5.15	4.82	3.71	2.49	3.89	5.02
7/1	4.65	0.95	1.18	0.55	0.85		1.11	0.49	1.04		1.03		0.92	0.78	1.00	4.65	4.61	5.72	2.73	4.12		5.36	2.38	5.04		5.00		4.46	3.78
7/15	4.83	0.95	1.15	1.00	1.10		1.07		0.92		1.11		0.94	0.29	1.00	4.83	4.59	5.55	4.83	5.31		5.17		4.44		5.36		4.54	1.40
8/1	4.50	0.95	1.05	1.15	0.65		1.04		0.80		1.13		0.94		1.00	4.50	4.28	4.78	5.16	3.93		4.68		3.60		5.09		4.23	
8/15	4.28	0.95	0.99	1.20	1.10		1.00		0.68		1.05		0.94		1.00	4.28	4.07	4.17	5.14	4.71		4.28		2.91		4.48		4.02	
9/1	3.75	0.95		1.20	0.85		0.97						0.94		1.00	3.75	3.56		4.50	3.19		3.64				0.00		3.53	
9/15	3.27	0.95		1.05	1.00								0.91		1.00	3.27	3.11		3.47	3.27						0.00		2.99	
10/1	2.90	0.95			1.10								0.85		1.00	2.90	2.76			3.19								2.47	
10/15	2.48	0.95			1.10								0.79		1.00	2.48	2.36			2.73								1.96	
11/1	1.70	0.95											0.70		1.00	1.70	1.62											1.19	
11/15	1.07	0.95													1.00	1.07	1.02												
12/1	0.97	0.95													1.00	0.97	0.92												
12/15	0.90	0.95													1.00	0.90	0.86												
TOTALS	67.66																												
												Total Inches of Water Use				67.66	63.00	36.23	27.56	31.70	23.11	40.59	22.29	41.91	30.42	34.42	34.16	48.27	34.01
												Irrigation Efficiency Estimate				80%	80%	80%	80%	80%	80%	75%	75%	75%	75%	75%	75%	75% before 1991 80% after 1991	75%
												Acre Feet of Water Use																	

[1]Crop Coefficients (Kc) were adapted from two sources.
1.) Hanson, B.R., L. Shwankl, and A. Fulton. 1999. Scheduling Irrigations: When and how much water to apply. Water Management Series Publication number 3396. Dept. of Land, Air Water Resources, University of California, Davis, California. Pp. 177-181.

2.) Pruitt, W.O., E. Fereres, K. Kaita, and R.L. Snyder. 1987. "Reference Evapotranspiration (ETo) for California." UC Bull. 1922. Pp. 13-13.

[2]Kc of 0.95 takes into account reduced ET during cuttings over season.

[3]Sudan cut 7/1, 8/15, and 10/15. ET reduced for 1 to 2 weeks after cutting.

[4]Deciduous Fruit Tree crop coefficients were adapted from Orloff, S.B. Deciduous Orchard Water Use, clean cultivated trees for a normal year in Litterock. Local Extension publication.

Pasture ETo and Forage crop Kc values were drafted by B.L. Sanden,Kern County Farm Advisor, 2002.
Modified by G.J. Poole, LA County Farm Advisor, 2004.

Appendix D-3: Table 6
Return Flow Rates Utilized with Crop Acreages Reported for 1970 - 2009
(developed from Appendix D-3: Table 4)

	ET of Applied Water ET_{AW}	Applied Crop Water Duty AW_T		Applied Water above ET_{AW} $(AW_T - ET_{AW})$		Applied Water for Erosion Control AW_{er}	Applied Water for Pre-Irrigation AW_{pr}	Evaporated Portion of AW_{pr}[1]	Return Flow[2]	
Crop	(in)	(in)	(ft)	(in)	(ft)	(in)	(in)	(in)	(in)	(ft)
Alfalfa	60.33	77.42	6.5	17.08	1.42	0	2.0	0.0	17.08	1.42
Carrots	27.47	46.83	3.9	19.37	1.61	6	6.5	0.5	12.87	1.07
Grain	21.52	30.90	2.6	9.38	0.78	0	4.0	0.5	8.88	0.74
Melons/Squash	23.91	33.88	2.8	9.98	0.83	0	4.0	0.5	9.48	0.79
Onions	37.57	53.96	4.5	16.39	1.37	3	4.0	0.5	12.89	1.07
Orchard (Deciduous)	47.38	59.22	4.9	11.84	0.99	0	0.0	0.0	11.84	0.99
Pasture	64.42	80.53	6.7	16.11	1.34	0	0.0	0.0	16.11	1.34
Potatoes	24.02	34.03	2.8	10.01	0.83	0	4.0	0.5	9.51	0.79
Silage	27.31	38.14	3.2	10.83	0.90	0	4.0	0.5	10.33	0.86
Sugar Beets	40.55	54.68	4.6	14.14	1.18	0	4.0	0.5	13.64	1.14
Vineyard (Grapes)	35.33	44.16	3.7	8.83	0.74	0	0.0	0.0	8.83	0.74

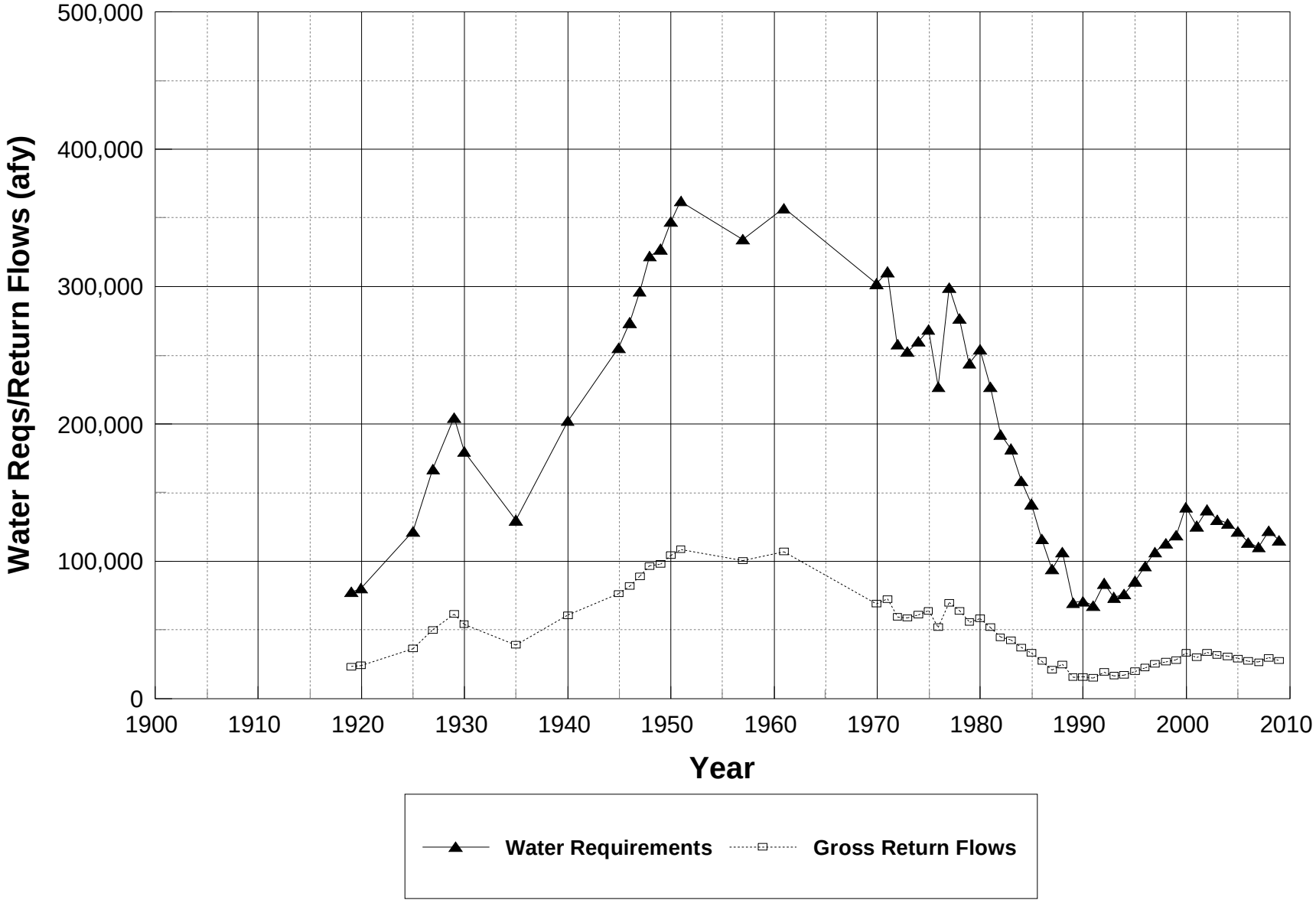
1) 1/2" (only for crops with $AW_{pr} > 2.00$")
2) Applied Water above ET_{AW} - AW_{er} - Evaporated Portion of AW_{pr}

Appendix D-3: Table 7
Historical Agricultural Return Flows
Antelope Valley Area of Adjudication
(all values in acre-feet)

	Calculated from Water Requirements (Snyder and DWR Acreages, and DU=70%)[1]		Calculated from Crop Acreages (LA/Kern County Crop/Pesticide Reports) and CIMIS-Derived Return Flow Rates (DU=80%)[2]											
	Total		Alfalfa/ Pasture	Grain	Carrots	Onions	Orchard	Sugar Beets	Melons and Squash	Potatoes	Grapes	Subtotal	Unreported Farms	Total	Historical Total
	30% of Water Requirement		1.4	0.7	1.1	1.1	1.0	1.1	0.8	0.8	0.7		(5% of Subtotal)		
			(in ac-feet/acre)												
Year[3]	Snyder	DWR													
1919	**23,269**														**23,269**
1920	**24,182**														**24,182**
1925	**36,524**														**36,524**
1927	**50,270**														**50,270**
1929	**61,417**														**61,417**
1930	**54,034**														**54,034**
1935	**39,053**														**39,053**
1940	**60,704**														**60,704**
1945	**76,593**														**76,593**
1946	**82,188**														**82,188**
1947	**89,027**														**89,027**
1948	**96,749**														**96,749**
1949	**98,305**														**98,305**
1950	**104,303**														**104,303**
1951	**108,765**														**108,765**
1957		**100,316**													**100,316**
1961		**107,209**													**107,209**
1970			45,966	12,572	86	1,035	2,351	2,805	753	0	0	65,568	3,278	**68,846**	**68,846**
1971			42,640	18,933	96	1,084	2,423	2,932	872	0	0	68,980	3,449	**72,429**	**72,429**
1972			37,279	12,950	76	948	2,033	2,683	666	0	0	56,634	2,832	**59,466**	**59,466**
1973			35,077	14,514	77	1,126	2,035	2,372	659	0	0	55,860	2,793	**58,653**	**58,653**
1974			33,250	18,759	84	1,216	2,028	2,289	781	0	0	58,407	2,920	**61,327**	**61,327**
1975			32,461	21,393	89	1,760	1,916	2,509	861	0	0	60,990	3,049	**64,039**	**64,039**
1976			32,432	9,692	66	2,029	1,546	2,970	897	0	0	49,633	2,482	**52,115**	**52,115**
1977			38,153	15,023	1,333	3,711	1,700	5,386	988	395	0	66,688	3,334	**70,023**	**70,023**
1978			37,637	13,223	82	2,750	1,662	4,698	892	0	0	60,944	3,047	**63,991**	**63,991**
1979			35,976	8,422	165	2,609	1,617	3,381	656	63	0	52,889	2,644	**55,533**	**55,533**
1980			35,983	10,239	127	1,283	1,775	5,335	825	0	0	55,566	2,778	**58,345**	**58,345**
1981			32,045	9,469	151	1,791	1,400	4,004	850	0	0	49,711	2,486	**52,196**	**52,196**
1982			26,292	10,362	251	2,196	1,387	1,135	954	0	0	42,576	2,129	**44,705**	**44,705**
1983			22,971	11,733	58	2,591	1,341	1,100	917	0	0	40,712	2,036	**42,747**	**42,747**
1984			19,898	10,260	116	2,122	1,341	943	870	0	0	35,549	1,777	**37,326**	**37,326**
1985			17,528	9,340	121	2,172	1,256	581	787	0	0	31,785	1,589	**33,374**	**33,374**
1986			14,066	7,738	128	1,977	1,079	478	602	0	0	26,068	1,303	**27,371**	**27,371**
1987			14,007	2,345	125	1,874	1,088	343	406	0	0	20,188	1,009	**21,197**	**21,197**
1988			12,908	6,237	117	2,218	1,185	489	608	0	0	23,762	1,188	**24,950**	**24,950**
1989			10,054	942	114	2,011	1,130	287	213	0	0	14,750	738	**15,488**	**15,488**
1990			10,180	1,118	142	1,905	1,195	316	232	0	0	15,089	754	**15,843**	**15,843**
1991			9,607	934	53	2,056	1,155	320	279	0	0	14,405	720	**15,125**	**15,125**
1992			9,699	4,571	43	2,186	1,254	496	424	0	0	18,672	934	**19,606**	**19,606**
1993			9,709	1,808	49	2,001	1,494	408	350	0	0	15,819	791	**16,610**	**16,610**
1994			9,645	2,408	55	1,775	1,683	410	403	0	0	16,379	819	**17,198**	**17,198**
1995			9,930	3,518	930	2,579	1,329	137	435	0	0	18,857	943	**19,800**	**19,800**
1996			9,923	3,286	3,606	2,947	1,372	205	295	0	0	21,635	1,082	**22,717**	**22,717**
1997			10,488	2,902	5,891	3,016	1,397	85	418	0	11	24,209	1,210	**25,419**	**25,419**
1998			10,221	1,410	8,709	3,190	1,591	85	256	253	18	25,733	1,287	**27,019**	**27,019**
1999			11,784	1,019	8,733	2,895	1,731	85	225	379	19	26,872	1,344	**28,216**	**28,216**
2000			12,208	1,074	11,542	3,535	2,103	465	193	630	24	31,774	1,589	**33,363**	**33,363**
2001			10,931	1,202	10,149	3,202	2,121	302	187	472	36	28,602	1,430	**30,032**	**30,032**
2002			11,142	1,260	15,117	2,378	1,433	46	255	363	40	32,033	1,602	**33,634**	**33,634**
2003			10,166	1,144	12,607	4,042	1,396	91	170	525	46	30,188	1,509	**31,698**	**31,698**
2004			10,784	1,319	11,721	3,518	1,412	46	171	311	104	29,386	1,469	**30,855**	**30,855**
2005			9,904	1,943	10,603	3,594	1,349	46	182	371	79	28,070	1,404	**29,474**	**29,474**
2006			9,437	2,120	8,695	3,469	1,784	0	61	444	84	26,094	1,305	**27,398**	**27,398**
2007			9,516	2,570	7,963	2,786	1,779	0	218	312	80	25,225	1,261	**26,486**	**26,486**
2008			9,414	2,599	10,778	3,183	1,802	0	131	251	98	28,257	1,413	**29,670**	**29,670**
2009			9,471	2,586	8,897	3,497	1,802	0	131	0	98	26,483	1,324	**27,807**	**27,807**

1) Years 1919 through 1961, Return Flows = Applied Water above ET_{AW} = 30% of Total Water Requirement.
2) Years 1970 through 2009, Return Flows = Return Flow Rates x Reported Crop Acreages
(see corresponding table, "Appendix D-3: Table 6, Return Flow Rates Utilized with Crop Acreages Reported for 1970 - 2009").
3) For years with no reported crop acreage information, water requirements and return flows were estimated by linear interpolation.

Appendix D-3: Figure 1
Agricultural Water Requirements and Gross Return Flows
Antelope Valley Area of Adjudication



Appendix D-4

Per Capita Water Use, Mutual and Private Water Companies

Appendix D-4: Table 1
Annual Water Requirement and Per Capita Water Use
Antelope Valley Mutual Water Companies

					DHS Data										Public Data	USGS Data										Per Capita/Connection Estimations (water req, 1992-95/population 2001-2006; in acre-feet)									
		DHS	Public	USGS	Population					Connections				Connections	Groundwater Pumpage (afy)				Surface Water Deliveries (afy)				Total Water Requirement (afy)				pop	pop	conn	conn	water req	water req	water req	per cap	per cap	per conn	per conn
System Name	Status	Listing	Listing	Listing	2001	2003*	2004	2005	2006	2001	2004	2005	2006	2005?	1992	1993	1994	1995	1992	1993	1994	1995	1992	1993	1994	1995	min	max	min	max	min	max	avg	max	min	max	min
Antelope Park MWC	MWC	x	x	x	390		390	390	390	136	136	136	136	136	161.1	149.5	162.5	162	0	0	0	0	161.1	149.5	162.5	162	390	390	136	136	150	163	159	0.41	0.41	1.17	1.17
Antelope Valley Progressive Club	MWC		x											0																						
Aqua J MWC	MWC	x	x	x	75		125	125	125	49	49	49	49	49	53.6	58.2	59	64.2	0	0	0	0	53.6	58.2	59	64.2	75	125	49	49	54	64	59	0.78	0.47	1.20	1.20
Averydale MWC	MWC	x	x	x	1,500		1,500	1,500	1,500	258	258	258	258	291	287.8	296.1	317.6	312.2	0	0	0	0	287.8	296.1	317.6	312.2	1500	1500	258	258	288	318	303	0.20	0.20	1.18	1.18
Baxter MWC	MWC		x											0																						
Big Rock MWC	MWC		x											0																						
Bleich Flats MWC	MWC	x		x	75		75	75	75	25	25	25	25		17.2	16.3	16.9	21	0	0	0	0	17.2	16.3	16.9	21	75	75	25	25	16	21	18	0.24	0.24	0.71	0.71
Colorado MWC	MWC	x	x		50		50	50	50	12	12	12	12	12													50	50	12	12							
Davenport Mutual Water System	MWC	x			42		42	42	42	17	17	17	17														42	42	17	17							
Deep Well Water Company	MWC		x											0																						
Edgemont Acres MWC	MWC	x	x	x	650		650	650	650	133	133	133	133	144	0	0	0	0	70	53	27	45	70	53	27	45	650	650	133	133	27	70	49	0.08	0.08	0.37	0.37
El Dorado MWC	MWC	x	x	x	600		600	600	600	197	197	197	197	230	117.4	195.3	39.6	47.5	190	117	308	304	307.4	312.3	347.6	351.5	600	600	197	197	307	352	330	0.55	0.55	1.67	1.67
Evergreen MWC	MWC	x	x	x	60		60	60	60	39	39	39	39	46	80	81	82	81	0	0	0	0	80	81	82	81	60	60	39	39	80	82	81	1.35	1.35	2.08	2.08
First Mutual Water System	MWC	x	x		41		41	41	41	15	15	15	15	16													41	41	15	15							
Fortieth Street MWC	MWC		x											0																						
Great Western Water Service	MWC		x											0																						
Green Grove MWC, Inc.	MWC		x											0																						
Joshua Acres MWC	MWC	x	x		30		30	30	30	10	10	10	10	0													30	30	10	10							
Kebb Company	MWC		x											0																						
Land Projects MWC	MWC	x	x	x	1,440		1,440	1,440	1,440	456	456	456	456	0	795.5	782.6	915.4	869.7	0	0	0	0	795.5	782.6	915.4	869.7	1440	1440	456	456	783	915	841	0.58	0.58	1.84	1.84
Landale MWC (CalWater)	MWC	x		x	300		382	382	382	145	166	166	166		0	220.7	---	---	1	15	0	0	1	235.7	---	---	300	382	145	166	0	236	59	0.20	0.15	0.41	0.36
Lands of Promise (CalWater)	MWC	x			198		198	198	198	62	62	62	62														198	198	62	62							
Llano Falls MWC	MWC		x											0																						
Llano Farms MWC	MWC		x			40								0																						
Llano MWC	MWC		x											0																						
Mettler Valley MWC	MWC	x			200		200	200	200	98	98	98	98														200	200	98	98							
Olsen A. Berto MWC	MWC		x											0																						
Piute MWC	MWC	x	x		45		45	45	45	14	14	14	14	0													45	45	14	14							
Reesedale MWC	MWC	x	x		68		68	68	68	22	22	22	22	22													68	68	22	22							
Rosamond MWC	MWC	x	x			60								60																						
Shadow Acres MWC	MWC	x	x	x	300		300	300	300	93	115	115	115	155	3.7	4	4.3	4.6	133	160	154	163	136.7	164	158.3	167.6	300	300	93	115	137	168	157	0.52	0.52	1.68	1.36
Sundale MWC	MWC	x	x		350		350	350	350	138	138	138	138	138													350	350	138	138							
Sunnyside Farms MWC	MWC	x	x	x	405		405	405	405	139	139	139	139	150	4.6	4.6	4.6	4.6	226	219	236	242	230.6	223.6	240.6	246.6	405	405	139	139	224	247	235	0.58	0.58	1.69	1.69
Tierra Bonita MWC	MWC	x	x	x	35		35	35	35	15	15	15	15	15	16.9	16.9	16.9	16.9	0	0	0	0	16.9	16.9	16.9	16.9	35	35	15	15	17	17	17	0.48	0.48	1.13	1.13
West Side Park MWC	MWC	x	x	x	300		550	550	550	193	144	144	144	193	230	176	96.7	238	0	47	131	24	230	223	227.7	262	300	550	144	193	223	262	236	0.79	0.43	1.64	1.22
White Fence Farms MWC #1/#2	MWC	x	x	x	1,571		1,571	1,571	1,760	425	425	425	440	0	590.4	257.5	304.9	583.5	22	398	316	120	612.4	655.5	620.9	703.5	1571	1760	425	440	612	704	648	0.41	0.37	1.52	1.47
White Fence Farms MWC #3	MWC	x	x	x	612		612	612	522	204	204	204	227	0	0	0	0	0	391	382	425	414	391	382	425	414	522	612	204	227	382	425	403	0.77	0.66	1.98	1.78
Wilsona Gardens MWC	MWC	x	x		75		75	75	75	32	32	32	32	0													75	75	32	32							
Avenue A Water Well Association	Private	x			41		41	41	41	13	13	13	13														41	41	13	13							
Dunes Apartments Water System	Private	x			30		30	30	30	17	17	17	17														30	30	17	17							
Fitts Water System	Private	x			74		74	74	74	37	37	37	37														74	74	37	37							
Lancaster Water Company	Private	x			80		80	80	80	24	24	24	24														80	80	24	24							
Little Baldy Water Company*	Private	x	x	x	76		76	76	76	23	27	27	27	0	0	0	0	0	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	76	76	23	27	22	22	22	0.29	0.29	0.94	0.80
Llano Del Rio Water Company	Private	x	x		449		449	449	449	136	163	163	163	0													449	449	136	163							
Mile High Water Association	Private	x			25		25	25	25	4	4	4	4														25	25	4	4							

			afy/capita		afy/connection	
With Evergreen MWC			0.51	0.46	1.33	1.25
Without Evergreen MWC			0.46	**0.40**	1.28	**1.20**

		2001	2003	2004	2005	2006	2001	2004	2005	2006
Total Reported Population/Connections		10,187	---	10,569	10,569	10,668	3,181	3,206	3,206	3,244
Additional Population (based on 2003 data)*		100	100	100	100	100	35	35	35	35
Additional Population/Connections (unreported)**		1,650	1,650	1,650	1,650	1,650	550	550	550	550
Total Population/Connections		11,937	---	12,319	12,319	12,418	3,766	3,791	3,791	3,829
Water Req (Per Capita in afy)	Rate= 0.28	3,342		3,449	3,449	3,477				
Water Req (Per Capita in afy)	**Rate= 0.40**	**4,775**		**4,928**	**4,928**	**4,967**				
Water Req (Per Connection in afy)	Rate= 1.10						4,143	4,170	4,170	4,212
Water Req (Per Connection in afy)	Rate= 1.25						4,708	4,739	4,739	4,786

	2001	2004	2005	2006
Total Water Requirement Main Purveyors	99,805	103,065	101,335	103,136
Total Water Requirement All Water Companies	4,775	4,928	4,928	4,967
% of Main Purveyors by Year	4.78	4.78	4.86	4.82
Average % of Main Purveyors				**4.81**

Compared to average afy/capita*	
LACWWD40	0.38
PWD	0.28

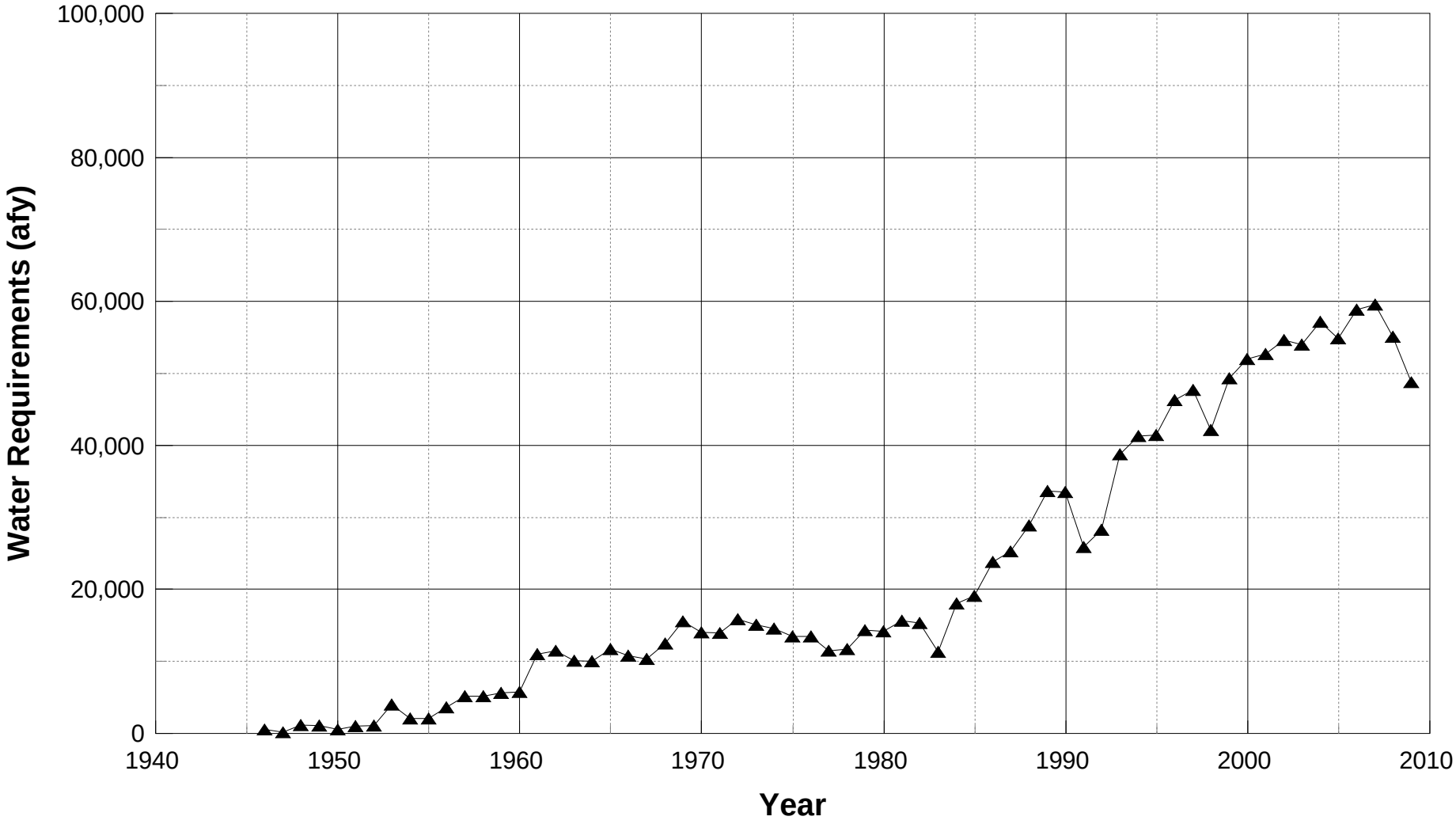
* IRWMP

*limited to population data for Llano Farms MWC and Rosamond MWC; number of connections assumed based on avg 3 people/connection.
** based on average population of 150 (median number of connections approx. = 50) for reported MWCs, applied to 11 unreported MWCs.

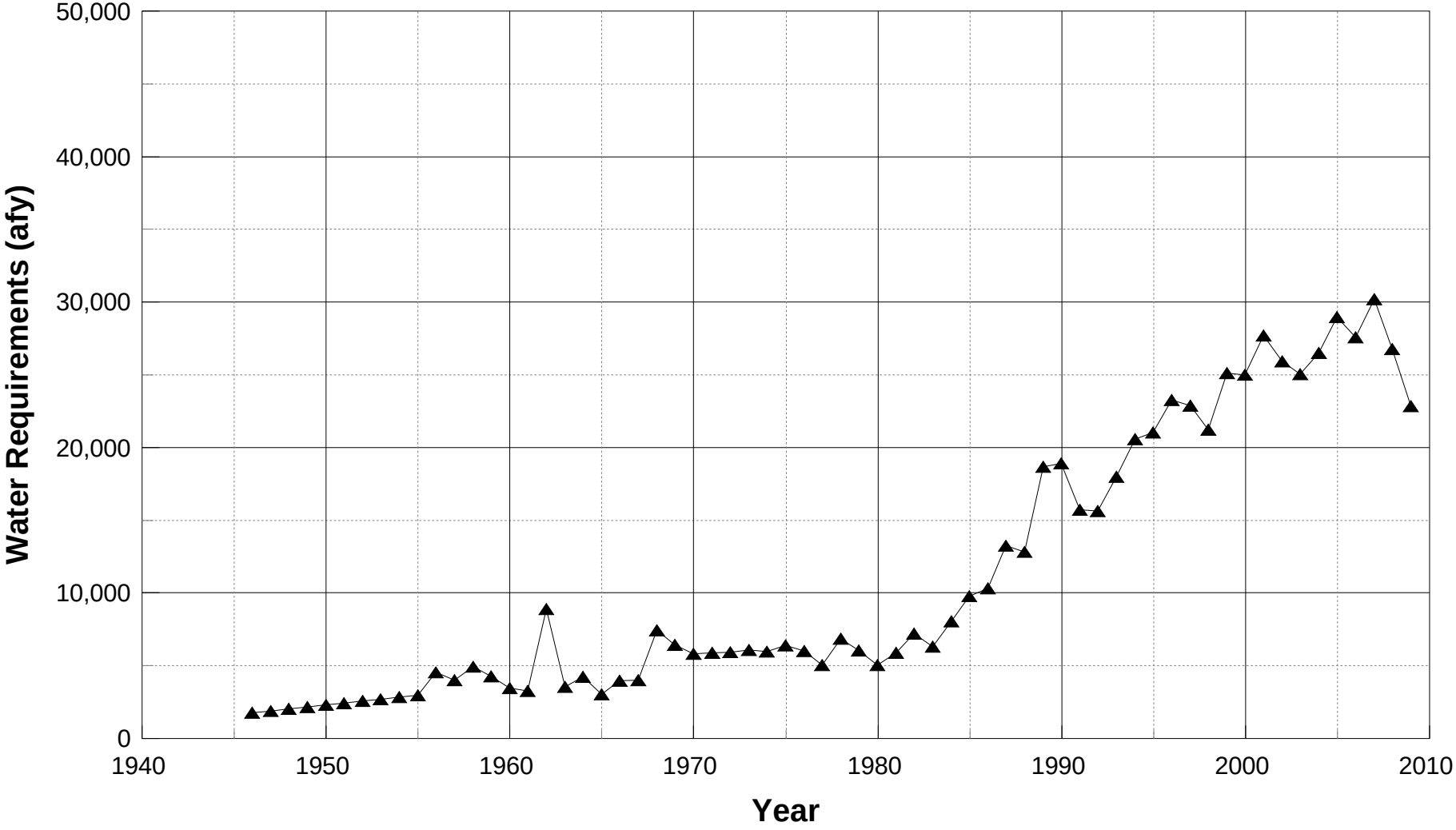
Appendix D-5

Historical M&I Water Requirements

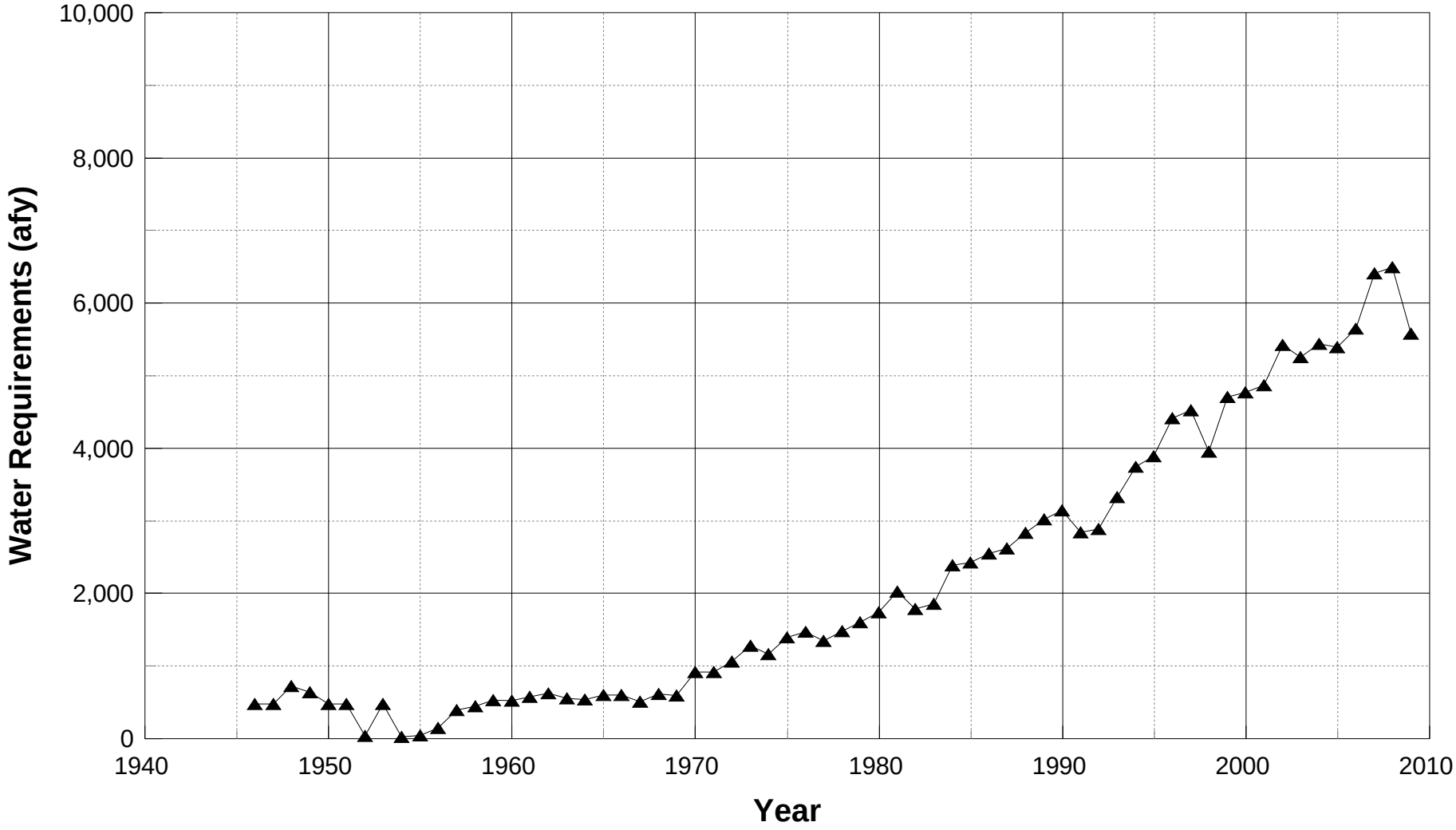
Appendix D-5: Figure 1
Historical Municipal Water Requirements
Los Angeles County Waterworks District No. 40



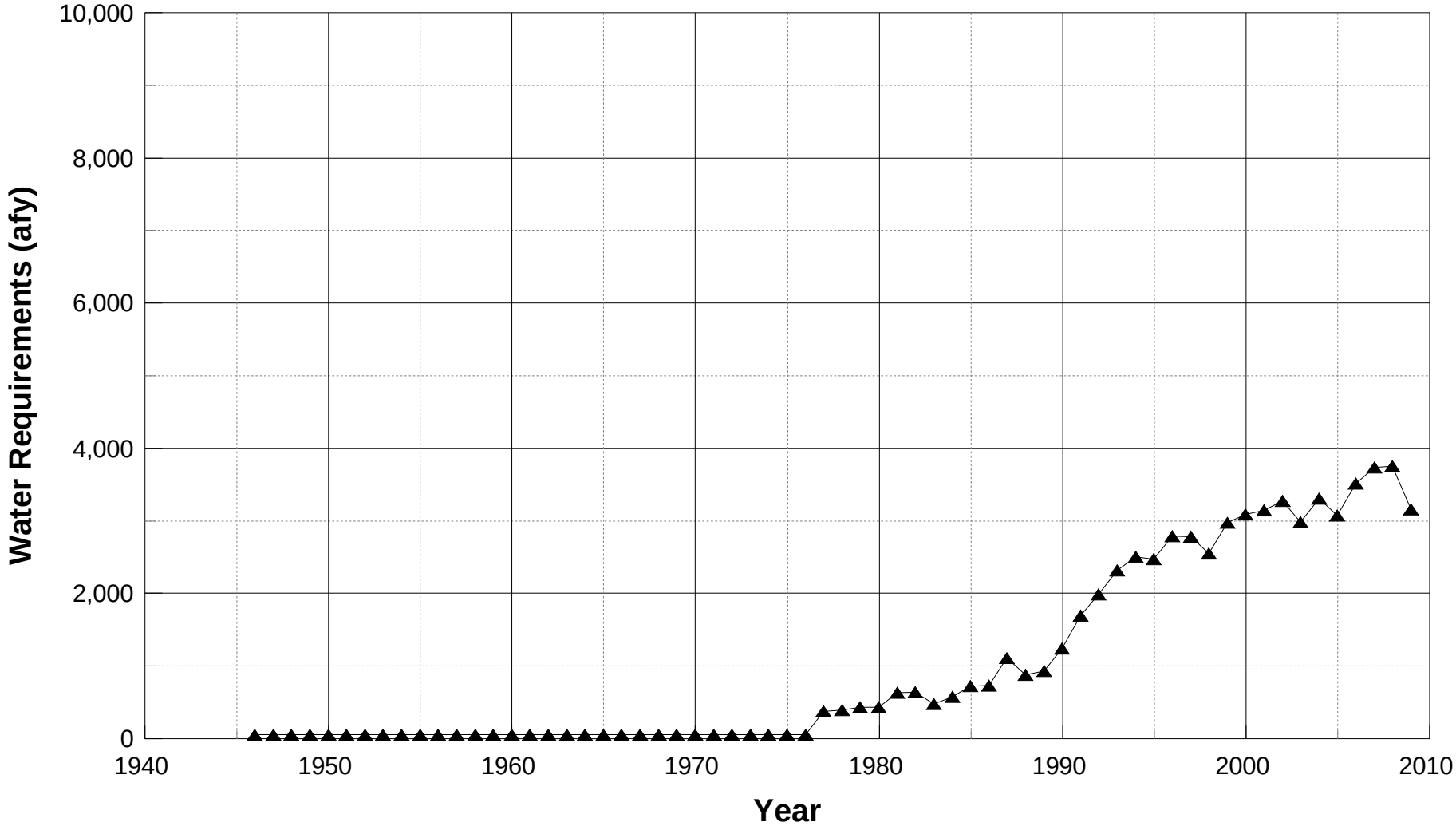
Appendix D-5: Figure 2
Historical Municipal Water Requirements
Palmdale Water District



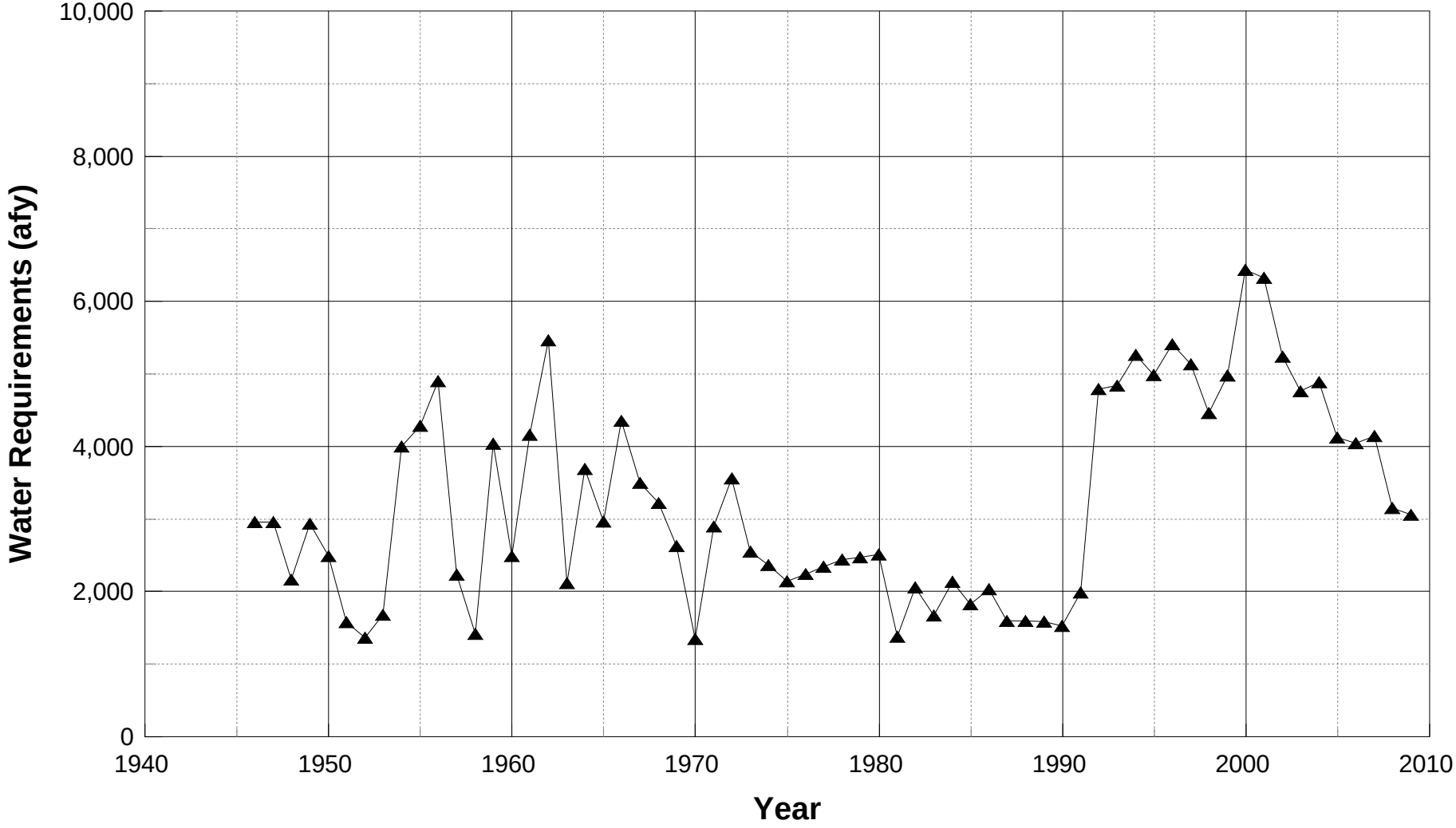
Appendix D-5: Figure 3
Historical Municipal Water Requirements
Quartz Hill Water District



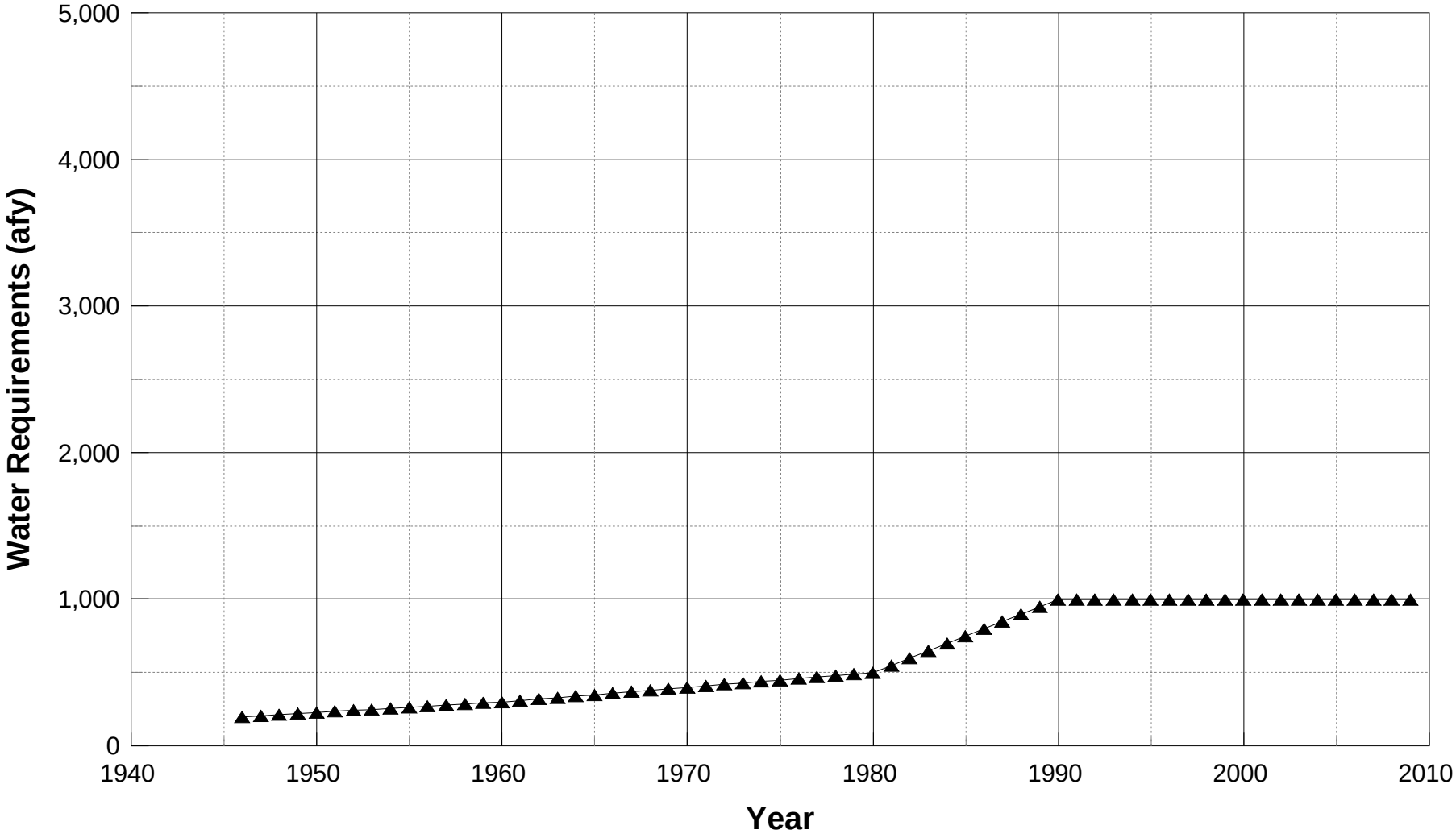
Appendix D-5: Figure 4
Historical Municipal Water Requirements
Rosamond Community Services District



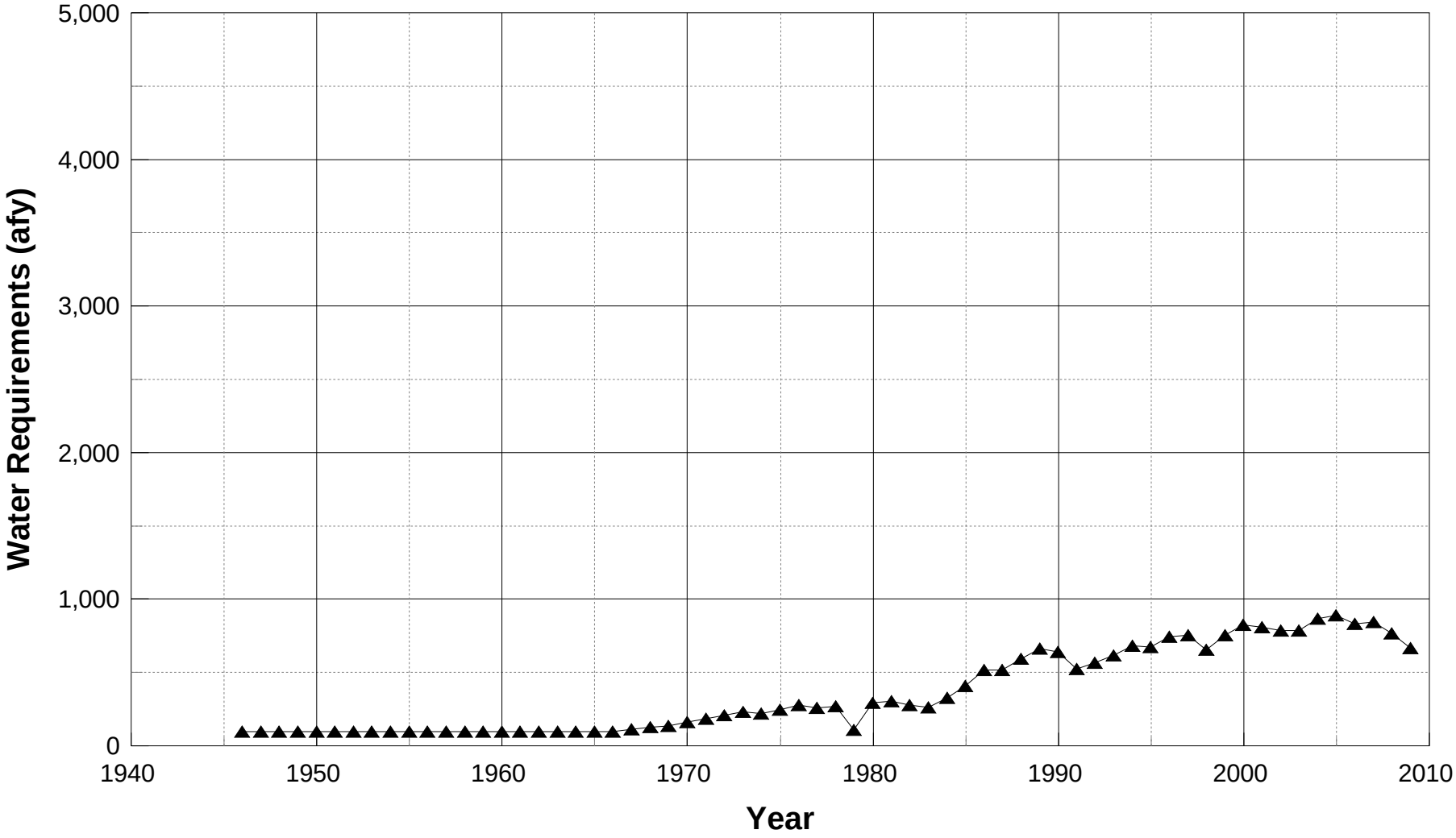
Appendix D-5: Figure 5
Historical Municipal Water Requirements
Edwards Air Force Base



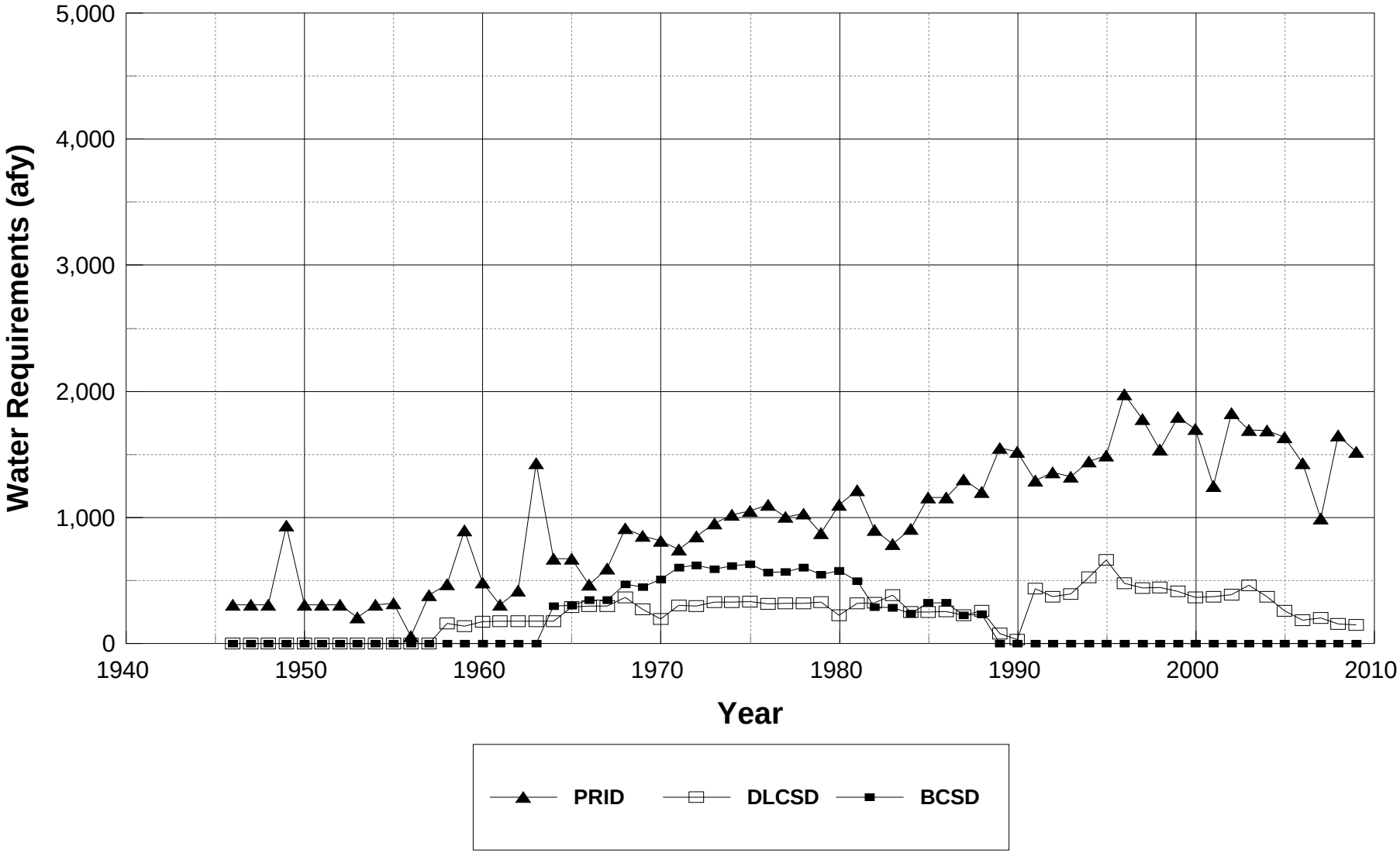
Appendix D-5: Figure 6
Historical Municipal Water Requirements
Littlerock Creek Irrigation District



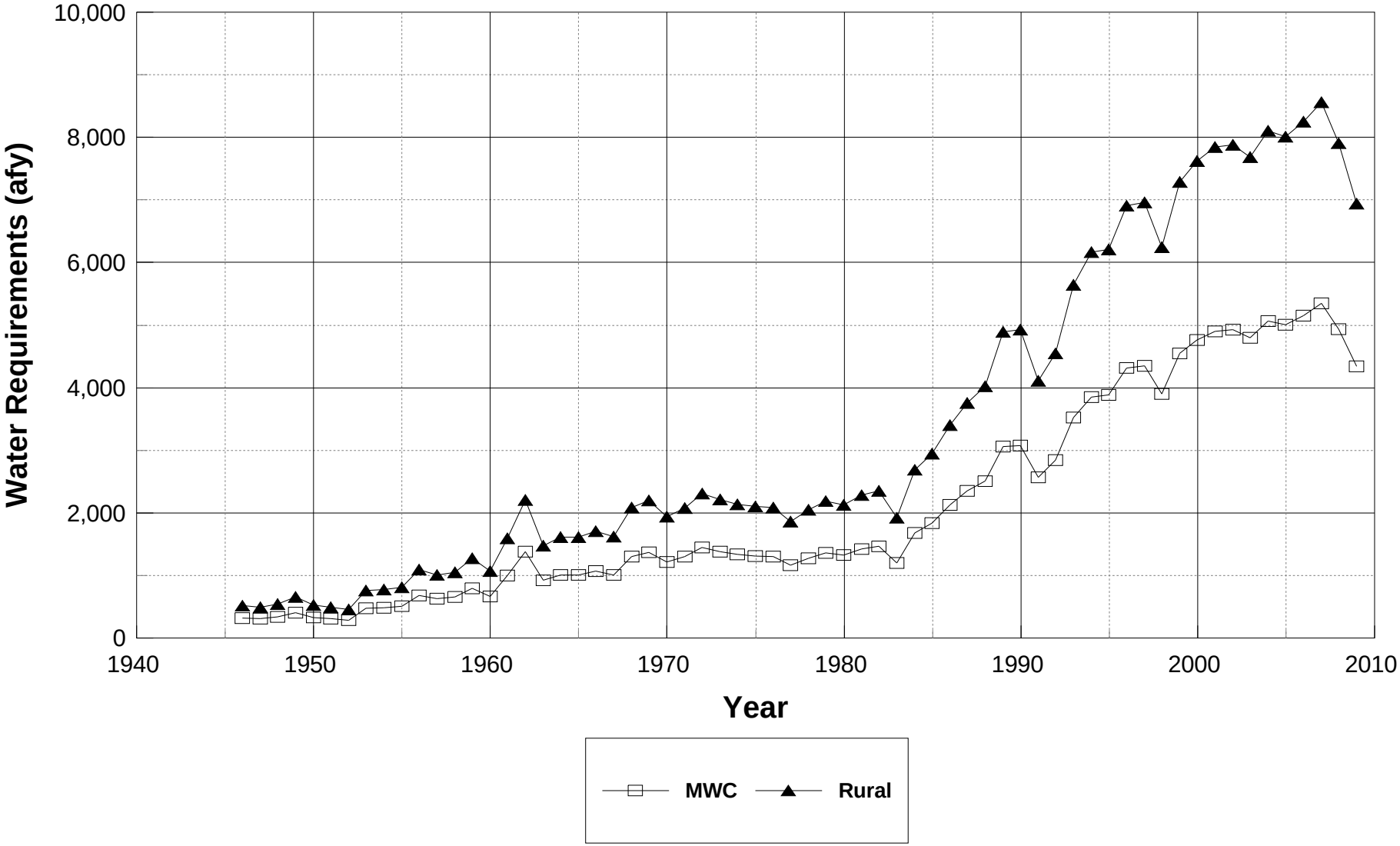
Appendix D-5: Figure 7
Historical Municipal Water Requirements
Antelope Valley Water Company



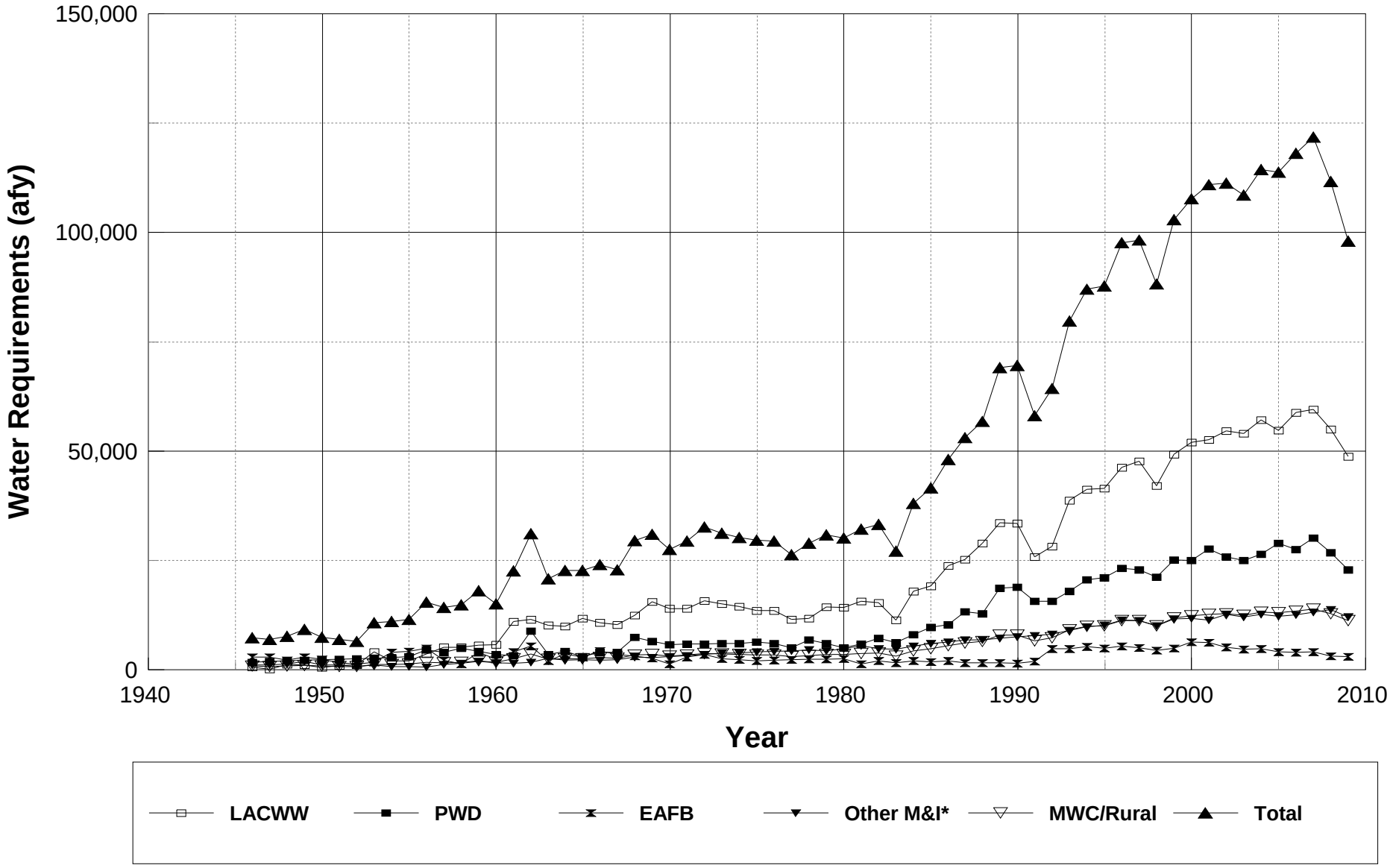
Appendix D-5: Figure 8
Historical Municipal Water Requirements
Palm Ranch ID, Desert Lake CSD, and Boron CSD



Appendix D-5: Figure 9
Historical Municipal Water Requirements
Mutual Water Companies and Rural Residential



Appendix D-5: Figure 10
Historical Municipal Water Requirements
Total M&I



*QHWD, AVWC, RCSD, LCID, PRID, DLCSD, BCSD

Appendix D-6

Historical M&I Return Flows

Appendix D-6: Table 1
Historical M&I Gross Return Flows and Water Requirements

Year	Total M&I Water Requirement[1] (afy)	On-Property Return Flows: Irrigation Gross Return Flow (afy)	On-Property Return Flows: On-Site Disposal Systems Gross Return Flow (afy)	On-Property Return Flows: Total Return Flows (afy)	Off-Property Return Flows[2]: Lancaster WRP Pond/Reservoir Gross Return Flow[4] (afy)	Off-Property Return Flows[2]: Palmdale WRP Ponds Gross Return Flow[4] (afy)	Off-Property Return Flows[2]: Palmdale WRP Land Application Gross Return Flow (afy)	Off-Property Return Flows[2]: Palmdale WRP Subtotal Gross Return Flow (afy)	Off-Property Return Flows[2]: Total Return Flows[3] (afy)	Total Gross Return Flows[3] (afy)
1919	876	96	150	247	------	------	------	------	------	247
1920	1,116	123	191	314	------	------	------	------	------	314
1921	1,355	149	232	381	------	------	------	------	------	381
1922	1,595	175	273	449	------	------	------	------	------	449
1923	1,834	202	314	516	------	------	------	------	------	516
1924	2,074	228	355	583	------	------	------	------	------	583
1925	2,313	254	396	651	------	------	------	------	------	651
1926	2,553	281	437	718	------	------	------	------	------	718
1927	2,792	307	478	785	------	------	------	------	------	785
1928	3,031	333	519	853	------	------	------	------	------	853
1929	3,271	360	560	920	------	------	------	------	------	920
1930	3,510	386	601	987	------	------	------	------	------	987
1931	3,750	412	642	1,055	------	------	------	------	------	1,055
1932	3,989	439	683	1,122	------	------	------	------	------	1,122
1933	4,229	465	724	1,189	------	------	------	------	------	1,189
1934	4,468	491	765	1,257	------	------	------	------	------	1,257
1935	4,708	518	806	1,324	------	------	------	------	------	1,324
1936	4,947	544	847	1,391	------	------	------	------	------	1,391
1937	5,186	571	888	1,459	------	------	------	------	------	1,459
1938	5,426	597	929	1,526	------	------	------	------	------	1,526
1939	5,665	623	970	1,593	------	------	------	------	------	1,593
1940	5,905	650	1,011	1,661	------	------	------	------	------	1,661
1941	6,144	676	1,052	1,728	------	------	------	------	------	1,728
1942	6,384	702	1,093	1,795	------	------	------	------	------	1,795
1943	6,623	729	1,134	1,863	------	------	------	------	------	1,863
1944	6,863	755	1,175	1,930	------	------	------	------	------	1,930
1945	7,102	781	1,216	1,997	------	------	------	------	------	1,997
1946	7,341	808	1,257	2,065	------	------	------	------	------	2,065
1947	7,049	775	1,207	1,983	------	------	------	------	------	1,983
1948	7,747	852	1,327	2,179	------	------	------	------	------	2,179
1949	9,296	1,023	1,592	2,614	------	------	------	------	------	2,614
1950	7,432	818	1,273	2,090	------	------	------	------	------	2,090
1951	7,039	774	1,205	1,980	------	------	------	------	------	1,980
1952	6,550	721	1,122	1,842	------	------	------	------	------	1,842
1953	10,821	1,190	1,853	3,043	------	116	0	116	116	3,159
1954	11,013	1,211	1,886	3,097	------	109	0	109	109	3,206
1955	11,529	1,268	1,974	3,242	------	142	0	142	142	3,384
1956	15,510	1,706	2,656	4,362	------	185	0	185	185	4,547
1957	14,305	1,574	2,450	4,023	------	171	0	171	171	4,194
1958	14,843	1,633	2,542	4,174	------	70	0	70	70	4,244
1959	18,056	1,986	3,092	5,078	------	42	0	42	42	5,120
1960	15,121	1,663	2,589	4,252	------	26	0	26	26	4,278
1961	22,625	2,489	3,874	6,363	------	23	0	23	23	6,386
1962	31,192	3,431	5,341	8,772	------	41	0	41	41	8,813
1963	20,912	2,300	3,581	5,881	------	37	0	37	37	5,918
1964	22,776	2,505	3,900	6,406	------	56	0	56	56	6,462
1965	22,793	2,507	3,903	6,410	------	92	0	92	92	6,502
1966	24,141	2,656	4,134	6,789	------	103	0	103	103	6,892
1967	22,873	2,516	3,917	6,433	------	124	0	124	124	6,557
1968	29,537	3,249	5,058	8,307	------	145	0	145	145	8,452
1969	31,025	3,413	5,313	8,725	------	154	0	154	154	8,879
1970	27,490	3,024	4,707	7,731	------	152	0	152	152	7,883
1971	29,434	3,238	5,040	8,278	------	150	0	150	150	8,428
1972	32,703	3,597	5,600	9,197	------	148	0	148	148	9,345
1973	31,292	3,442	5,358	8,801	------	145	0	145	145	8,946
1974	30,273	3,330	5,184	8,514	------	143	0	143	143	8,657
1975	29,696	3,267	5,085	8,352	125	142	0	142	267	8,619
1976	29,467	3,241	5,046	8,287	125	140	0	140	265	8,552
1977	26,308	2,894	4,505	7,399	125	138	0	138	263	7,662
1978	28,957	3,185	4,959	8,144	125	136	0	136	261	8,405
1979	30,910	3,400	5,293	8,693	125	134	0	134	259	8,952
1980	30,168	3,318	5,166	8,484	125	745	0	745	870	9,354
1981	32,243	3,547	5,521	9,068	125	1,049	109	1,158	1,283	10,351
1982	33,272	3,660	5,697	9,357	125	1,019	1,254	2,273	2,398	11,755
1983	27,240	2,996	4,665	7,661	125	1,034	750	1,784	1,909	9,570
1984	38,036	4,184	6,513	10,697	125	879	1,022	1,901	2,026	12,723
1985	41,609	4,577	7,125	11,702	125	439	1,655	2,094	2,219	13,921
1986	48,142	5,296	8,244	13,540	125	261	2,068	2,329	2,454	15,994
1987	53,159	5,848	9,103	14,950	125	225	2,871	3,096	3,221	18,172
1988	56,820	6,250	9,730	15,980	125	210	2,994	3,204	3,329	19,309
1989	69,145	7,606	11,840	19,446	1,045	2,186	3,186	5,372	6,417	25,863
1990	69,591	7,655	11,917	19,572	428	2,072	4,358	6,430	6,858	26,430
1991	58,094	6,390	9,948	16,338	384	1,956	4,297	6,253	6,637	22,975
1992	64,358	7,079	11,021	18,100	200	1,149	4,939	6,088	6,288	24,388
1993	79,796	8,778	13,664	22,442	200	647	5,566	6,213	6,413	28,854
1994	87,124	9,584	14,919	24,503	200	267	5,942	6,209	6,409	30,911
1995	87,816	9,660	15,037	24,697	200	255	6,402	6,657	6,857	31,555
1996	97,670	10,744	16,725	27,468	200	253	6,406	6,659	6,859	34,327
1997	98,362	10,820	16,843	27,663	200	251	6,692	6,943	7,143	34,806
1998	88,211	9,703	15,105	24,808	200	249	7,260	7,509	7,709	32,517
1999	102,958	11,325	17,630	28,956	200	247	6,890	7,137	7,337	36,293
2000	107,690	11,846	18,441	30,287	200	245	6,952	7,197	7,397	37,684
2001	110,950	12,205	18,999	31,203	200	243	7,361	7,604	7,804	39,007
2002	111,383	12,252	19,073	31,325	200	241	5,262	5,503	5,703	37,029
2003	108,556	11,941	18,589	30,530	200	239	4,574	4,813	5,013	35,544
2004	114,497	12,595	19,606	32,201	200	237	4,554	4,791	4,991	37,192
2005	113,264	12,459	19,395	31,854	200	235	2,615	2,850	3,050	34,905
2006	116,584	12,824	19,964	32,788	200	235	1,149	1,384	1,584	34,372
2007	121,047	13,315	20,728	34,043	200	235	1,446	1,681	1,881	35,924
2008	111,720	12,289	19,131	31,420	200	235	1,318	1,553	1,753	33,173
2009	98,116	10,793	16,801	27,594	200	235	212	447	647	28,241

1) Totals exclude ASR water (2005, 2006, and 2007)

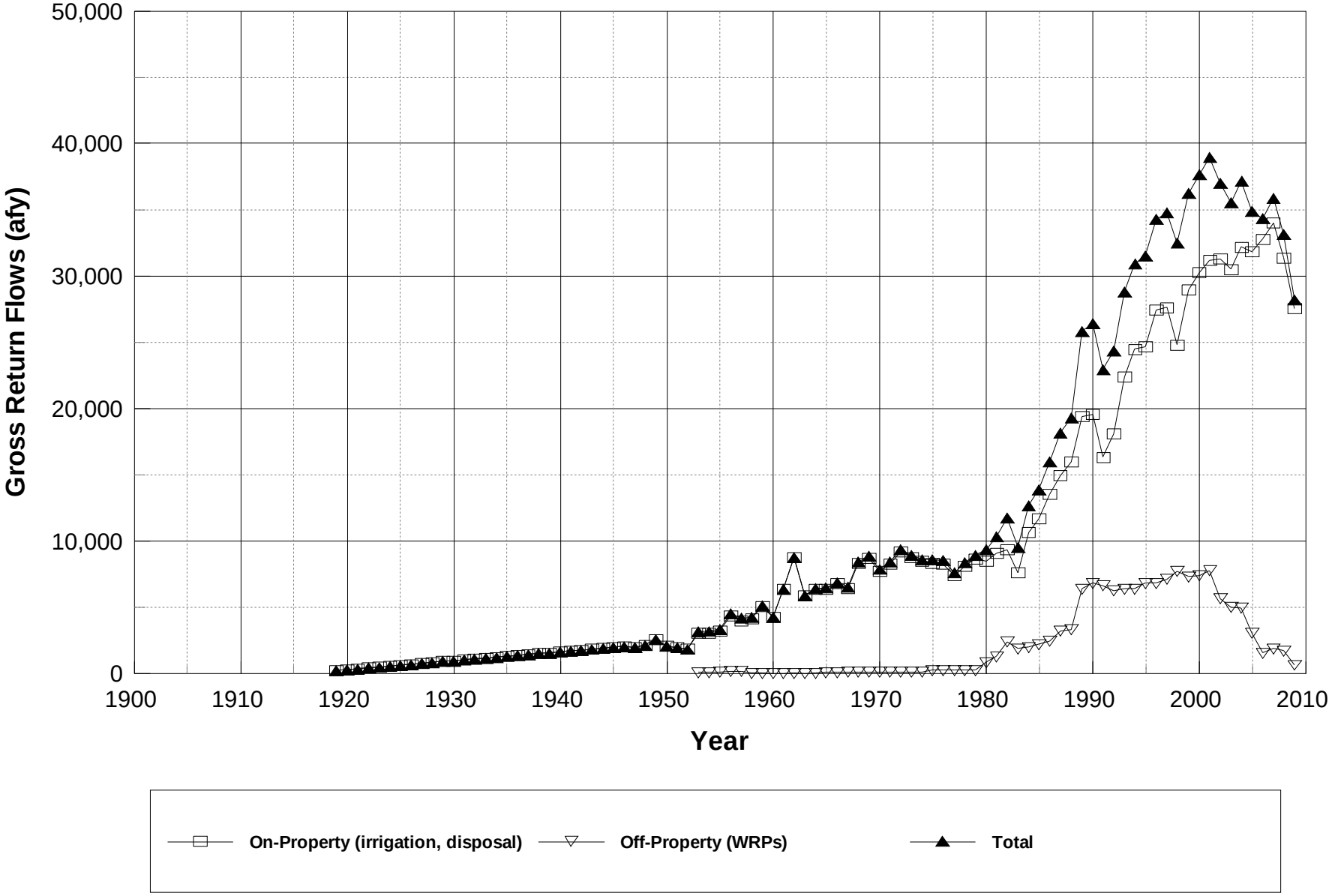
2) From Chapter 4.6 and Appendix G of this report

3) Totals exclude environmental return flows (20 afy from Paiute Ponds)

4) WRP pond return flows for 2006 through 2009 are assumed equal to those from 2005

------ Not estimated

Appendix D-6: Figure 1
M&I Gross Return Flows
Antelope Valley Area of Adjudication



Appendix D-7

Historical Water Supplies

Appendix D-7: Table 1
Historical Surface Water Supplies
Municipal and Industrial Users
Antelope Valley Area of Adjudication
(acre-feet per year)

Los Angeles County Waterworks District 40

Year	Reg.4 Lancaster (SWP-AVEK)	Code	Transfer to AVWC from Reg. 4 Lancaster (SWP-AVEK)	Code	Transfer to ASR Project from Reg. 4 Lancaster (SWP-AVEK)	Code	Reg. 4 Lancaster Total (SWP-AVEK)	Reg.24 Pearblossom (SWP-AVEK)	Code	Reg33 Sun Village (SWP-AVEK)	Code	Reg34 Palmdale (SWP-AVEK)	Code	Transfer from QHWD to Reg. 34 Palmdale (SWP-AVEK)	Code	Reg. 34 Palmdale Total (SWP-AVEK)	Reg38 Lake LA (SWP-AVEK)	Code	Total (SWP-AVEK)
1946	0	10	0	est	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1947	0	10	0	est	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1948	0	10	0	est	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1949	0	10	0	est	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1950	0	10	0	est	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1951	0	10	0	est	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1952	0	10	0	est	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1953	0	10	0	est	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1954	0	10	0	est	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1955	0	10	0	est	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1956	0	10	0	est	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1957	0	10	0	est	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1958	0	10	0	est	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1959	0	10	0	est	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1960	0	10	0	est	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1961	0	10	0	est	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1962	0	10	0	est	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1963	0	10	0	est	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1964	0	10	0	est	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1965	0	10	0	est	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1966	0	10	0	7	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1967	0	10	0	7	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1968	0	10	0	7	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1969	0	10	0	7	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1970	0	10	0	7	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1971	0	10	0	7	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1972	0	10	0	7	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1973	0	10	0	7	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1974	0	10	0	7	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1975	0	10	0	7	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1976	0	10	0	7	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1977	0	10	0	7	0	2	0	0	10	0	10	0	10	0	est	0	0	10	0
1978	4,266	10	0	7	0	2	4,266	0	10	0	10	0	10	0	est	0	0	10	4,266
1979	5,750	10	0	7	0	2	5,750	0	10	0	10	0	10	0	est	0	0	10	5,750
1980	4,732	10	0	7	0	2	4,732	0	10	0	10	0	10	0	est	0	0	10	4,732
1981	6,359	10	0	7	0	2	6,359	0	10	0	10	0	10	0	est	0	0	10	6,359
1982	4,359	10	0	7	0	2	4,359	0	10	66	10	0	10	0	est	0	0	10	4,425
1983	3,978	10	0	7	0	2	3,978	0	10	193	10	0	10	0	est	0	0	10	4,171
1984	7,088	10	0	7	0	2	7,088	0	10	391	10	0	10	0	est	0	53	10	7,532
1985	7,819	10	0	7	0	2	7,819	45	10	664	10	0	10	0	est	0	916	10	9,445
1986	9,475	10	0	7	0	2	9,475	191	10	656	10	0	10	0	est	0	673	10	10,995
1987	9,788	10	0	7	0	2	9,788	232	10	705	10	0	10	0	est	0	883	10	11,608
1988	12,132	10	0	7	0	2	12,132	360	10	703	10	0	10	0	est	0	1,260	10	14,454
1989	12,263	10	0	7	0	2	12,263	386	10	773	10	1,278	10	0	est	1,278	1,597	10	16,298
1990	15,882	10	0	7	0	2	15,882	488	10	465	10	1,608	10	0	est	1,608	2,100	10	20,543
1991	9,518	10	0	7	0	2	9,518	186	10	642	10	1,140	10	0	est	1,140	1,454	10	12,940
1992	12,689	10	0	7	0	2	12,689	219	10	823	10	2,738	10	0	est	2,738	2,230	10	18,700
1993	16,765	10	0	7	0	2	16,765	513	10	991	10	3,649	10	0	est	3,649	2,489	10	24,407
1994	16,758	10	0	7	0	2	16,758	579	10	1,049	10	4,035	10	0	est	4,035	1,906	10	24,328
1995	13,849	10	0	7	0	2	13,849	495	10	776	10	4,023	10	0	est	4,023	2,546	10	21,689
1996	16,528	10	0	7	0	2	16,528	611	10	1,012	10	5,943	10	0	est	5,943	2,895	10	26,990
1997	17,548	10	0	7	0	2	17,548	526	10	1,194	10	6,070	10	0	est	6,070	2,751	10	28,089
1998	17,074	10	0	7	0	2	17,074	588	10	1,131	10	3,814	10	0	est	3,814	1,991	10	24,599
1999	21,365	10	0	7	0	2	21,365	736	10	1,176	10	4,612	10	0	est	4,612	2,768	10	30,657
2000	25,220	10	0	7	0	2	25,220	934	10	1,165	10	4,995	10	0	est	4,995	2,339	10	34,653
2001	22,161	10	0	7	0	2	22,161	848	10	685	10	5,027	10	1	2	5,028	2,244	10	30,965
2002	23,059	10	0	7	0	2	23,059	1,210	10	922	10	5,833	10	3	2	5,836	2,458	10	33,485
2003	25,976	2	(184)	7	0	2	25,793	1,230	2	914	2	5,986	2	2	2	5,987	3,334	2	37,258
2004	25,315	2	(275)	7	0	2	25,040	1,347	2	1,227	2	6,107	2	2	2	6,110	2,231	2	35,955
2005	26,321	2	(277)	7	(558)	2	25,487	930	2	1,135	2	6,244	2	2	2	6,246	1,860	2	35,657
2006	36,095	2	(298)	7	(1,612)	2	34,185	1,437	2	977	2	7,441	2	59	2	7,500	2,530	2	46,628
2007	28,686	2	(0)	7	(857)	2	27,829	1,227	2	1,028	2	7,383	2	149	2	7,532	2,547	2	40,162
2008	18,473	2	0	7	0	2	18,473	916	2	928	2	7,098	2	0	2	7,098	1,872	2	29,286
2009	21,278	2	0	7	0	2	21,278	1,012	2	823	2	6,282	2	0	2	6,282	1,217	2	30,611

Palmdale Water District / Littlerock Creek Irrigation District

Year	PWD (SWP)	Code	PWD Transfer to LCID for Municipal Supply (SWP)	PWD Transfer to LCID for Agricultural Supply (SWP)	Code	PWD Total (SWP)	PWD (Local)	Code	PWD Transfer to LCID for Municipal Supply (Local)	PWD Transfer to LCID for Agricultural Supply (Local)	Code	PWD Total (Local)	PWD Total (SWP+Local)	LCID (SWP)	LCID Transfer from PWD for Municipal Supply (SWP)	Code	LCID Total (SWP)	LCID (Local)	LCID Transfer from PWD for Municipal Supply (Local)	Code	LCID Total (Local)	LCID Total (SWP+Local)
1946	0	1	0	0	4	0	1,000	est	0	0	4	1,000	1,000	0	0	1	0	0	0	4	0	0
1947	0	1	0	0	4	0	1,000	est	0	0	4	1,000	1,000	0	0	1	0	0	0	4	0	0
1948	0	1	0	0	4	0	1,000	est	0	0	4	1,000	1,000	0	0	1	0	0	0	4	0	0
1949	0	1	0	0	4	0	1,000	est	0	0	4	1,000	1,000	0	0	1	0	0	0	4	0	0
1950	0	1	0	0	4	0	1,000	est	0	0	4	1,000	1,000	0	0	1	0	0	0	4	0	0
1951	0	1	0	0	4	0	1,000	est	0	0	4	1,000	1,000	0	0	1	0	0	0	4	0	0
1952	0	1	0	0	4	0	1,000	est	0	0	4	1,000	1,000	0	0	1	0	0	0	4	0	0
1953	0	1	0	0	4	0	1,000	est	0	0	4	1,000	1,000	0	0	1	0	0	0	4	0	0
1954	0	1	0	0	4	0	1,000	est	0	0	4	1,000	1,000	0	0	1	0	0	0	4	0	0
1955	0	1	0	0	4	0	1,000	est	0	0	4	1,000	1,000	0	0	1	0	0	0	4	0	0
1956	0	1	0	0	4	0	2,422	3	0	0	4	2,422	2,422	0	0	1	0	0	0	4	0	0
1957	0	1	0	0	4	0	1,752	3	0	0	4	1,752	1,752	0	0	1	0	0	0	4	0	0
1958	0	1	0	0	4	0	2,434	3	0	0	4	2,434	2,434	0	0	1	0	0	0	4	0	0
1959	0	1	0	0	4	0	1,311	3	0	0	4	1,311	1,311	0	0	1	0	0	0	4	0	0
1960	0	1	0	0	4	0	385	3	0	0	4	385	385	0	0	1	0	0	0	4	0	0
1961	0	1	0	0	4	0	0	3	0	0	4	0	0	0	0	1	0	0	0	4	0	0
1962	0	1	0	0	4	0	5,534	3	0	0	4	5,534	5,534	0	0	1	0	0	0	4	0	0
1963	0	1	0	0	4	0	136	3	0	0	4	136	136	0	0	1	0	0	0	4	0	0
1964	0	1	0	0	4	0	262	3	0	0	4	262	262	0	0	1	0	0	0	4	0	0
1965	0	1	0	0	4	0	1,318	3	0	0	4	1,318	1,318	0	0	1	0	0	0	4	0	0
1966	0	1	0	0	4	0	0	3	0	0	4	0	0	0	0	1	0	0	0	4	0	0
1967	0	1	0	0	4	0	0	3	0	0	4	0	0	0	0	1	0	0	0	4	0	0
1968	0	1	0	0	4	0	3,150	3	0	0	4	3,150	3,150	0	0	1	0	0	0	4	0	0
1969	0	1	0	0	4	0	2,105	3	0	0	4	2,105	2,105	0	0	1	0	0	0	4	0	0
1970	0	1	0	0	4	0	1,396	3	0	0	4	1,396	1,396	0	0	1	0	231	0	4	231	231
1971	0	1	0	0	4	0	1,389	3	0	0	4	1,389	1,389	0	0	1	0	150	0	4	150	150
1972	0	1	0	0	4	0	1,360	3	0	0	4	1,360	1,360	26	0	4	26	121	0	4	121	147
1973	0	1	0	0	4	0	1,523	3	0	0	4	1,523	1,523	28	0	4	28	159	0	4	159	187
1974	0	1	0	0	4	0	938	3	0	0	4	938	938	40	0	4	40	164	0	4	164	204
1975	0	1	0	0	4	0	1,586	3	0	0	4	1,586	1,586	56	0	4	56	163	0	4	163	219
1976	0	1	0	0	4	0	1,151	3	0	0	4	1,151	1,151	64	0	4	64	152	0	4	152	216
1977	0	1	0	0	4	0	468	3	0	0	4	468	468	18	0	4	18	80	0	4	80	97
1978	0	1	0	0	4	0	2,024	3	0	0	4	2,024	2,024	23	0	4	23	187	0	4	187	210
1979	0	1	0	0	4	0	913	3	0	0	4	913	913	14	0	4	14	209	0	4	209	224
1980	0	1	0	0	4	0	913	3	0	0	4	913	913	21	0	4	21	209	0	4	209	230
1981	0	1	0	0	4	0	1,638	3	0	0	4	1,638	1,638	189	0	4	189	155	0	4	155	344
1982	0	1	0	0	4	0	1,680	3	0	0	4	1,680	1,680	0	0	4	0	263	0	4	263	263
1983	0	1	0	0	4	0	714	3	0	0	4	714	714	8	0	4	8	268	0	4	268	276
1984	0	1	0	0	4	0	927	3	0	0	4	927	927	0	0	4	0	284	0	4	284	284
1985	1,558	1	0	0	4	1,558	1,460	3	0	0	4	1,460	3,018	0	0	4	0	322	0	4	322	322
1986	3,096	1	0	0	4	3,096	332	3	0	0	4	332	3,428	38	0	4	38	290	0	4	290	327
1987	5,379	1	0	0	4	5,379	0	3	0	0	4	0	5,379	249	0	4	249	231	0	4	231	480
1988	1,770	1	0	0	4	1,770	1,330	3	0	0	4	1,330	3,100	254	0	4	254	606	0	4	606	861
1989	9,009	1	0	0	4	9,009	1,400	3	0	0	4	1,400	10,409	283	0	4	283	204	0	4	204	486
1990	8,608	1	0	0	4	8,608	110	3	0	0	4	110	8,718	489	0	4	489	84	0	4	84	573
1991	3,914	3	0	0	4	3,914	286	3	0	0	4	286	4,200	160	0	4	160	230	0	4	230	390
1992	4,035	3	0	0	4	4,035	3,465	3	0	0	4	3,465	7,500	106	0	4	106	381	0	4	381	487
1993	7,761	3	0	0	4	7,761	2,239	3	0	0	4	2,239	10,000	269	0	4	269	266	0	4	266	535
1994	8,418	3	0	0	4	8,418	867	3	0	0	4	867	9,285	323	0	4	323	153	0	4	153	476
1995	6,613	3	(52)	(81)	est	6,481	3,771	3	(30)	(46)	est	3,695	10,176	188	52	est	239	0	30	est	30	269
1996	11,021	3	(54)	(86)	est	10,881	3,043	3	(15)	(24)	est	3,004	13,885	191	54	est	245	0	15	est	15	260
1997	11,550	3	(34)	(46)	est	11,470	2,363	3	(7)	(9)	est	2,346	13,816	188	34	est	222	0	7	est	7	229
1998	8,437	3	(50)	(60)	est	8,327	5,040	3	(30)	(36)	est	4,974	13,301	183	50	est	233	0	30	est	30	263
1999	12,733	3	(48)	(67)	est	12,618	3,050	3	(12)	(16)	est	3,022	15,639	143	48	est	191	0	12	est	12	203
2000	9,154	3	(44)	(47)	est	9,064	6,500	3	(31)	(33)	est	6,436	15,500	0	44	est	44	0	31	est	31	75
2001	10,398	3	(111)	(181)	est	10,106	6,851	3	(73)	(119)	est	6,659	16,765	0	111	est	111	0	73	est	73	184
2002	18,425	3	(192)	(326)	est	17,907	0	3	0	0	est	0	17,907	0	192	est	192	0	0	est	0	192
2003	11,458	3	(86)	(120)	est	11,251	3,499	3	(26)	(37)	est	3,436	14,687	0	86	est	86	0	26	est	26	113
2004	12,064	3	(82)	(142)	est	11,841	3,959	3	(27)	(46)	est	3,886	15,727	0	82	est	82	0	27	est	27	109
2005	11,678	3	(101)	(152)	est	11,426	6,900	3	(59)	(90)	est	6,751	18,177	0	101	est	101	0	59	est	59	160
2006	12,224	3	(23)	(30)	est	12,171	4,173	3	(8)	(10)	est	4,155	16,326	0	23	est	23	0	8	est	8	31
2007	20,030	3	(54)	(88)	est	19,888	0	3	0	0	est	0	19,888	0	54	est	54	0	0	est	0	54
2008	14,272	3	(65)	(75)	est	14,132	3,045	3	(14)	(16)	est	3,015	17,147	0	65	est	65	0	14	est	14	79
2009	15,386	3	(105)	(111)	est	15,170	79	3	(1)	(1)	est	77	15,248	0	105	est	105	0	1	est	1	105

Quartz Hill Water District, Rosamond Community Services District, Antelope Valley Water Company, Palm Ranch Irrigation District, Desert Lake Community Services District, Edwards Air Force Base, Subtotal, Mutual and Private Water Companies, ASR Project LACWW40, Total

Year	Quartz Hill (SWP-AVEK)	Code	Quartz Hill Transfer to LACWW40-Reg.34 from QHWD (SWP-AVEK)	Code	Quartz Hill Total (SWP-AVEK)	Rosamond Community Services District (SWP-AVEK)	Code	Antelope Valley Water Company Transfer from LACWW40-Reg 4 to Lancaster Subsystem (SWP-AVEK)	Code	Palm Ranch Irrigation District (SWP-AVEK)	Code	Desert Lake Community Services District (SWP-AVEK)	Code	Edwards Air Force Base (SWP-AVEK)	Code	Subtotal	Mutual and Private Water Companies (SWP-AVEK)	Code	ASR Project LACWW40 Transfer from LACWW40-Reg 4 to ASR Project (SWP-AVEK)	Code	Total
1946	0	10	0	est	0	0	10	0	est	0	10	0	10	0	10	1,000	0	10	0	2	1,000
1947	0	10	0	est	0	0	10	0	est	0	10	0	10	0	10	1,000	0	10	0	2	1,000
1948	0	10	0	est	0	0	10	0	est	0	10	0	10	0	10	1,000	0	10	0	2	1,000
1949	0	10	0	est	0	0	10	0	est	0	10	0	10	0	10	1,000	0	10	0	2	1,000
1950	0	10	0	est	0	0	10	0	est	0	10	0	10	0	10	1,000	0	10	0	2	1,000
1951	0	10	0	est	0	0	10	0	est	0	10	0	10	0	10	1,000	0	10	0	2	1,000
1952	0	10	0	est	0	0	10	0	est	0	10	0	10	0	10	1,000	0	10	0	2	1,000
1953	0	10	0	est	0	0	10	0	est	0	10	0	10	0	10	1,000	0	10	0	2	1,000
1954	0	10	0	est	0	0	10	0	est	0	10	0	10	0	10	1,000	0	10	0	2	1,000
1955	0	10	0	est	0	0	10	0	est	0	10	0	10	0	10	1,000	0	10	0	2	1,000
1956	0	10	0	est	0	0	10	0	est	0	10	0	10	0	10	2,422	0	10	0	2	2,422
1957	0	10	0	est	0	0	10	0	est	0	10	0	10	0	10	1,752	0	10	0	2	1,752
1958	0	10	0	est	0	0	10	0	est	0	10	0	10	0	10	2,434	0	10	0	2	2,434
1959	0	10	0	est	0	0	10	0	est	0	10	0	10	0	10	1,311	0	10	0	2	1,311
1960	0	10	0	est	0	0	10	0	est	0	10	0	10	0	10	385	0	10	0	2	385
1961	0	10	0	est	0	0	10	0	est	0	10	0	10	0	10	0	0	10	0	2	0
1962	0	10	0	est	0	0	10	0	est	0	10	0	10	0	10	5,534	0	10	0	2	5,534
1963	0	10	0	est	0	0	10	0	est	0	10	0	10	0	10	136	0	10	0	2	136
1964	0	10	0	est	0	0	10	0	est	0	10	0	10	0	10	262	0	10	0	2	262
1965	0	10	0	est	0	0	10	0	est	0	10	0	10	0	10	1,318	0	10	0	2	1,318
1966	0	10	0	est	0	0	10	0	7	0	10	0	10	0	10	0	0	10	0	2	0
1967	0	10	0	est	0	0	10	0	7	0	10	0	10	0	10	0	0	10	0	2	0
1968	0	10	0	est	0	0	10	0	7	0	10	0	10	0	10	3,150	0	10	0	2	3,150
1969	0	10	0	est	0	0	10	0	7	0	10	0	10	0	10	2,105	0	10	0	2	2,105
1970	0	10	0	est	0	0	10	0	7	0	10	0	10	0	10	1,627	0	10	0	2	1,627
1971	0	10	0	est	0	0	10	0	7	0	10	0	10	0	10	1,539	0	10	0	2	1,539
1972	0	10	0	est	0	0	10	0	7	0	10	0	10	0	10	1,507	0	10	0	2	1,507
1973	0	10	0	est	0	0	10	0	7	0	10	0	10	0	10	1,710	0	10	0	2	1,710
1974	0	10	0	est	0	0	10	0	7	0	10	0	10	0	10	1,142	0	10	0	2	1,142
1975	0	10	0	est	0	0	10	0	7	0	10	0	10	0	10	1,805	0	10	0	2	1,805
1976	0	10	0	est	0	0	10	0	7	0	10	0	10	0	10	1,367	0	10	0	2	1,367
1977	0	10	0	est	0	0	10	0	7	0	10	0	10	0	10	565	0	10	0	2	565
1978	568	10	0	est	568	0	10	0	7	217	10	0	10	0	10	7,285	220	10	0	2	7,505
1979	872	10	0	est	872	21	10	0	7	307	10	0	10	0	10	8,087	298	10	0	2	8,385
1980	992	10	0	est	992	3	10	0	7	779	10	0	10	0	10	7,649	372	10	0	2	8,021
1981	1,154	10	0	est	1,154	6	10	0	7	992	10	62	10	0	10	10,556	798	10	0	2	11,354
1982	1,131	10	0	est	1,131	11	10	0	7	591	10	54	10	0	10	8,155	709	10	0	2	8,864
1983	930	10	0	est	930	64	10	0	7	388	10	85	10	0	10	6,628	900	10	0	2	7,529
1984	1,247	10	0	est	1,247	76	10	0	7	339	10	72	10	0	10	10,477	1,252	10	0	2	11,728
1985	1,601	10	0	est	1,601	50	10	0	7	407	10	58	10	0	10	14,900	1,367	10	0	2	16,266
1986	1,220	10	0	est	1,220	14	10	0	7	979	10	44	10	0	10	17,008	1,198	10	0	2	18,206
1987	1,407	10	0	est	1,407	20	10	0	7	1,058	10	31	10	0	10	19,983	1,524	10	0	2	21,507
1988	1,133	10	0	est	1,133	79	10	0	7	790	10	82	10	0	10	20,499	1,714	10	0	2	22,213
1989	1,369	10	0	est	1,369	159	10	0	7	968	10	80	10	0	10	29,770	2,430	10	0	2	32,200
1990	1,950	10	0	est	1,950	464	10	0	7	1,070	10	30	10	0	10	33,349	2,037	10	0	2	35,386
1991	1,543	10	0	est	1,543	467	10	0	7	409	10	30	10	0	10	19,979	1,420	10	0	2	21,399
1992	1,646	10	0	est	1,646	898	10	0	7	679	10	24	10	0	10	29,934	1,316	10	0	2	31,250
1993	1,833	10	0	est	1,833	1,294	10	0	7	175	10	43	10	1,345	10	39,632	1,798	10	0	2	41,430
1994	2,485	10	0	est	2,485	1,479	10	0	7	484	10	174	10	2,103	10	40,813	2,078	10	0	2	42,891
1995	2,098	10	0	est	2,098	1,649	10	0	7	736	10	314	10	1,171	10	38,102	1,737	10	0	2	39,839
1996	2,115	10	0	est	2,115	768	10	0	7	832	10	128	10	1,675	10	46,653	1,883	10	0	2	48,536
1997	2,493	10	0	est	2,493	809	10	0	7	633	10	88	10	1,357	10	47,514	1,607	10	0	2	49,121
1998	2,723	10	0	est	2,723	1,015	10	0	7	393	10	91	10	1,737	10	44,121	1,464	10	0	2	45,585
1999	3,217	10	0	est	3,217	1,512	10	0	7	650	10	63	10	1,782	10	53,723	1,917	10	0	2	55,640
2000	3,354	10	0	est	3,354	1,631	10	0	7	558	10	15	10	2,724	10	58,509	1,477	10	0	2	59,986
2001	1,830	10	(1)	2	1,829	979	10	0	7	102	8	19	10	2,226	10	53,069	1,603	10	0	2	54,673
2002	2,630	10	(3)	2	2,627	920	10	0	7	291	8	35	10	2,155	10	57,611	1,767	10	0	2	59,379
2003	3,706	5	(2)	2	3,705	1,217	6	184	7	137	8	26	10	2,831	9	60,157	1,717	10	0	2	61,874
2004	4,099	5	(2)	2	4,097	1,191	6	275	7	877	8	161	10	1,873	9	60,264	1,631	10	0	2	61,895
2005	4,154	5	(2)	2	4,152	1,375	6	277	7	501	8	56	10	1,773	9	62,128	1,796	10	558	2	64,481
2006	4,322	5	(59)	2	4,263	1,302	6	298	7	843	8	165	10	2,043	9	71,900	2,256	10	1,612	2	75,768
2007	4,539	5	(149)	2	4,391	1,256	6	0	7	896	10	205	10	2,057	9	68,908	1,876	10	857	2	71,641
2008	3,645	5	0	2	3,645	894	6	0	7	838	10	113	10	1,594	9	53,597	1,284	10	0	2	54,881
2009	3,146	5	0	2	3,146	307	6	0	7	84	10	15	10	1,893	9	51,408	883	10	0	2	52,291

Source Codes
- **1** USGS; Templin, W.E., et al., 1995
- **1a** USGS; Leighton and Phillips, 2003
- **2** LACWW40
- **3** PWD
- **4** LCID
- **5** QHWD
- **6** RCSD
- **7** AVWC (CalWater Service Co)
- **8** PRID
- **9** EAFB
- **10** AVEK
- **11** Desert Lake CSD

Appendix D-7: Table 2
Calculation of Agricultural Groundwater Pumpage (in afy)

Year	Historical Total Agricultural Water Requirements	SWP Imported Water (AVEK)	SWP Imported Water (LCID)	SWP Imported Water (PWD to LCID)	SWP Imported Water (Total)	Littlerock Ck Local Water (LCID)	Littlerock Ck Local Water (PWD to LCID)	Littlerock Ck Local Water (Total)	WRPs Recycled Water	Total Surface and Recycled Water	Calculated Groundwater Pumpage to meet Agricultural Requirements	Additional Groundwater Pumpage to export to California Aqueduct	Total Calculated Groundwater Pumpage
1919	77,565	0	0	0	0	0	0	0	0	0	**77,565**	0	**77,565**
1920	80,606	0	0	0	0	0	0	0	0	0	**80,606**	0	**80,606**
1925	121,746	0	0	0	0	0	0	0	0	0	**121,746**	0	**121,746**
1927	167,566	0	0	0	0	0	0	0	0	0	**167,566**	0	**167,566**
1929	204,724	0	0	0	0	0	0	0	0	0	**204,724**	0	**204,724**
1930	180,112	0	0	0	0	0	0	0	0	0	**180,112**	0	**180,112**
1935	130,176	0	0	0	0	0	0	0	0	0	**130,176**	0	**130,176**
1940	202,348	0	0	0	0	0	0	0	0	0	**202,348**	0	**202,348**
1945	255,311	0	0	0	0	0	0	0	0	0	**255,311**	0	**255,311**
1946	273,960	0	0	0	0	0	0	0	0	0	**273,960**	0	**273,960**
1947	296,757	0	0	0	0	0	0	0	0	0	**296,757**	0	**296,757**
1948	322,497	0	0	0	0	0	0	0	0	0	**322,497**	0	**322,497**
1949	327,685	0	0	0	0	0	0	0	0	0	**327,685**	0	**327,685**
1950	347,676	0	0	0	0	0	0	0	0	0	**347,676**	0	**347,676**
1951	362,549	0	0	0	0	0	0	0	0	0	**362,549**	0	**362,549**
1952	357,856 *	0	0	0	0	0	0	0	0	0	**357,856**	0	**357,856**
1953	353,162 *	0	0	0	0	0	0	0	0	0	**353,162**	0	**353,162**
1954	348,468 *	0	0	0	0	0	0	0	0	0	**348,468**	0	**348,468**
1955	343,774 *	0	0	0	0	0	0	0	0	0	**343,774**	0	**343,774**
1956	339,081 *	0	0	0	0	0	0	0	0	0	**339,081**	0	**339,081**
1957	334,387	0	0	0	0	0	0	0	0	0	**334,387**	0	**334,387**
1958	340,131 *	0	0	0	0	0	0	0	0	0	**340,131**	0	**340,131**
1959	345,875 *	0	0	0	0	0	0	0	83	83	**345,792**	0	**345,792**
1960	351,618 *	0	0	0	0	0	0	0	83	83	**351,535**	0	**351,535**
1961	357,362	0	0	0	0	0	0	0	83	83	**357,279**	0	**357,279**
1962	351,240 *	0	0	0	0	0	0	0	97	97	**351,143**	0	**351,143**
1963	345,119 *	0	0	0	0	0	0	0	97	97	**345,022**	0	**345,022**
1964	338,997 *	0	0	0	0	0	0	0	135	135	**338,862**	0	**338,862**
1965	332,876 *	0	0	0	0	0	0	0	224	224	**332,652**	0	**332,652**
1966	326,754 *	0	0	0	0	0	0	0	224	224	**326,530**	0	**326,530**
1967	320,633 *	0	0	0	0	0	0	0	424	424	**320,209**	0	**320,209**
1968	314,511 *	0	0	0	0	0	0	0	424	424	**314,087**	0	**314,087**
1969	308,390 *	0	0	0	0	0	0	0	512	512	**307,878**	0	**307,878**
1970	302,268	0	0	0	0	1,618	0	1,618	509	2,127	**300,142**	0	**300,142**
1971	311,131	0	0	0	0	1,513	0	1,513	700	2,213	**308,917**	0	**308,917**
1972	258,393	0	312	0	312	1,466	0	1,466	704	2,482	**255,911**	0	**255,911**
1973	252,893	0	262	0	262	1,513	0	1,513	891	2,666	**250,227**	0	**250,227**
1974	260,133	0	360	0	360	1,487	0	1,487	806	2,653	**257,480**	0	**257,480**
1975	269,078	0	464	0	464	1,350	0	1,350	891	2,705	**266,373**	0	**266,373**
1976	227,036	27,295	525	0	27,820	1,248	0	1,248	891	29,959	**197,077**	0	**197,077**
1977	299,706	32,133	93	0	32,227	420	0	420	941	33,588	**266,118**	0	**266,118**
1978	276,582	37,428	185	0	37,613	1,501	0	1,501	996	40,110	**236,472**	0	**236,472**
1979	244,010	50,934	119	0	51,053	1,741	0	1,741	1,036	53,830	**190,180**	0	**190,180**
1980	254,239	58,054	170	0	58,225	1,741	0	1,741	958	60,924	**193,315**	0	**193,315**
1981	227,045	63,894	1,081	0	64,975	885	0	885	548	66,408	**160,637**	0	**160,637**
1982	192,624	39,053	0	0	39,053	1,341	0	1,341	0	40,394	**152,229**	0	**152,229**
1983	181,978	23,505	30	0	23,534	931	0	931	88	24,553	**157,425**	0	**157,425**
1984	158,865	18,176	1	0	18,177	1,180	0	1,180	404	19,761	**139,104**	0	**139,104**
1985	141,879	21,583	0	0	21,583	1,053	0	1,053	399	23,035	**118,844**	0	**118,844**
1986	116,210	14,381	125	0	14,506	960	0	960	52	15,519	**100,691**	0	**100,691**
1987	94,306	13,916	831	0	14,746	769	0	769	64	15,579	**78,727**	0	**78,727**
1988	106,671	14,154	165	0	14,319	394	0	394	2,033	16,745	**89,925**	0	**89,925**
1989	69,683	16,100	688	0	16,788	496	0	496	2,725	20,010	**49,673**	0	**49,673**
1990	71,125	14,775	1,258	0	16,033	216	0	216	3,824	20,073	**51,052**	0	**51,052**
1991	67,961	922	362	0	1,284	520	0	520	4,011	5,815	**62,146**	15,658	**77,804**
1992	84,158	2,323	145	0	2,468	519	0	519	3,661	6,648	**77,510**	0	**77,510**
1993	73,820	8,115	465	0	8,580	459	0	459	3,127	12,166	**61,654**	0	**61,654**
1994	75,937	11,637	775	0	12,412	367	0	367	3,762	16,541	**59,395**	0	**59,395**
1995	85,438	12,846	293	81	13,219	0	46	46	3,294	16,559	**68,879**	0	**68,879**
1996	96,411	18,245	303	86	18,634	0	24	24	3,602	22,260	**74,152**	0	**74,152**
1997	106,937	23,691	256	46	23,994	0	9	9	3,838	27,841	**79,095**	0	**79,095**
1998	113,062	17,710	221	60	17,991	0	36	36	3,414	21,441	**91,622**	0	**91,622**
1999	119,125	25,235	199	67	25,502	0	16	16	3,678	29,196	**89,929**	0	**89,929**
2000	139,348	28,221	0	47	28,267	0	33	33	4,381	32,681	**106,667**	0	**106,667**
2001	125,649	19,643	0	181	19,824	0	119	119	4,597	24,540	**101,109**	0	**101,109**
2002	137,468	10,138	0	326	10,465	0	0	0	6,628	17,093	**120,376**	0	**120,376**
2003	130,350	6,390	0	120	6,510	0	37	37	7,501	14,048	**116,302**	0	**116,302**
2004	127,701	7,682	0	142	7,824	0	46	46	8,142	16,012	**111,690**	0	**111,690**
2005	121,576	9,282	0	152	9,434	0	90	90	9,998	19,521	**102,054**	0	**102,054**
2006	114,012	12,731	0	30	12,760	0	10	10	11,797	24,568	**89,445**	0	**89,445**
2007	110,292	17,858	0	88	17,946	0	0	0	13,228	31,175	**79,118**	0	**79,118**
2008	122,089	3,692	0	75	3,767	0	16	16	12,941	16,724	**105,365**	0	**105,365**
2009	115,573	1,805	0	111	1,916	0	1	1	14,573	16,490	**99,084**	0	**99,084**

*** Extrapolated between land use survey years 1950, 1957, and 1961, and crop report year 1970**

Appendix D-7: Table 3
Historical Groundwater Supply
Municipal and Industrial Users
Antelope Valley Area of Adjudication
(pumpage in acre-feet per year)

Los Angeles County Waterworks District 40

Year	Reg. 4 Lancaster	Code	Transfer to AVWC from Reg. 4 Lancaster	Code	Reg. 4 Lancaster Total	Reg. 24 Pearblossom	Code	Reg. 27 Littlerock	Code	Reg. 33 Sun Village	Code	Reg. 34 Palmdale	Code	Transfer from QHWD to Reg. 34 Palmdale	Code	Reg. 34 Palmdale Total	Reg. 35 NE LA	Code	Reg. 38 Lake LA	Code	Reg. 39 Rock Ck	Code	Total
1946	200.0	1	0	est	**200.0**	0	1	400.0	1	0	1	0	1	0	est	**0**	0	1	0	1	0	1	**600.0**
1947	200.0	1	0	est	**200.0**	0	1	0.0	1	0	1	0	1	0	est	**0**	0	1	0	1	0	1	**200.0**
1948	839.0	1	0	est	**839.0**	0	1	200.0	1	0	1	0	1	0	est	**0**	0	1	188.0	1	0	1	**1,227.0**
1949	1,137.0	1	0	est	**1,137.0**	0	1	0.0	1	0	1	0	1	0	est	**0**	0	1	0	1	0	1	**1,137.0**
1950	585.0	1	0	est	**585.0**	0	1	0.0	1	0	1	0	1	0	est	**0**	0	1	0	1	0	1	**585.0**
1951	298.0	1	0	est	**298.0**	0	1	400.0	1	306.0	1	0	1	0	est	**0**	0	1	0	1	0	1	**1,004.0**
1952	1,087.0	1	0	est	**1,087.0**	0	1	0.0	1	0	1	0	1	0	est	**0**	0	1	0	1	0	1	**1,087.0**
1953	3,136.0	1	0	est	**3,136.0**	0	1	399.0	1	214.0	1	0	1	0	est	**0**	316.0	1	0	1	0	1	**4,065.0**
1954	1,515.0	1	0	est	**1,515.0**	455.0	1	0.0	1	160.0	1	0	1	0	est	**0**	0	1	0	1	0	1	**2,130.0**
1955	1,762.0	1	0	est	**1,762.0**	0	1	208.0	1	160.0	1	0	1	0	est	**0**	0	1	0	1	0	1	**2,130.0**
1956	2,463.0	1	0	est	**2,463.0**	0	1	1,017.0	1	160.0	1	0	1	0	est	**0**	0	1	0	1	0	1	**3,640.0**
1957	4,333.0	1	0	est	**4,333.0**	0	1	782.0	1	53.0	1	0	1	0	est	**0**	0	1	21.0	1	0	1	**5,189.0**
1958	3,405.0	1	0	est	**3,405.0**	0	1	550.0	1	878.0	1	0	1	0	est	**0**	0	1	403.0	1	0	1	**5,236.0**
1959	4,157.0	1	0	est	**4,157.0**	0	1	1,320.0	1	147.0	1	0	1	0	est	**0**	0	1	10.0	1	0	1	**5,634.0**
1960	5,387.0	1	0	est	**5,387.0**	6.0	1	194.0	1	192.0	1	0	1	0	est	**0**	0	1	0	1	0	1	**5,779.0**
1961	3,649.0	1	0	est	**3,649.0**	884.0	1	1,081.0	1	4,800.0	1	0	1	0	est	**0**	37.0	1	585.0	1	0	1	**11,036.0**
1962	9,945.0	1	0	est	**9,945.0**	819.0	1	219.0	1	197.0	1	0	1	0	est	**0**	0	1	355.0	1	0	1	**11,535.0**
1963	7,760.0	1	0	est	**7,760.0**	227.0	1	283.0	1	125.0	1	0	1	0	est	**0**	0	1	1,772.0	1	0	1	**10,167.0**
1964	8,097.0	1	0	est	**8,097.0**	241.0	1	246.0	1	244.0	1	0	1	0	est	**0**	1.0	1	1,204.0	1	0	1	**10,033.0**
1965	8,223.0	1	0	est	**8,223.0**	145.0	1	330.0	1	60.0	1	0	1	0	est	**0**	0	1	3,002.0	1	0	1	**11,760.0**
1966	7,979.0	1	0	7	**7,979.0**	152.0	1	403.0	1	20.0	1	0	1	0	est	**0**	10.0	1	2,227.0	1	0	1	**10,791.0**
1967	8,365.0	1	0	7	**8,365.0**	948.0	1	362.0	1	417.0	1	0	1	0	est	**0**	17.0	1	289.0	1	0	1	**10,398.0**
1968	10,750.0	1	0	7	**10,750.0**	170.0	1	443.0	1	0	1	0	1	0	est	**0**	23.0	1	1,150.0	1	0	1	**12,536.0**
1969	10,978.0	1	0	7	**10,978.0**	147.0	1	730.0	1	1,103.0	1	0	1	0	est	**0**	35.0	1	2,600.0	1	0	1	**15,593.0**
1970	12,572.0	1	0	7	**12,572.0**	186.0	1	674.0	1	0	1	0	1	0	est	**0**	72.0	1	579.0	1	0	1	**14,083.0**
1971	12,462.0	1	0	7	**12,462.0**	270.0	1	502.0	1	22.0	1	0	1	0	est	**0**	79.0	1	672.0	1	0	1	**14,007.0**
1972	13,206.0	1	0	7	**13,206.0**	117.0	1	846.0	1	0	1	0	1	0	est	**0**	1,630.0	1	94.0	1	0	1	**15,893.0**
1973	13,890.0	1	0	7	**13,890.0**	123.0	1	468.0	1	0	1	0	1	0	est	**0**	138.0	1	558.0	1	0	1	**15,177.0**
1974	13,252.0	1	0	7	**13,252.0**	130.0	1	504.0	1	0	1	0	1	0	est	**0**	92.0	1	590.0	1	0	1	**14,568.0**
1975	12,207.0	1	0	7	**12,207.0**	96.0	1	453.0	1	0	1	0	1	0	est	**0**	104.0	1	680.0	1	0	1	**13,540.0**
1976	11,875.0	1	0	7	**11,875.0**	139.0	1	728.0	1	0	1	0	1	0	est	**0**	69.0	1	742.0	1	0	1	**13,553.0**
1977	10,038.0	1	0	7	**10,038.0**	119.0	1	657.0	1	0	1	0	1	0	est	**0**	86.0	1	604.0	1	0	1	**11,504.0**
1978	5,982.9	2	0	7	**5,982.9**	163.4	2	655.0	2	0	2	0	2	0	est	**0**	55.0	2	593.4	2	0	2	**7,449.7**
1979	6,847.7	2	0	7	**6,847.7**	179.3	2	656.1	2	0	2	0	2	0	est	**0**	16.7	2	800.1	2	148.7	2	**8,648.6**
1980	7,534.8	2	0	7	**7,534.8**	109.0	2	726.7	2	0	2	0	2	0	est	**0**	0.4	2	980.7	2	142.4	2	**9,493.9**
1981	7,856.3	2	0	7	**7,856.3**	93.1	2	550.4	2	0	2	0	2	0	est	**0**	5.6	2	666.9	2	165.0	2	**9,337.2**
1982	9,155.9	2	0	7	**9,155.9**	101.2	2	717.3	2	0	2	0	2	0	est	**0**	64.5	2	723.9	2	158.9	2	**10,921.7**
1983	5,972.3	1	0	7	**5,972.3**	114.0	1	500.9	1	0	1	0	1	0	est	**0**	53.4	1	575.4	1	0	1	**7,216.0**
1984	9,022.2	2	0	7	**9,022.2**	134.4	2	426.7	2	0	2	0	2	0	est	**0**	7.8	2	754.2	2	160.6	2	**10,505.9**
1985	8,699.1	2	0	7	**8,699.1**	189.2	2	518.3	2	0	2	0	2	0	est	**0**	68.2	2	162.5	2	68.9	2	**9,706.0**
1986	10,976.7	2	0	7	**10,976.7**	164.9	2	535.0	2	0	2	0	2	0	est	**0**	42.8	2	961.6	2	199.6	2	**12,880.6**
1987	11,609.1	2	0	7	**11,609.1**	111.6	2	611.5	2	0	2	0	2	0	est	**0**	56.6	2	1,147.8	2	152.4	2	**13,689.0**
1988	12,326.9	2	0	7	**12,326.9**	128.9	2	660.0	2	0	2	0	2	0	est	**0**	82.1	2	1,117.1	2	176.6	2	**14,491.6**
1989	15,402.0	2	0	7	**15,402.0**	95.2	2	590.5	2	0	2	0	2	0	est	**0**	2.2	2	1,134.6	2	167.0	2	**17,391.4**
1990	11,061.5	2	0	7	**11,061.5**	173.6	2	859.5	2	0	2	0	2	0	est	**0**	8.1	2	740.2	2	151.5	2	**12,994.3**
1991	11,322.9	2	0	7	**11,322.9**	96.1	2	634.7	2	0	2	0	2	0	est	**0**	60.3	2	726.1	2	118.6	2	**12,958.7**
1992	8,589.9	2	0	7	**8,589.9**	117.3	2	366.8	2	0	2	0	2	0	est	**0**	86.8	2	200.5	2	239.0	2	**9,600.2**
1993	13,361.4	2	0	7	**13,361.4**	66.3	2	196.1	2	0	2	199.3	2	0	est	**199.3**	2.6	2	264.3	2	267.1	2	**14,357.1**
1994	14,985.9	2	0	7	**14,985.9**	4.5	2	426.8	2	0	2	224.0	2	0	est	**224.0**	74.4	2	1,059.5	2	228.3	2	**17,003.4**
1995	17,776.0	2	0	7	**17,776.0**	42.8	2	835.6	2	0	2	438.3	2	0	est	**438.3**	8.2	2	478.8	2	208.4	2	**19,788.0**
1996	17,287.4	2	0	7	**17,287.4**	0.5	2	1,071.5	2	0	2	418.2	2	0	est	**418.2**	73.8	2	275.2	2	212.9	2	**19,339.4**
1997	17,443.5	2	0	7	**17,443.5**	6.3	2	1,128.2	2	0	2	344.9	2	0	est	**344.9**	28.3	2	515.1	2	177.9	2	**19,644.1**
1998	15,174.9	2	0	7	**15,174.9**	0.3	2	794.1	2	0	2	656.3	2	0	est	**656.3**	37.6	2	838.2	2	87.2	2	**17,588.5**
1999	16,311.0	2	0	7	**16,311.0**	0.1	2	982.3	2	0	2	633.3	2	0	est	**633.3**	0	2	550.6	2	220.6	2	**18,698.0**
2000	14,434.8	2	0	7	**14,434.8**	0.3	2	1,155.0	2	0	2	456.4	2	0	est	**456.4**	126.8	2	1,138.6	2	106.7	2	**17,418.7**
2001	18,052.1	2	0	7	**18,052.1**	385.4	2	1,262.3	2	0	2	518.3	2	0.4	2	**518.6**	122.1	2	1,283.6	2	112.1	2	**21,736.1**
2002	18,193.9	2	0	7	**18,193.9**	445.8	2	931.2	2	0	2	21.0	2	1.0	2	**22.0**	116.8	2	1,364.0	2	122.0	2	**21,195.6**
2003	14,859.8	2	(45.9)	7	**14,813.9**	319.5	2	691.1	2	0	2	271.5	2	0.6	2	**272.1**	114.6	2	371.5	2	208.8	2	**16,791.4**
2004	18,173.8	2	(68.7)	7	**18,105.0**	268.6	2	592.3	2	0	2	633.1	2	0.8	2	**634.0**	325.0	2	1,227.4	2	128.3	2	**21,280.6**
2005	15,880.6	2	(69.2)	7	**15,811.4**	382.9	2	645.8	2	0	2	537.4	2	0.7	2	**538.0**	425.7	2	1,179.8	2	217.3	2	**19,201.0**
2006	10,108.2	2	(74.6)	7	**10,033.7**	124.3	2	685.5	2	0	2	299.6	2	19.6	2	**319.2**	446.7	2	440.4	2	227.4	2	**12,277.1**
2007	16,991.6	2	0.0	7	**16,991.6**	383.1	2	559.8	2	0	2	393.9	2	49.5	2	**443.4**	394.7	2	429.2	2	210.8	2	**19,412.7**
2008	23,420.7	2	0.0	7	**23,420.7**	474.9	2	604.1	2	0	2	17.8	2	0.0	2	**17.8**	721.6	2	349.3	2	210.6	2	**25,799.0**
2009	15,875.3	2	0.0	7	**15,875.3**	319.6	2	311.0	2	0	2	0.0	2	0.0	2	**0.0**	475.9	2	1,046.5	2	169.8	2	**18,198.0**

Palmdale Water District / Littlerock Creek Irrigation District / Quartz Hill Water District / Rosamond Community Services District / Antelope Valley Water Company

Year	Palmdale Water District: Lancaster System	Code	Pearland System	Code	Transfer to LCID for Municipal Supply	Transfer to LCID for Agricultural Supply	Code	Total	Littlerock Creek Irrigation District: LCID Municipal Supply	Transfer from PWD for Municipal Supply	Code	Total	Quartz Hill Water District	Code	Transfer to LACWW40 (Reg.34) from QHWD	Code	Total	Rosamond Community Services District	Code	Antelope Valley Water Company: Lancaster System	Code	Transfer from LACWW40-Reg 4 to Lancaster Subsystem	Code	Total
1946	756	est	36	est	0	0	4	**792**	200	0	est	**200**	480	est	0	est	**480**	**54**	est	98	est	0	est	**98**
1947	890	est	36	est	0	0	4	**926**	207	0	est	**207**	480.0	1	0	est	**480.0**	**54**	est	98	est	0	est	**98**
1948	1,024	est	36	est	0	0	4	**1,060**	214	0	est	**214**	729.0	1	0	est	**729.0**	**54**	est	98	est	0	est	**98**
1949	1,159	est	36	est	0	0	4	**1,195**	221	0	est	**221**	645.0	1	0	est	**645.0**	**54**	est	98	est	0	est	**98**
1950	1,293	est	36	est	0	0	4	**1,329**	229	0	est	**229**	480.0	1	0	est	**480.0**	**54**	est	98	est	0	est	**98**
1951	1,428	est	36	est	0	0	4	**1,463**	236	0	est	**236**	480.0	1	0	est	**480.0**	**54**	est	98	est	0	est	**98**
1952	1,562	est	36	est	0	0	4	**1,598**	243	0	est	**243**	43.0	1	0	est	**43.0**	**54**	est	98	est	0	est	**98**
1953	1,696	est	36	est	0	0	4	**1,732**	250	0	est	**250**	480.0	1	0	est	**480.0**	**54**	est	98	est	0	est	**98**
1954	1,831	est	36	est	0	0	4	**1,867**	257	0	est	**257**	28.0	1	0	est	**28.0**	**54**	est	98	est	0	est	**98**
1955	1,965	est	36	est	0	0	4	**2,001**	264	0	est	**264**	50.0	5	0	est	**50.0**	**54**	est	98	est	0	est	**98**
1956	2,099	est	36	est	0	0	4	**2,135**	271	0	est	**271**	147.0	5	0	est	**147.0**	**54**	est	98	est	0	est	**98**
1957	2,233.7	3	36	est	0	0	4	**2,270**	279	0	est	**279**	394.0	5	0	est	**394.0**	**54**	est	98	est	0	est	**98**
1958	2,487.7	3	36	est	0	0	4	**2,524**	286	0	est	**286**	447.0	5	0	est	**447.0**	**54**	est	98	est	0	est	**98**
1959	2,942.6	3	36	est	0	0	4	**2,979**	293	0	est	**293**	534.9	5	0	est	**534.9**	**54**	est	98	est	0	est	**98**
1960	3,050.1	3	35.9	3	0	0	4	**3,086.0**	300	0	est	**300**	525.8	5	0	est	**525.8**	**54**	est	98	est	0	est	**98**
1961	3,235.9	3	48.0	3	0	0	4	**3,283.9**	310	0	est	**310**	585.4	5	0	est	**585.4**	**54**	est	98	est	0	est	**98**
1962	3,219.7	3	155.8	3	0	0	4	**3,375.5**	320	0	est	**320**	624.8	5	0	est	**624.8**	**54**	est	98	est	0	est	**98**
1963	3,270.0	3	157.2	3	0	0	4	**3,427.2**	330	0	est	**330**	561.2	5	0	est	**561.2**	**54**	est	98	est	0	est	**98**
1964	3,798.2	3	179.7	3	0	0	4	**3,977.9**	340	0	est	**340**	544.9	5	0	est	**544.9**	**54**	est	98	est	0	est	**98**
1965	1,675.8	3	72.1	3	0	0	4	**1,747.9**	350	0	est	**350**	605.9	5	0	est	**605.9**	**54**	est	98	est	0	est	**98**
1966	3,803.0	3	184.5	3	0	0	4	**3,987.5**	360	0	est	**360**	603.1	5	0	est	**603.1**	**54**	est	97.7	7	0	7	**97.7**
1967	3,846.0	3	192.8	3	0	0	4	**4,038.8**	370	0	est	**370**	516.0	5	0	est	**516.0**	**54**	est	114.4	7	0	7	**114.4**
1968	4,084.2	3	203.2	3	0	0	4	**4,287.4**	380	0	est	**380**	621.5	5	0	est	**621.5**	**54**	est	127.7	7	0	7	**127.7**
1969	4,136	est	230	est	0	0	4	**4,366**	390	0	est	**390**	596.0	5	0	est	**596.0**	**54**	est	138.2	7	0	7	**138.2**
1970	4,188	est	257	est	0	0	4	**4,445**	169	0	est	**169**	917.5	5	0	est	**917.5**	**54**	est	164.1	7	0	7	**164.1**
1971	4,240	est	283	est	0	0	4	**4,523**	260	0	est	**260**	922.5	5	0	est	**922.5**	**54**	est	187	est	0	7	**186.8**
1972	4,292.3	3	309.8	3	0	0	4	**4,602.1**	273	0	est	**273**	1,065.0	5	0	est	**1,065.0**	**54**	est	209	est	0	7	**209.4**
1973	4,180.9	3	382.5	3	0	0	4	**4,563.4**	243	0	est	**243**	1,281.0	5	0	est	**1,281.0**	**54**	est	232.1	7	0	7	**232.1**
1974	4,755.5	3	306.7	3	0	0	4	**5,062.2**	236	0	est	**236**	1,166.5	5	0	est	**1,166.5**	**54**	est	219.8	7	0	7	**219.8**
1975	4,269.8	3	572.5	3	0	0	4	**4,842.3**	231	0	est	**231**	1,395.5	5	0	est	**1,395.5**	**54**	est	247.9	7	0	7	**247.9**
1976	3,926.8	3	948.4	3	0	0	4	**4,875.2**	244	0	est	**244**	1,474.0	5	0	est	**1,474.0**	**54.5**	6	281.0	7	0	7	**281.0**
1977	3,446.9	3	1,152.1	3	0	0	4	**4,599.0**	373	0	est	**373**	1,353.0	5	0	est	**1,353.0**	**383.0**	6	260.9	7	0	7	**260.9**
1978	3,605.5	3	1,243.2	3	0	0	4	**4,848.7**	270	0	est	**270**	915.0	5	0	est	**915.0**	**400.0**	6	271.1	7	0	7	**271.1**
1979	4,482.4	3	683.0	3	0	0	4	**5,165.4**	266	0	est	**266**	733.0	5	0	est	**733.0**	**417.4**	6	109.2	7	0	7	**109.2**
1980	3,493.0	3	667.3	3	0	0	4	**4,160.3**	270	0	est	**270**	752.0	5	0	est	**752.0**	**433.3**	6	296.5	7	0	7	**296.5**
1981	3,680.1	3	576.3	3	0	0	4	**4,256.4**	206	0	est	**206**	879.2	5	0	est	**879.2**	**626.1**	6	305.9	7	0	7	**305.9**
1982	4,879.3	3	650.0	3	0	0	4	**5,529.3**	337	0	est	**337**	658.3	5	0	est	**658.3**	**629.2**	6	280.7	7	0	7	**280.7**
1983	5,312.6	3	306.3	3	0	0	4	**5,618.9**	374	0	est	**374**	928.9	5	0	est	**928.9**	**416.3**	6	263.8	7	0	7	**263.8**
1984	6,544.5	3	605.9	3	0	0	4	**7,150.4**	416	0	est	**416**	1,147.0	5	0	est	**1,147.0**	**507.6**	6	328.3	7	0	7	**328.3**
1985	6,285.2	3	482.5	3	0	0	4	**6,767.7**	428	0	est	**428**	826.2	5	0	est	**826.2**	**677.4**	6	412.0	7	0	7	**412.0**
1986	6,416.5	3	495.2	3	0	0	4	**6,911.7**	473	0	est	**473**	1,332.1	5	0	est	**1,332.1**	**721.2**	6	517.2	7	0	7	**517.2**
1987	7,543.1	3	364.3	3	0	0	4	**7,907.4**	370	0	est	**370**	1,219.8	5	0	est	**1,219.8**	**1,092.6**	6	516.9	7	0	7	**516.9**
1988	9,176.4	3	553.4	3	0	0	4	**9,729.8**	39	0	est	**39**	1,709.3	5	0	est	**1,709.3**	**800.0**	6	593.6	7	0	7	**593.6**
1989	7,776.9	3	515.3	3	0	0	4	**8,292.2**	464	0	est	**464**	1,657.3	5	0	est	**1,657.3**	**775.0**	1	665.6	7	0	7	**665.6**
1990	9,775.1	3	441.8	3	0	0	4	**10,216.9**	427	0	est	**427**	1,199.0	5	0	est	**1,199.0**	**780.0**	1	642.1	7	0	7	**642.1**
1991	10,064.9	3	1,452.2	3	0	0	4	**11,517.1**	610	0	est	**610**	1,307.2	5	0	est	**1,307.2**	**1,228.3**	6	525.5	7	0	7	**525.5**
1992	6,902.3	3	1,275.6	3	0	0	4	**8,177.9**	513	0	est	**513**	1,245.4	5	0	est	**1,245.4**	**1,089.9**	6	569.6	7	0	7	**569.6**
1993	6,318.1	3	1,697.7	3	0	0	4	**8,015.8**	465	0	est	**465**	1,499.0	5	0	est	**1,499.0**	**1,025.4**	6	618.3	7	0	7	**618.3**
1994	9,157.2	3	2,156.0	3	0	0	4	**11,313.2**	524	0	est	**524**	1,262.1	5	0	est	**1,262.1**	**1,025.4**	6	682.6	7	0	7	**682.6**
1995	8,845.6	3	2,240.5	3	(87)	(135)	est	**10,864.1**	645	87	est	**731**	1,798.3	5	0	est	**1,798.3**	**825.8**	6	677.1	7	0	7	**677.1**
1996	6,930.7	3	2,577.3	3	(47)	(74)	est	**9,387.0**	693	47	est	**740**	2,306.1	5	0	est	**2,306.1**	**2,026.7**	6	746.8	7	0	7	**746.8**
1997	7,005.2	3	2,133.2	3	(27)	(37)	est	**9,075.0**	745	27	est	**771**	2,030.0	5	0	est	**2,030.0**	**1,973.3**	6	756.7	7	0	7	**756.7**
1998	6,157.4	3	1,904.4	3	(48)	(57)	est	**7,957.0**	690	48	est	**737**	1,231.1	5	0	est	**1,231.1**	**1,540.9**	6	655.2	7	0	7	**655.2**
1999	7,321.7	3	2,246.3	3	(36)	(51)	est	**9,481.2**	761	36	est	**797**	1,495.9	5	0	est	**1,495.9**	**1,462.7**	6	756.5	7	0	7	**756.5**
2000	7,915.2	3	1,709.7	3	(46)	(49)	est	**9,529.7**	879	46	est	**925**	1,418.9	5	0	est	**1,418.9**	**1,460.8**	6	827.4	7	0	7	**827.4**
2001	9,305.5	3	1,955.1	3	(120)	(196)	est	**10,944.7**	696	120	est	**816**	3,040.7	5	(0.4)	2	**3,040.3**	**2,165.4**	6	810.5	7	0	7	**810.5**
2002	6,601.3	3	1,659.4	3	(86)	(146)	est	**8,028.5**	722	86	est	**808**	2,802.3	5	(1.0)	2	**2,801.3**	**2,358.8**	6	787.0	7	0	7	**787.0**
2003	8,724.2	3	1,842.9	3	(80)	(111)	est	**10,376.7**	808	80	est	**887**	1,554.7	5	(0.6)	2	**1,554.1**	**1,767.4**	6	556.4	7	45.9	7	**602.3**
2004	9,210.7	3	1,779.1	3	(75)	(129)	est	**10,786.3**	817	75	est	**891**	1,348.0	5	(0.8)	2	**1,347.2**	**2,118.3**	6	526.1	7	68.7	7	**594.9**
2005	9,492.0	3	1,553.1	3	(95)	(144)	est	**10,806.4**	745	95	est	**840**	1,245.0	5	(0.7)	2	**1,244.3**	**1,702.0**	6	545.2	7	69.2	7	**614.4**
2006	9,430.1	3	1,889.7	3	(22)	(27)	est	**11,270.8**	947	22	est	**969**	1,406.0	5	(19.6)	2	**1,386.4**	**2,213.5**	6	459.5	7	74.6	7	**534.1**
2007	8,664.0	3	1,722.4	3	(28)	(46)	est	**10,312.9**	919	28	est	**946**	2,073.2	5	(49.5)	2	**2,023.7**	**2,484.2**	6	844.2	7	0.0	7	**844.2**
2008	8,101.5	3	1,649.5	3	(44)	(51)	est	**9,655.5**	877	44	est	**921**	2,854.0	5	0.0	2	**2,854.0**	**2,858.8**	6	767.9	7	0.0	7	**767.9**
2009	6,461.1	3	1,273.1	3	(53)	(56)	est	**7,625.9**	842	53	est	**895**	2,431.6	5	0.0	2	**2,431.6**	**2,856.0**	6	667.3	7	0.0	7	**667.3**

Year	Palm Ranch Irrigation District	Code	Desert Lake Community Services District	Code	Boron Community Services District	Code	Edwards Air Force Base	Code	Subtotal	Mutual and Private Water Companies	Code	Rural Residential	Code	Total
1946	**307**	est	**0**	1	**0**	1	**2,966**	est	**5,497**	**325**	est*	**520**	est*	**6,341**
1947	**307.0**	1	**0**	1	**0**	1	**2,966.0**	1	**5,238**	**312**	est*	**499**	est*	**6,049**
1948	**307.0**	1	**0**	1	**0**	1	**2,166.0**	1	**5,856**	**343**	est*	**548**	est*	**6,747**
1949	**935.0**	1	**0**	1	**0**	1	**2,941.0**	1	**7,226**	**411**	est*	**658**	est*	**8,296**
1950	**307.0**	1	**0**	1	**0**	1	**2,495.0**	1	**5,577**	**329**	est*	**526**	est*	**6,432**
1951	**307.0**	1	**0**	1	**0**	1	**1,587.0**	1	**5,229**	**311**	est*	**498**	est*	**6,039**
1952	**307.0**	1	**0**	1	**0**	1	**1,367.0**	1	**4,797**	**290**	est*	**464**	est*	**5,550**
1953	**210.0**	1	**0**	1	**0**	1	**1,687.0**	1	**8,576**	**479**	est*	**766**	est*	**9,821**
1954	**307.0**	1	**0**	1	**0**	1	**4,005.0**	1	**8,746**	**487**	est*	**780**	est*	**10,013**
1955	**320.0**	1	**0**	1	**0**	1	**4,285.0**	1	**9,202**	**510**	est*	**816**	est*	**10,529**
1956	**56.0**	1	**0**	1	**0**	1	**4,902.0**	1	**11,304**	**686**	est*	**1,098**	est*	**13,088**
1957	**384.0**	1	**0**	1	**0**	1	**2,240.0**	1	**10,907**	**633**	est*	**1,013**	est*	**12,553**
1958	**472.0**	1	**160.0**	1	**0**	1	**1,425.0**	1	**10,702**	**657**	est*	**1,051**	est*	**12,409**
1959	**898.0**	1	**140.0**	1	**0**	1	**4,037.0**	1	**14,667**	**799**	est*	**1,278**	est*	**16,745**
1960	**483.0**	1	**174.0**	1	**0**	1	**2,496.0**	1	**12,996**	**669**	est*	**1,070**	est*	**14,736**
1961	**310.0**	1	**180.0**	1	**0**	1	**4,165.0**	1	**20,023**	**1,001**	est*	**1,602**	est*	**22,625**
1962	**418.0**	1	**180.0**	1	**0**	1	**5,464.0**	1	**22,070**	**1,380**	est*	**2,208**	est*	**25,658**
1963	**1,431.0**	1	**180.0**	1	**0**	1	**2,122.0**	1	**18,371**	**925**	est*	**1,481**	est*	**20,776**
1964	**675.0**	1	**180.0**	1	**298.0**	1	**3,693.0**	1	**19,894**	**1,008**	est*	**1,612**	est*	**22,514**
1965	**675.0**	1	**290.0**	1	**305.0**	1	**2,967.0**	1	**18,853**	**1,009**	est*	**1,614**	est*	**21,475**
1966	**466.0**	1	**300.0**	1	**347.0**	1	**4,357.0**	1	**21,364**	**1,068**	est*	**1,709**	est*	**24,141**
1967	**598.0**	1	**300.0**	1	**347.0**	1	**3,505.0**	1	**20,242**	**1,012**	est*	**1,619**	est*	**22,873**
1968	**916.0**	1	**367.0**	1	**472.0**	1	**3,227.0**	1	**22,989**	**1,307**	est*	**2,091**	est*	**26,387**
1969	**857.0**	1	**275.0**	1	**451.0**	1	**2,630.0**	1	**25,351**	**1,373**	est*	**2,196**	est*	**28,920**
1970	**815.0**	1	**194.0**	1	**509.0**	1	**1,350.0**	1	**22,701**	**1,216**	est*	**1,946**	est*	**25,863**
1971	**747.0**	1	**305.0**	1	**606.0**	1	**2,897.0**	1	**24,510**	**1,302**	est*	**2,084**	est*	**27,896**
1972	**850**	est	**300.0**	1	**621.0**	1	**3,566.0**	1	**27,434**	**1,447**	est*	**2,315**	est*	**31,196**
1973	**953.0**	1	**329.0**	1	**592.0**	1	**2,557.0**	1	**25,982**	**1,385**	est*	**2,215**	est*	**29,582**
1974	**1,021.0**	1	**331.0**	1	**620.0**	1	**2,369.0**	1	**25,648**	**1,339**	est*	**2,143**	est*	**29,130**
1975	**1,053.0**	1	**335.0**	1	**630.0**	1	**2,145.0**	1	**24,474**	**1,314**	est*	**2,102**	est*	**27,891**
1976	**1,101.0**	1	**318.0**	1	**565.0**	1	**2,245**	est	**24,710**	**1,304**	est*	**2,086**	est*	**28,100**
1977	**1,007.0**	1	**320.0**	1	**572.0**	1	**2,344**	est	**22,716**	**1,164**	est*	**1,862**	est*	**25,743**
1978	**815.0**	1	**322.0**	1	**605.0**	1	**2,444.0**	1	**18,341**	**1,061**	est*	**2,050**	est*	**21,452**
1979	**569**	est	**330.0**	1	**549.0**	1	**2,480.0**	1	**19,268**	**1,069**	est*	**2,188**	est*	**22,525**
1980	**322.2**	1	**225.0**	1	**580.0**	1	**2,515.0**	1	**19,048**	**963**	est*	**2,136**	est*	**22,147**
1981	**223.7**	1	**260.0**	1	**498.0**	1	**1,385.0**	1	**17,978**	**628**	est*	**2,283**	est*	**20,889**
1982	**313**	est	**270.0**	1	**290.0**	1	**2,060.0**	1	**21,289**	**763**	est*	**2,356**	est*	**24,408**
1983	**402.3**	1	**300.0**	1	**286.0**	1	**1,672.0**	1	**17,478**	**305**	est*	**1,928**	est*	**19,711**
1984	**569.7**	1	**180.0**	1	**238.0**	1	**2,141.0**	1	**23,184**	**431**	est*	**2,693**	est*	**26,308**
1985	**753.8**	1	**193.0**	1	**327.0**	1	**1,831.0**	1	**21,922**	**475**	est*	**2,946**	est*	**25,343**
1986	**183.5**	1	**213.0**	1	**323.0**	1	**2,041.0**	1	**25,596**	**932**	est*	**3,408**	est*	**29,936**
1987	**244.5**	1	**195.0**	1	**225.0**	1	**1,601.0**	1	**27,061**	**828**	est*	**3,763**	est*	**31,652**
1988	**413**	est	**177.0**	1	**233.0**	1	**1,597**	est	**29,784**	**800**	est*	**4,023**	est*	**34,607**
1989	**582.0**	1	**0**	1	**0**	1	**1,593.0**	1	**31,420**	**629**	est*	**4,895**	est*	**36,944**
1990	**451.0**	1	**0**	1	**0**	1	**1,526.0**	1	**28,236**	**1,042**	est*	**4,927**	est*	**34,205**
1991	**887.3**	1	**406.2**	1	**0**	1	**1,991.0**	1	**31,431**	**1,151**	est*	**4,113**	est*	**36,695**
1992	**682.0**	1a	**348.0**	1a	**0**	1	**4,794.2**	1a	**27,020**	**1,532**	est*	**4,556**	est*	**33,108**
1993	**1,151.0**	1a	**353.0**	1a	**0**	est	**3,498.8**	1a	**30,984**	**1,733**	est*	**5,649**	est*	**38,366**
1994	**962.0**	1a	**353**	est	**0**	est	**3,162.3**	1a	**36,288**	**1,777**	est*	**6,168**	est*	**44,233**
1995	**758.0**	1a	**353**	est	**0**	est	**3,815.2**	9	**39,611**	**2,149**	est*	**6,217**	est*	**47,976**
1996	**1,147**	est	**353**	est	**0**	est	**3,735.1**	9	**39,780**	**2,439**	est*	**6,915**	est*	**49,134**
1997	**1,147**	est	**353**	est	**0**	est	**3,781.2**	9	**39,531**	**2,745**	est*	**6,964**	est*	**49,240**
1998	**1,147**	est	**353**	est	**0**	est	**2,731.7**	9	**33,941**	**2,439**	est*	**6,245**	est*	**42,626**
1999	**1,147**	est	**353**	est	**0**	est	**3,199.1**	9	**37,390**	**2,639**	est*	**7,289**	est*	**47,318**
2000	**1,147**	est	**353**	est	**0**	est	**3,711.5**	9	**36,792**	**3,288**	est*	**7,624**	est*	**47,703**
2001	**1,147**	est	**353**	est	**0**	est	**4,103.9**	9	**45,117**	**3,306**	est*	**7,855**	est*	**56,278**
2002	**1,535.6**	8	**353**	est	**0**	est	**3,090.0**	9	**40,958**	**3,161**	est*	**7,886**	est*	**52,005**
2003	**1,558.4**	8	**437.0**	est	**0**	est	**1,935.2**	9	**35,910**	**3,087**	est*	**7,685**	est*	**46,682**
2004	**814.1**	8	**213.0**	est	**0**	est	**3,014.9**	9	**41,061**	**3,435**	est*	**8,106**	est*	**52,602**
2005	**1,138.6**	8	**203.4**	est	**0**	est	**2,356.2**	9	**38,106**	**3,216**	est*	**8,019**	est*	**49,341**
2006	**590.7**	8	**23.0**	est	**0**	est	**2,007.2**	9	**31,271**	**2,903**	est*	**8,254**	est*	**42,428**
2007	**95.3**	8	**0.0**	est	**0**	est	**2,093.5**	9	**38,213**	**3,480**	est*	**8,570**	est*	**50,263**
2008	**812.1**	8	**44.2**	est	**0**	est	**1,557.2**	9	**45,270**	**3,659**	est*	**7,909**	est*	**56,839**
2009	**1,438.3**	8	**136.2**	est	**0**	est	**1,172.1**	9	**35,420**	**3,458**	est*	**6,946**	est*	**45,825**

*** MWC estimated as historical total water requirement - historical AVEK surface water deliveries; Rural estimated as historical total water requirement (no surface water deliveries).**

Source Codes

- **1** USGS; Templin, W.E., et al., 1995
- **1a** USGS; Leighton and Phillips, 2003
- **2** LACWW40
- **3** PWD
- **4** LCID
- **5** QHWD
- **6** RCSD
- **7** AVWC (CalWater Service Co)
- **8** PRID
- **9** EAFB
- **10** AVEK
- **11** Desert Lake CSD

Appendix D-7: Table 4
Historical Total Water Supply
Municipal and Industrial Users
Antelope Valley Area of Adjudication
(acre-feet per year)

	Los Angeles County Waterworks District 40																							Palmdale Water District					Littlerock Creek Irrigation District					Quartz Hill Water District		
	Reg. 4 Lancaster			Reg. 24 Pearblossom			Reg. 27 Littlerock		Reg. 33 Sun Village			Reg. 34 Palmdale			Reg. 35 NE LA		Reg. 38 Lake LA			Reg. 39 Rock Ck		All Regions in District 40															
		SWP			SWP					SWP			SWP					SWP					SWP						SWP	Local	Total			SWP		
Year	GW	SW	Total	GW	SW	Total	GW	Total	GW	SW	Total	GW	SW	Total	GW	Total	GW	SW	Total	GW	Total	GW	SW	Total	GW	SW	SW	SW	Total	GW	SW	SW	SW	Total	GW	SW	Total
1946	200	0	200	0	0	0	400	400	0	0	0	0	0	0	0	0	0	0	0	0	0	600	0	**600**	792	0	1,000	1,000	**1,792**	200	0	0	0	**200**	480	0	**480**
1947	200	0	200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	200	0	**200**	926	0	1,000	1,000	**1,926**	207	0	0	0	**207**	480	0	**480**
1948	839	0	839	0	0	0	200	200	0	0	0	0	0	0	0	0	188	0	188	0	0	1,227	0	**1,227**	1,060	0	1,000	1,000	**2,060**	214	0	0	0	**214**	729	0	**729**
1949	1,137	0	1,137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,137	0	**1,137**	1,195	0	1,000	1,000	**2,195**	221	0	0	0	**221**	645	0	**645**
1950	585	0	585	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	585	0	**585**	1,329	0	1,000	1,000	**2,329**	229	0	0	0	**229**	480	0	**480**
1951	298	0	298	0	0	0	400	400	306	0	306	0	0	0	0	0	0	0	0	0	0	1,004	0	**1,004**	1,463	0	1,000	1,000	**2,463**	236	0	0	0	**236**	480	0	**480**
1952	1,087	0	1,087	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,087	0	**1,087**	1,598	0	1,000	1,000	**2,598**	243	0	0	0	**243**	43	0	**43**
1953	3,136	0	3,136	0	0	0	399	399	214	0	214	0	0	0	316	316	0	0	0	0	0	4,065	0	**4,065**	1,732	0	1,000	1,000	**2,732**	250	0	0	0	**250**	480	0	**480**
1954	1,515	0	1,515	455	0	455	0	0	160	0	160	0	0	0	0	0	0	0	0	0	0	2,130	0	**2,130**	1,867	0	1,000	1,000	**2,867**	257	0	0	0	**257**	28	0	**28**
1955	1,762	0	1,762	0	0	0	208	208	160	0	160	0	0	0	0	0	0	0	0	0	0	2,130	0	**2,130**	2,001	0	1,000	1,000	**3,001**	264	0	0	0	**264**	50	0	**50**
1956	2,463	0	2,463	0	0	0	1,017	1,017	160	0	160	0	0	0	0	0	0	0	0	0	0	3,640	0	**3,640**	2,135	0	2,422	2,422	**4,557**	271	0	0	0	**271**	147	0	**147**
1957	4,333	0	4,333	0	0	0	782	782	53	0	53	0	0	0	0	0	21	0	21	0	0	5,189	0	**5,189**	2,270	0	1,752	1,752	**4,022**	279	0	0	0	**279**	394	0	**394**
1958	3,405	0	3,405	0	0	0	550	550	878	0	878	0	0	0	0	0	403	0	403	0	0	5,236	0	**5,236**	2,524	0	2,434	2,434	**4,958**	286	0	0	0	**286**	447	0	**447**
1959	4,157	0	4,157	0	0	0	1,320	1,320	147	0	147	0	0	0	0	0	10	0	10	0	0	5,634	0	**5,634**	2,979	0	1,311	1,311	**4,290**	293	0	0	0	**293**	535	0	**535**
1960	5,387	0	5,387	6	0	6	194	194	192	0	192	0	0	0	0	0	0	0	0	0	0	5,779	0	**5,779**	3,086	0	385	385	**3,471**	300	0	0	0	**300**	526	0	**526**
1961	3,649	0	3,649	884	0	884	1,081	1,081	4,800	0	4,800	0	0	0	37	37	585	0	585	0	0	11,036	0	**11,036**	3,284	0	0	0	**3,284**	310	0	0	0	**310**	585	0	**585**
1962	9,945	0	9,945	819	0	819	219	219	197	0	197	0	0	0	0	0	355	0	355	0	0	11,535	0	**11,535**	3,376	0	5,534	5,534	**8,910**	320	0	0	0	**320**	625	0	**625**
1963	7,760	0	7,760	227	0	227	283	283	125	0	125	0	0	0	0	0	1,772	0	1,772	0	0	10,167	0	**10,167**	3,427	0	136	136	**3,563**	330	0	0	0	**330**	561	0	**561**
1964	8,097	0	8,097	241	0	241	246	246	244	0	244	0	0	0	1	1	1,204	0	1,204	0	0	10,033	0	**10,033**	3,978	0	262	262	**4,240**	340	0	0	0	**340**	545	0	**545**
1965	8,223	0	8,223	145	0	145	330	330	60	0	60	0	0	0	0	0	3,002	0	3,002	0	0	11,760	0	**11,760**	1,748	0	1,318	1,318	**3,066**	350	0	0	0	**350**	606	0	**606**
1966	7,979	0	7,979	152	0	152	403	403	20	0	20	0	0	0	10	10	2,227	0	2,227	0	0	10,791	0	**10,791**	3,988	0	0	0	**3,988**	360	0	0	0	**360**	603	0	**603**
1967	8,365	0	8,365	948	0	948	362	362	417	0	417	0	0	0	17	17	289	0	289	0	0	10,398	0	**10,398**	4,039	0	0	0	**4,039**	370	0	0	0	**370**	516	0	**516**
1968	10,750	0	10,750	170	0	170	443	443	0	0	0	0	0	0	23	23	1,150	0	1,150	0	0	12,536	0	**12,536**	4,287	0	3,150	3,150	**7,437**	380	0	0	0	**380**	622	0	**622**
1969	10,978	0	10,978	147	0	147	730	730	1,103	0	1,103	0	0	0	35	35	2,600	0	2,600	0	0	15,593	0	**15,593**	4,366	0	2,105	2,105	**6,471**	390	0	0	0	**390**	596	0	**596**
1970	12,572	0	12,572	186	0	186	674	674	0	0	0	0	0	0	72	72	579	0	579	0	0	14,083	0	**14,083**	4,445	0	1,396	1,396	**5,841**	169	0	231	231	**400**	918	0	**918**
1971	12,462	0	12,462	270	0	270	502	502	22	0	22	0	0	0	79	79	672	0	672	0	0	14,007	0	**14,007**	4,523	0	1,389	1,389	**5,912**	260	0	150	150	**410**	923	0	**923**
1972	13,206	0	13,206	117	0	117	846	846	0	0	0	0	0	0	1,630	1,630	94	0	94	0	0	15,893	0	**15,893**	4,602	0	1,360	1,360	**5,962**	273	26	121	147	**420**	1,065	0	**1,065**
1973	13,890	0	13,890	123	0	123	468	468	0	0	0	0	0	0	138	138	558	0	558	0	0	15,177	0	**15,177**	4,563	0	1,523	1,523	**6,086**	243	28	159	187	**430**	1,281	0	**1,281**
1974	13,252	0	13,252	130	0	130	504	504	0	0	0	0	0	0	92	92	590	0	590	0	0	14,568	0	**14,568**	5,062	0	938	938	**6,000**	236	40	164	204	**440**	1,167	0	**1,167**
1975	12,207	0	12,207	96	0	96	453	453	0	0	0	0	0	0	104	104	680	0	680	0	0	13,540	0	**13,540**	4,842	0	1,586	1,586	**6,428**	231	56	163	219	**450**	1,396	0	**1,396**
1976	11,875	0	11,875	139	0	139	728	728	0	0	0	0	0	0	69	69	742	0	742	0	0	13,553	0	**13,553**	4,875	0	1,151	1,151	**6,026**	244	64	152	216	**460**	1,474	0	**1,474**
1977	10,038	0	10,038	119	0	119	657	657	0	0	0	0	0	0	86	86	604	0	604	0	0	11,504	0	**11,504**	4,599	0	468	468	**5,067**	373	18	80	97	**470**	1,353	0	**1,353**
1978	5,983	4,266	10,249	163	0	163	655	655	0	0	0	0	0	0	55	55	593	0	593	0	0	7,450	4,266	**11,716**	4,849	0	2,024	2,024	**6,873**	270	23	187	210	**480**	915	568	**1,483**
1979	6,848	5,750	12,598	179	0	179	656	656	0	0	0	0	0	0	17	17	800	0	800	149	149	8,649	5,750	**14,399**	5,165	0	913	913	**6,078**	266	14	209	224	**490**	733	872	**1,605**
1980	7,535	4,732	12,267	109	0	109	727	727	0	0	0	0	0	0	0	0	981	0	981	142	142	9,494	4,732	**14,226**	4,160	0	913	913	**5,073**	270	21	209	230	**500**	752	992	**1,744**
1981	7,856	6,359	14,215	93	0	93	550	550	0	0	0	0	0	0	6	6	667	0	667	165	165	9,337	6,359	**15,696**	4,256	0	1,638	1,638	**5,894**	206	189	155	344	**550**	879	1,154	**2,033**
1982	9,156	4,359	13,515	101	0	101	717	717	0	66	66	0	0	0	64	64	724	0	724	159	159	10,922	4,425	**15,347**	5,529	0	1,680	1,680	**7,209**	337	0	263	263	**600**	658	1,131	**1,789**
1983	5,972	3,978	9,951	114	0	114	501	501	0	193	193	0	0	0	53	53	575	0	575	0	0	7,216	4,171	**11,387**	5,619	0	714	714	**6,333**	374	8	268	276	**650**	929	930	**1,859**
1984	9,022	7,088	16,110	134	0	134	427	427	0	391	391	0	0	0	8	8	754	53	807	161	161	10,506	7,532	**18,038**	7,150	0	927	927	**8,077**	416	0	284	284	**700**	1,147	1,247	**2,394**
1985	8,699	7,819	16,518	189	45	235	518	518	0	664	664	0	0	0	68	68	162	916	1,078	69	69	9,706	9,445	**19,151**	6,768	1,558	1,460	3,018	**9,786**	428	0	322	322	**750**	826	1,601	**2,427**
1986	10,977	9,475	20,452	165	191	355	535	535	0	656	656	0	0	0	43	43	962	673	1,635	200	200	12,881	10,995	**23,875**	6,912	3,096	332	3,428	**10,340**	473	38	290	327	**800**	1,332	1,220	**2,553**
1987	11,609	9,788	21,397	112	232	343	612	612	0	705	705	0	0	0	57	57	1,148	883	2,031	152	152	13,689	11,608	**25,297**	7,907	5,379	0	5,379	**13,286**	370	249	231	480	**850**	1,220	1,407	**2,627**
1988	12,327	12,132	24,459	129	360	489	660	660	0	703	703	0	0	0	82	82	1,117	1,260	2,377	177	177	14,492	14,454	**28,946**	9,730	1,770	1,330	3,100	**12,830**	39	254	606	861	**900**	1,709	1,133	**2,842**
1989	15,402	12,263	27,665	95	386	481	590	590	0	773	773	0	1,278	1,278	2	2	1,135	1,597	2,732	167	167	17,391	16,298	**33,689**	8,292	9,009	1,400	10,409	**18,701**	464	283	204	486	**950**	1,657	1,369	**3,026**
1990	11,062	15,882	26,944	174	488	661	859	859	0	465	465	0	1,608	1,608	8	8	740	2,100	2,840	151	151	12,994	20,543	**33,538**	10,217	8,608	110	8,718	**18,935**	427	489	84	573	**1,000**	1,199	1,950	**3,149**
1991	11,323	9,518	20,841	96	186	282	635	635	0	642	642	0	1,140	1,140	60	60	726	1,454	2,180	119	119	12,959	12,940	**25,899**	11,517	3,914	286	4,200	**15,717**	610	160	230	390	**1,000**	1,307	1,543	**2,850**
1992	8,590	12,689	21,279	117	219	336	367	367	0	823	823	0	2,738	2,738	87	87	200	2,230	2,431	239	239	9,600	18,700	**28,300**	8,178	4,035	3,465	7,500	**15,678**	513	106	381	487	**1,000**	1,245	1,646	**2,891**
1993	13,361	16,765	30,127	66	513	580	196	196	0	991	991	199	3,649	3,848	3	3	264	2,489	2,753	267	267	14,357	24,407	**38,764**	8,016	7,761	2,239	10,000	**18,016**	465	269	266	535	**1,000**	1,499	1,833	**3,332**
1994	14,986	16,758	31,744	5	579	584	427	427	0	1,049	1,049	224	4,035	4,259	74	74	1,059	1,906	2,966	228	228	17,003	24,328	**41,331**	11,313	8,418	867	9,285	**20,598**	524	323	153	476	**1,000**	1,262	2,485	**3,747**
1995	17,776	13,849	31,625	43	495	538	836	836	0	776	776	438	4,023	4,461	8	8	479	2,546	3,025	208	208	19,788	21,689	**41,477**	10,864	6,481	3,695	10,176	**21,040**	731	239	30	269	**1,000**	1,798	2,098	**3,897**
1996	17,287	16,528	33,816	1	611	612	1,071	1,071	0	1,012	1,012	418	5,943	6,361	74	74	275	2,895	3,170	213	213	19,339	26,990	**46,329**	9,387	10,881	3,004	13,885	**23,272**	740	245	15	260	**1,000**	2,306	2,115	**4,421**
1997	17,443	17,548	34,992	6	526	533	1,128	1,128	0	1,194	1,194	345	6,070	6,415	28	28	515	2,751	3,266	178	178	19,644	28,089	**47,733**	9,075	11,470	2,346	13,816	**22,891**	771	222	7	229	**1,000**	2,030	2,493	**4,523**
1998	15,175	17,074	32,249	0	588	589	794	794	0	1,131	1,131	656	3,814	4,470	38	38	838	1,991	2,829	87	87	17,589	24,599	**42,187**	7,957	8,327	4,974	13,301	**21,258**	737	233	30	263	**1,000**	1,231	2,723	**3,955**
1999	16,311	21,365	37,676	0	736	736	982	982	0	1,176	1,176	633	4,612	5,245	0	0	551	2,768	3,319	221	221	18,698	30,657	**49,355**	9,481	12,618	3,022	15,639	**25,121**	797	191	12	203	**1,000**	1,496	3,217	**4,713**
2000	14,435	25,220	39,655	0	934	934	1,155	1,155	0	1,165	1,165	456	4,995	5,451	127	127	1,139	2,339	3,477	107	107	17,419	34,653	**52,071**	9,530	9,064	6,436	15,500	**25,029**	925	44	31	75	**1,000**	1,419	3,354	**4,773**
2001	18,052	22,161	40,213	385	848	1,233	1,262	1,262	0	685	685	519	5,028	5,547	122	122	1,284	2,244	3,527	112	112	21,736	30,965	**52,701**	10,945	10,106	6,659	16,765	**27,709**	816	111	73	184	**1,000**	3,040	1,829	**4,870**
2002	18,194	23,059	41,253	446	1,210	1,656	931	931	0	922	922	22	5,836	5,858	117	117	1,364	2,458	3,822	122	122	21,196	33,485	**54,680**	8,028	17,907	0	17,907	**25,936**	808	192	0	192	**1,000**	2,801	2,627	**5,428**
2003	14,814	25,793	40,607	320	1,230	1,549	691	691	0	914	914	272	5,987	6,259	115	115	372	3,334	3,706	209	209	16,791	37,258	**54,050**	10,377	11,251	3,436	14,687	**25,064**	887	86	26	113	**1,000**	1,554	3,705	**5,259**
2004	18,105	25,040	43,145	269	1,347	1,616	592	592	0	1,227	1,227	634	6,110	6,744	325	325	1,227	2,231	3,459	128	128	21,281	35,955	**57,236**	10,786	11,841	3,886	15,727	**26,513**	891	82	27	109	**1,000**	1,347	4,097	**5,444**
2005	15,811	25,487	41,298	383	930	1,313	646	646	0	1,135	1,135	538	6,246	6,784	426	426	1,180	1,860	3,039	217	217	19,201	35,657	**54,858**	10,806	11,426	6,751	18,177	**28,983**	840	101	59	160	**1,000**	1,244	4,152	**5,396**
2006	10,034	34,185	44,218	124	1,437	1,561	686	686	0	977	977	319	7,500	7,819	447	447	440	2,530	2,970	227	227	12,277	46,628	**58,905**	11,271	12,171	4,155	16,326	**27,597**	969	23	8	31	**1,000**	1,386	4,263	**5,650**
2007	16,992	27,829	44,820	383	1,227	1,610	560	560	0	1,028	1,028	443	7,532	7,975	395	395	429	2,547	2,976	211	211	19,413	40,162	**59,575**	10,313	19,888	0	19,888	**30,201**	946	54	0	54	**1,000**	2,024	4,391	**6,415**
2008	23,421	18,473	41,893	475	916	1,391	604	604	0	928	928	18	7,098	7,116	722	722	349	1,872	2,221	211	211	25,799	29,286	**55,085**	9,655	14,132	3,015	17,147	**26,803**	921	65	14	79	**1,000**	2,854	3,645	**6,499**
2009	15,875	21,278	37,153	320	1,012	1,331	311	311	0	823	823	0	6,282	6,282	476	476	1,046	1,217	2,264	170	170	18,198	30,611	**48,809**	7,626	15,170	77	15,248	**22,873**	895	105	1	105	**1,000**	2,432	3,146	**5,578**

Appendix D-7: Table 4 (cont.)
Historical Total Water Supply
Municipal and Industrial Users
Antelope Valley Area of Adjudication
(acre-feet per year)

	Rosamond Community Services District			Antelope Valley Water Company			Palm Ranch Irrigation District			Desert Lake Community Services District			Boron Community Services District		Edwards Air Force Base			Major M&I Subtotal					Mutual and Private Water Companies			Rural Residential		ASR Project LACWW40		Total Supplies by Source				
		SWP		Lancaster SWP				SWP			SWP					SWP			SWP	Local	Total			SWP				SWP			SWP	Local	Total	Total
Year	GW	SW	Total	GW	SW	Total	GW	SW	Total	GW	SW	Total	GW	Total	GW	SW	Total	GW	SW	SW	SW	Total	GW	SW	Total	GW	Total	SW	Total	GW	SW	SW	SW	Supply
1946	54	0	**54**	98	0	**98**	307	0	**307**	0	0	**0**	0	**0**	2,966	0	**2,966**	5,497	0	1,000	1,000	**6,497**	325	0	**325**	520	**520**	0	**0**	**6,341**	**0**	**1,000**	**1,000**	**7,341**
1947	54	0	**54**	98	0	**98**	307	0	**307**	0	0	**0**	0	**0**	2,966	0	**2,966**	5,238	0	1,000	1,000	**6,238**	312	0	**312**	499	**499**	0	**0**	**6,049**	**0**	**1,000**	**1,000**	**7,049**
1948	54	0	**54**	98	0	**98**	307	0	**307**	0	0	**0**	0	**0**	2,166	0	**2,166**	5,856	0	1,000	1,000	**6,856**	343	0	**343**	548	**548**	0	**0**	**6,747**	**0**	**1,000**	**1,000**	**7,747**
1949	54	0	**54**	98	0	**98**	935	0	**935**	0	0	**0**	0	**0**	2,941	0	**2,941**	7,226	0	1,000	1,000	**8,226**	411	0	**411**	658	**658**	0	**0**	**8,296**	**0**	**1,000**	**1,000**	**9,296**
1950	54	0	**54**	98	0	**98**	307	0	**307**	0	0	**0**	0	**0**	2,495	0	**2,495**	5,577	0	1,000	1,000	**6,577**	329	0	**329**	526	**526**	0	**0**	**6,432**	**0**	**1,000**	**1,000**	**7,432**
1951	54	0	**54**	98	0	**98**	307	0	**307**	0	0	**0**	0	**0**	1,587	0	**1,587**	5,229	0	1,000	1,000	**6,229**	311	0	**311**	498	**498**	0	**0**	**6,039**	**0**	**1,000**	**1,000**	**7,039**
1952	54	0	**54**	98	0	**98**	307	0	**307**	0	0	**0**	0	**0**	1,367	0	**1,367**	4,797	0	1,000	1,000	**5,797**	290	0	**290**	464	**464**	0	**0**	**5,550**	**0**	**1,000**	**1,000**	**6,550**
1953	54	0	**54**	98	0	**98**	210	0	**210**	0	0	**0**	0	**0**	1,687	0	**1,687**	8,576	0	1,000	1,000	**9,576**	479	0	**479**	766	**766**	0	**0**	**9,821**	**0**	**1,000**	**1,000**	**10,821**
1954	54	0	**54**	98	0	**98**	307	0	**307**	0	0	**0**	0	**0**	4,005	0	**4,005**	8,746	0	1,000	1,000	**9,746**	487	0	**487**	780	**780**	0	**0**	**10,013**	**0**	**1,000**	**1,000**	**11,013**
1955	54	0	**54**	98	0	**98**	320	0	**320**	0	0	**0**	0	**0**	4,285	0	**4,285**	9,202	0	1,000	1,000	**10,202**	510	0	**510**	816	**816**	0	**0**	**10,529**	**0**	**1,000**	**1,000**	**11,529**
1956	54	0	**54**	98	0	**98**	56	0	**56**	0	0	**0**	0	**0**	4,902	0	**4,902**	11,304	0	2,422	2,422	**13,726**	686	0	**686**	1,098	**1,098**	0	**0**	**13,088**	**0**	**2,422**	**2,422**	**15,510**
1957	54	0	**54**	98	0	**98**	384	0	**384**	0	0	**0**	0	**0**	2,240	0	**2,240**	10,907	0	1,752	1,752	**12,659**	633	0	**633**	1,013	**1,013**	0	**0**	**12,553**	**0**	**1,752**	**1,752**	**14,305**
1958	54	0	**54**	98	0	**98**	472	0	**472**	160	0	**160**	0	**0**	1,425	0	**1,425**	10,702	0	2,434	2,434	**13,136**	657	0	**657**	1,051	**1,051**	0	**0**	**12,409**	**0**	**2,434**	**2,434**	**14,843**
1959	54	0	**54**	98	0	**98**	898	0	**898**	140	0	**140**	0	**0**	4,037	0	**4,037**	14,667	0	1,311	1,311	**15,978**	799	0	**799**	1,278	**1,278**	0	**0**	**16,745**	**0**	**1,311**	**1,311**	**18,056**
1960	54	0	**54**	98	0	**98**	483	0	**483**	174	0	**174**	0	**0**	2,496	0	**2,496**	12,996	0	385	385	**13,381**	669	0	**669**	1,070	**1,070**	0	**0**	**14,736**	**0**	**385**	**385**	**15,121**
1961	54	0	**54**	98	0	**98**	310	0	**310**	180	0	**180**	0	**0**	4,165	0	**4,165**	20,023	0	0	0	**20,023**	1,001	0	**1,001**	1,602	**1,602**	0	**0**	**22,625**	**0**	**0**	**0**	**22,625**
1962	54	0	**54**	98	0	**98**	418	0	**418**	180	0	**180**	0	**0**	5,464	0	**5,464**	22,070	0	5,534	5,534	**27,604**	1,380	0	**1,380**	2,208	**2,208**	0	**0**	**25,658**	**0**	**5,534**	**5,534**	**31,192**
1963	54	0	**54**	98	0	**98**	1,431	0	**1,431**	180	0	**180**	0	**0**	2,122	0	**2,122**	18,371	0	136	136	**18,507**	925	0	**925**	1,481	**1,481**	0	**0**	**20,776**	**0**	**136**	**136**	**20,912**
1964	54	0	**54**	98	0	**98**	675	0	**675**	180	0	**180**	298	**298**	3,693	0	**3,693**	19,894	0	262	262	**20,156**	1,008	0	**1,008**	1,612	**1,612**	0	**0**	**22,514**	**0**	**262**	**262**	**22,776**
1965	54	0	**54**	98	0	**98**	675	0	**675**	290	0	**290**	305	**305**	2,967	0	**2,967**	18,853	0	1,318	1,318	**20,171**	1,009	0	**1,009**	1,614	**1,614**	0	**0**	**21,475**	**0**	**1,318**	**1,318**	**22,793**
1966	54	0	**54**	98	0	**98**	466	0	**466**	300	0	**300**	347	**347**	4,357	0	**4,357**	21,364	0	0	0	**21,364**	1,068	0	**1,068**	1,709	**1,709**	0	**0**	**24,141**	**0**	**0**	**0**	**24,141**
1967	54	0	**54**	114	0	**114**	598	0	**598**	300	0	**300**	347	**347**	3,505	0	**3,505**	20,242	0	0	0	**20,242**	1,012	0	**1,012**	1,619	**1,619**	0	**0**	**22,873**	**0**	**0**	**0**	**22,873**
1968	54	0	**54**	128	0	**128**	916	0	**916**	367	0	**367**	472	**472**	3,227	0	**3,227**	22,989	0	3,150	3,150	**26,139**	1,307	0	**1,307**	2,091	**2,091**	0	**0**	**26,387**	**0**	**3,150**	**3,150**	**29,537**
1969	54	0	**54**	138	0	**138**	857	0	**857**	275	0	**275**	451	**451**	2,630	0	**2,630**	25,351	0	2,105	2,105	**27,456**	1,373	0	**1,373**	2,196	**2,196**	0	**0**	**28,920**	**0**	**2,105**	**2,105**	**31,025**
1970	54	0	**54**	164	0	**164**	815	0	**815**	194	0	**194**	509	**509**	1,350	0	**1,350**	22,701	0	1,627	1,627	**24,328**	1,216	0	**1,216**	1,946	**1,946**	0	**0**	**25,863**	**0**	**1,627**	**1,627**	**27,490**
1971	54	0	**54**	187	0	**187**	747	0	**747**	305	0	**305**	606	**606**	2,897	0	**2,897**	24,510	0	1,539	1,539	**26,048**	1,302	0	**1,302**	2,084	**2,084**	0	**0**	**27,896**	**0**	**1,539**	**1,539**	**29,434**
1972	54	0	**54**	209	0	**209**	850	0	**850**	300	0	**300**	621	**621**	3,566	0	**3,566**	27,434	26	1,481	1,507	**28,941**	1,447	0	**1,447**	2,315	**2,315**	0	**0**	**31,196**	**26**	**1,481**	**1,507**	**32,703**
1973	54	0	**54**	232	0	**232**	953	0	**953**	329	0	**329**	592	**592**	2,557	0	**2,557**	25,982	28	1,682	1,710	**27,692**	1,385	0	**1,385**	2,215	**2,215**	0	**0**	**29,582**	**28**	**1,682**	**1,710**	**31,292**
1974	54	0	**54**	220	0	**220**	1,021	0	**1,021**	331	0	**331**	620	**620**	2,369	0	**2,369**	25,648	40	1,102	1,142	**26,790**	1,339	0	**1,339**	2,143	**2,143**	0	**0**	**29,130**	**40**	**1,102**	**1,142**	**30,273**
1975	54	0	**54**	248	0	**248**	1,053	0	**1,053**	335	0	**335**	630	**630**	2,145	0	**2,145**	24,474	56	1,749	1,805	**26,279**	1,314	0	**1,314**	2,102	**2,102**	0	**0**	**27,891**	**56**	**1,749**	**1,805**	**29,696**
1976	54	0	**54**	281	0	**281**	1,101	0	**1,101**	318	0	**318**	565	**565**	2,245	0	**2,245**	24,710	64	1,303	1,367	**26,077**	1,304	0	**1,304**	2,086	**2,086**	0	**0**	**28,100**	**64**	**1,303**	**1,367**	**29,467**
1977	383	0	**383**	261	0	**261**	1,007	0	**1,007**	320	0	**320**	572	**572**	2,344	0	**2,344**	22,716	18	548	565	**23,281**	1,164	0	**1,164**	1,862	**1,862**	0	**0**	**25,743**	**18**	**548**	**565**	**26,308**
1978	400	0	**400**	271	0	**271**	815	217	**1,032**	322	0	**322**	605	**605**	2,444	0	**2,444**	18,341	5,074	2,211	7,285	**25,625**	1,061	220	**1,281**	2,050	**2,050**	0	**0**	**21,452**	**5,294**	**2,211**	**7,505**	**28,957**
1979	417	21	**438**	109	0	**109**	569	307	**875**	330	0	**330**	549	**549**	2,480	0	**2,480**	19,268	6,964	1,122	8,087	**27,354**	1,069	298	**1,368**	2,188	**2,188**	0	**0**	**22,525**	**7,262**	**1,122**	**8,385**	**30,910**
1980	433	3	**436**	297	0	**297**	322	779	**1,102**	225	0	**225**	580	**580**	2,515	0	**2,515**	19,048	6,526	1,122	7,649	**26,697**	963	372	**1,335**	2,136	**2,136**	0	**0**	**22,147**	**6,898**	**1,122**	**8,021**	**30,168**
1981	626	6	**632**	306	0	**306**	224	992	**1,216**	260	62	**322**	498	**498**	1,385	0	**1,385**	17,978	8,763	1,793	10,556	**28,534**	628	798	**1,427**	2,283	**2,283**	0	**0**	**20,889**	**9,562**	**1,793**	**11,354**	**32,243**
1982	629	11	**640**	281	0	**281**	313	591	**904**	270	54	**324**	290	**290**	2,060	0	**2,060**	21,289	6,212	1,943	8,155	**29,444**	763	709	**1,472**	2,356	**2,356**	0	**0**	**24,408**	**6,921**	**1,943**	**8,864**	**33,272**
1983	416	64	**480**	264	0	**264**	402	388	**790**	300	85	**385**	286	**286**	1,672	0	**1,672**	17,478	5,646	982	6,628	**24,106**	305	900	**1,205**	1,928	**1,928**	0	**0**	**19,711**	**6,547**	**982**	**7,529**	**27,240**
1984	508	76	**584**	328	0	**328**	570	339	**909**	180	72	**252**	238	**238**	2,141	0	**2,141**	23,184	9,265	1,211	10,477	**33,660**	431	1,252	**1,683**	2,693	**2,693**	0	**0**	**26,308**	**10,517**	**1,211**	**11,728**	**38,036**
1985	677	50	**727**	412	0	**412**	754	407	**1,160**	193	58	**251**	327	**327**	1,831	0	**1,831**	21,922	13,118	1,782	14,900	**36,822**	475	1,367	**1,841**	2,946	**2,946**	0	**0**	**25,343**	**14,485**	**1,782**	**16,266**	**41,609**
1986	721	14	**736**	517	0	**517**	184	979	**1,163**	213	44	**257**	323	**323**	2,041	0	**2,041**	25,596	16,386	622	17,008	**42,604**	932	1,198	**2,130**	3,408	**3,408**	0	**0**	**29,936**	**17,585**	**622**	**18,206**	**48,142**
1987	1,093	20	**1,112**	517	0	**517**	245	1,058	**1,302**	195	31	**226**	225	**225**	1,601	0	**1,601**	27,061	19,752	231	19,983	**47,044**	828	1,524	**2,352**	3,763	**3,763**	0	**0**	**31,652**	**21,276**	**231**	**21,507**	**53,159**
1988	800	79	**879**	594	0	**594**	413	790	**1,204**	177	82	**259**	233	**233**	1,597	0	**1,597**	29,784	18,563	1,936	20,499	**50,283**	800	1,714	**2,514**	4,023	**4,023**	0	**0**	**34,607**	**20,277**	**1,936**	**22,213**	**56,820**
1989	775	159	**934**	666	0	**666**	582	968	**1,550**	0	80	**80**	0	**0**	1,593	0	**1,593**	31,420	28,166	1,604	29,770	**61,190**	629	2,430	**3,059**	4,895	**4,895**	0	**0**	**36,944**	**30,596**	**1,604**	**32,200**	**69,145**
1990	780	464	**1,244**	642	0	**642**	451	1,070	**1,521**	0	30	**30**	0	**0**	1,526	0	**1,526**	28,236	33,155	194	33,349	**61,585**	1,042	2,037	**3,079**	4,927	**4,927**	0	**0**	**34,205**	**35,192**	**194**	**35,386**	**69,591**
1991	1,228	467	**1,696**	526	0	**526**	887	409	**1,296**	406	30	**436**	0	**0**	1,991	0	**1,991**	31,431	19,463	516	19,979	**51,410**	1,151	1,420	**2,571**	4,113	**4,113**	0	**0**	**36,695**	**20,883**	**516**	**21,399**	**58,094**
1992	1,090	898	**1,988**	570	0	**570**	682	679	**1,361**	348	24	**372**	0	**0**	4,794	0	**4,794**	27,020	26,088	3,846	29,934	**56,954**	1,532	1,316	**2,848**	4,556	**4,556**	0	**0**	**33,108**	**27,404**	**3,846**	**31,250**	**64,358**
1993	1,025	1,294	**2,319**	618	0	**618**	1,151	175	**1,326**	353	43	**396**	0	**0**	3,499	1,345	**4,844**	30,984	37,128	2,505	39,632	**70,616**	1,733	1,798	**3,531**	5,649	**5,649**	0	**0**	**38,366**	**38,926**	**2,505**	**41,430**	**79,796**
1994	1,025	1,479	**2,504**	683	0	**683**	962	484	**1,446**	353	174	**527**	0	**0**	3,162	2,103	**5,265**	36,288	39,793	1,020	40,813	**77,101**	1,777	2,078	**3,855**	6,168	**6,168**	0	**0**	**44,233**	**41,871**	**1,020**	**42,891**	**87,124**
1995	826	1,649	**2,475**	677	0	**677**	758	736	**1,494**	353	314	**667**	0	**0**	3,815	1,171	**4,986**	39,611	34,377	3,725	38,102	**77,713**	2,149	1,737	**3,886**	6,217	**6,217**	0	**0**	**47,976**	**36,114**	**3,725**	**39,839**	**87,816**
1996	2,027	768	**2,795**	747	0	**747**	1,147	832	**1,979**	353	128	**481**	0	**0**	3,735	1,675	**5,410**	39,780	43,634	3,019	46,653	**86,433**	2,439	1,883	**4,322**	6,915	**6,915**	0	**0**	**49,134**	**45,517**	**3,019**	**48,536**	**97,670**
1997	1,973	809	**2,782**	757	0	**757**	1,147	633	**1,780**	353	88	**441**	0	**0**	3,781	1,357	**5,139**	39,531	45,161	2,353	47,514	**87,046**	2,745	1,607	**4,352**	6,964	**6,964**	0	**0**	**49,240**	**46,768**	**2,353**	**49,121**	**98,362**
1998	1,541	1,015	**2,556**	655	0	**655**	1,147	393	**1,540**	353	91	**444**	0	**0**	2,732	1,737	**4,468**	33,941	39,117	5,004	44,121	**78,063**	2,439	1,464	**3,903**	6,245	**6,245**	0	**0**	**42,626**	**40,581**	**5,004**	**45,585**	**88,211**
1999	1,463	1,512	**2,975**	756	0	**756**	1,147	650	**1,797**	353	63	**416**	0	**0**	3,199	1,782	**4,981**	37,390	50,690	3,033	53,723	**91,114**	2,639	1,917	**4,556**	7,289	**7,289**	0	**0**	**47,318**	**52,607**	**3,033**	**55,640**	**102,958**
2000	1,461	1,631	**3,091**	827	0	**827**	1,147	558	**1,705**	353	15	**368**	0	**0**	3,712	2,724	**6,436**	36,792	52,042	6,467	58,509	**95,301**	3,288	1,477	**4,765**	7,624	**7,624**	0	**0**	**47,703**	**53,519**	**6,467**	**59,986**	**107,690**
2001	2,165	979	**3,144**	810	0	**810**	1,147	102	**1,249**	353	19	**372**	0	**0**	4,104	2,226	**6,329**	45,117	46,337	6,732	53,069	**98,186**	3,306	1,603	**4,909**	7,855	**7,855**	0	**0**	**56,278**	**47,941**	**6,732**	**54,673**	**110,950**
2002	2,359	920	**3,279**	787	0	**787**	1,536	291	**1,827**	353	35	**388**	0	**0**	3,090	2,155	**5,245**	40,958	57,611	0	57,611	**98,569**	3,161	1,767	**4,928**	7,886	**7,886**	0	**0**	**52,005**	**59,379**	**0**	**59,379**	**111,383**
2003	1,767	1,217	**2,984**	602	184	**786**	1,558	137	**1,695**	437	26	**463**	0	**0**	1,935	2,831	**4,766**	35,910	56,695	3,462	60,157	**96,067**	3,087	1,717	**4,803**	7,685	**7,685**	0	**0**	**46,682**	**58,412**	**3,462**	**61,874**	**108,556**
2004	2,118	1,191	**3,309**	595	275	**870**	814	877	**1,691**	213	161	**374**	0	**0**	3,015	1,873	**4,888**	41,061	56,351	3,913	60,264	**101,324**	3,435	1,631	**5,066**	8,106	**8,106**	0	**0**	**52,602**	**57,982**	**3,913**	**61,895**	**114,497**
2005	1,702	1,375	**3,077**	614	277	**891**	1,139	501	**1,639**	203	56	**259**	0	**0**	2,356	1,773	**4,129**	38,106	55,317	6,810	62,128	**100,234**	3,216	1,796	**5,012**	8,019	**8,019**	558	**558**	**49,341**	**57,671**	**6,810**	**64,481**	**113,822**
2006	2,213	1,302	**3,515**	534	298	**832**	591	843	**1,434**	23	165	**188**	0	**0**	2,007	2,043	**4,050**	31,271	67,737	4,163	71,900	**103,171**	2,903	2,256	**5,159**	8,254	**8,254**	1,612	**1,612**	**42,428**	**71,605**	**4,163**	**75,768**	**118,196**
2007	2,484	1,256	**3,740**	844	0	**844**	95	896	**991**	0	205	**205**	0	**0**	2,094	2,057	**4,150**	38,213	68,908	0	68,908	**107,121**	3,480	1,876	**5,356**	8,570	**8,570**	857	**857**	**50,263**	**71,641**	**0**	**71,641**	**121,904**
2008	2,859	894	**3,753**	768	0	**768**	812	838	**1,650**	44	113	**158**	0	**0**	1,557	1,594	**3,152**	45,270	50,568	3,029	53,597	**98,867**	3,659	1,284	**4,943**	7,909	**7,909**	0	**0**	**56,839**	**51,852**	**3,029**	**54,881**	**111,720**
2009	2,856	307	**3,163**	667	0	**667**	1,438	84	**1,522**	136	15	**151**	0	**0**	1,172	1,893	**3,065**	35,420	51,330	78	51,408	**86,829**	3,458	883	**4,341**	6,946	**6,946**	0	**0**	**45,825**	**52,213**	**78**	**52,291**	**98,116**