4. BACKGROUND INFORMATION

4.1 DESCRIPTION OF THE REGION

Water users in Lea County have much in common with each other, such as shared politics, common physical geographic features, the regional climate, area demographic characteristics, and local economic issues. In fact, most of the things that influence the lives of Lea County water users are to a large extent unique to Lea County and are not shared by other adjacent New Mexico Counties. Actually when it comes to water, Lea County is more related to the adjacent counties in Texas than to any entity in New Mexico. Because of this, when the Lea County Water Users Association, as encouraged by the ISC[1], accepted the task of preparing a Regional Water Plan, all the area within Lea County was included and areas outside of the County were not.

4.1.1 Location and Boundaries

Lea County, located in the southeast corner of New Mexico, is approximately 4,400 square miles in size. Lea County is bounded to the north by Roosevelt County, New Mexico, to the east and south by the Texas Counties of Cochran, Yoakum, Gaines, Andrews, Winkler, and Loving, and to the west by Chaves and Eddy Counties, New Mexico. The Lea County Water Users Association represents water users in all areas of Lea County, including the cities and towns of Hobbs, Lovington, Eunice, Jal, and Tatum (FIGURE 1).

4.1.2 Geography and Landscape

Lea County is divided approximately in half by an escarpment oriented northwest to southeast. This prominent topographic feature is known as Mescalero Ridge (FIGURE 2B). The Mescalero Ridge traverses the western and central portions of Lea County and is a nearly perpendicular cliff that indicates the southern limits of the High Plains[2] in New Mexico. The High Plains are capped by a thick layer of caliche, locally known as Caprock, that extends throughout northern Lea County. In the east-central part of Lea County, the cliff relief becomes more subdued and is no longer considered a ridge. In the eastern portion of the County it is barely visible as it is partly buried beneath sand dunes.

Elevations in Lea County vary from approximately 2,900 feet in the southeast to approximately 4,400 feet in the northwest. This relief provides for two surface water drainage basins in the County. The Texas Gulf Basin, located in the northern portion of Lea County, and the Pecos River Basin, located in the southern portion of the County, are separated by Mescalero Ridge and its extended escarpment. The high area north of the Ridge, known as the Llano Estacado, is a depositional, low relief surface that slopes uniformly to the southeast. The Llano Estacado contains loamy and sandy soil deposits with numerous undrained depressions, known as playas or "buffalo wallows." The area south of the Ridge is an irregular erosional surface that generally slopes to the west and south, towards the Pecos River. This southern area includes large areas of stabilized and drifting sand dunes and drainage areas created by solution deep-seated collapse.

Two areas having different soil associations exist in Lea County. They are also divided by the Mescalero Ridge and include the southern High Plains and the southern Desertic Basins, Plains, and Mountains (FIGURE 3). The southern High Plains area, located in the upper half of Lea County, consists of five related soil associations,

[1] New Mexico Interstate Stream Commission (1994, pg. 5)

[2] Also known as the Great Plains Physiographic province (Fenneman, 1931).

Kimbrough, Kimbrough-Lea, Portales-Stegall-Lea, Amarillo-Arvana, and Brownfield-Patricia-Tivoli. These associations are generally comprised of shallow to deep gravelly and loamy soils or deep sandy soils formed from windblown and water-deposited materials in the Quaternary and late Tertiary periods. Soft or hard caliche is generally found to below soils in the majority of this area. The southern Desertic Basins, Plains, and Mountains area, located in the lower half of Lea County, consists of three soil associations; Simona-Tonuco, Berino-Cacique, and Pyote-Maljamar-Kermit. These associations are generally comprised of shallow to deep sandy and/or loamy soils. Soils in this area were also formed from windblown and water-deposited materials in the Quaternary and late Tertiary periods, however, some valley-fill sediments are from the Permian, Triassic, and Recent periods. Soft and/or hard caliche may be found beneath soils of the Simona-Tonuco and Berino-Cacique associations. The majority of the surface geology in Lea County may be historically classified as Cenozoic in origin. A limited area having a Mesozoic origin exists in the southwestern portion of the County (FIGURE 2A). A geologic time scale and stratigraphic nomenclature chart is provided in APPENDIX D. TABLE 4-1 summarizes the characteristics of the primary soils in each soil association and APPENDIX E presents a textural guide for soil classifications.

Two life-form zones exist within Lea County. Life-forms can be either plant or wildlife. As with the other geography and landscape features, they are separated by the Mescalero Ridge. The Upper Sonoran zone is located in the northern half of County and the Lower Sonoran is located in the southern half. Grasses and interspersed oak shinnery are the predominant native plant type for both zones. While ranching and farming have impacted native vegetation in most parts of the County, the only rare and sensitive plant species listed is the dune unicorn plant (*Proboscidea sabulosa*). The dune unicorn plant is rare, especially outside of New Mexico, but it is not endangered. APPENDIX F contains more information regarding this plant and a description of the New Mexico Energy, Minerals, and Natural Resources Department program to protect native plant species. Native wildlife in Lea County includes coyote, deer, antelope and other lesser desert mammals as well as reptiles and birds. The Aplomado Falcon is the only species in the County listed under the U.S. Fish and Wildlife Service Endangered Species Act (ESA). The American Peregrine Falcon, another bird of prey found in the County, was removed from the endangered species list in 1999. Lea County contains many other raptors that are federally protected under the Migratory Bird Treaty Act. The listing of the Black-tailed Prairie Dog under ESA is currently being considered by the U.S. Fish and Wildlife Service. APPENDIX F contains information on other wildlife of concern in Lea County and a list of migratory birds protected by the Migratory Bird Treaty Act.

4.1.3 Climate

The climate of Lea County is semiarid with warm summers, cool and dry winters, with abundant sunshine all year. In the north, Tatum's average highest temperature of 92.5 F occurs during August and the average lowest temperature of 22.8 F occurs during January. In comparison, Jal, in the south, has an average highest temperature of 96.5 F (F) in August and an average lowest temperature of 27.9 F in January. Approximately 80% of the yearly rainfall occurs during May through October from brief, heavy thunderstorms. Average yearly precipitation ranges from 12 to 16 inches, from southern Lea County (Jal) to northern Lea County (Hobbs and Tatum), respectively. Average yearly snowfall ranges from 4 to 9 inches, from southern Lea County (Jal) to northern Lea County (Lovington), respectively. The average annual wind velocity in Lea County is 12.2 miles per hour. The highest wind velocities occur in the spring. Tornadoes and dust storms may occur several times per year. Lake surface evaporation averages approximately 45 inches per year and the average annual relative humidity ranges from 45 to 50%.

TABLE 4–1: SUMMARY OF CHARACTERISTICS OF THE PRIMARY SOILS IN EACH SOIL ASSOCIATION IN LEA COUNTY

Soil Series	Description	Total Depth Inches	Permeability Inches/Hour	Salinity Mmhos/Cm	Degree of Limitation For Filter (Sewage Disposal) Field	Shrink-Swell Potential
Amarillo	sandy clay loam, chalky loam	60	0.63 to 2.0	0-1	slight to moderate: moderate permeability	low to moderate
Arvana	sandy clay loam	28	0.63 to 2.0	0-1	severe: indurated caliche at shallow depth	moderate
Berino	sandy clay loam, soft caliche	60	0.63 to 2.0	0-2	slight to moderate: moderate permeability	moderate
Brownfield	fine sand, sandy clay loam	63	0.63 to 20.0	0-1	-	low to moderate
Cacique	loamy fine sand, sandy clay loam	28	0.63 to 6.3	0-1	severe: indurated caliche at shallow depth	low to moderate
Kermit	fine sand	60	>20.0	0-1	slight to moderate: in places slopes exceed 5%; pollution of ground water possible	low
Kimbrough	gravelly loam	6	0.63 to 2	0-2	severe: indurated caliche at shallow depth	low
Lea	loam	26	0.63 to 2.0	0-2	severe: indurated caliche at shallow depth	moderate
Maljamar	fine sand, sandy clay loam	50	0.63 to 20.0	0-1	slight to moderate: moderate permeability	low to moderate
Patricia	fine sand, sandy clay loam	70	0.63 to 20.0	0-1	slight to moderate: moderate permeability	low to moderate
Portales	loam and clay loam	60	0.63 to 2.0	0-2	slight to moderate: moderate permeability	moderate
Pyote	fine sand, loamy fine sand, fine sandy loam	60	2.0 to 20.0	0-1	severe: moderately rapid permeability	low
Simona	fine sandy loam	16	2.0 to 6.3	0-1	severe: shallow over indurated caliche	low
Stegall	clay loam	28	0.06 to 0.2	0-4	severe: indurated caliche at shallow depth; slow permeability	high
Tivoli	fine sand	60	6.3 to 20.0	0-1	slight to moderate: possible contamination of underground water; 0 to 12 percent slopes	low
Tonuco	loamy fine sand	60	0.63 to 2.0	0-1	severe: indurated caliche at a shallow depth	low

Source: USDA, Soil Conservation Service, 1974
Mmhos/cm millimhos per centimeter

4.1.4 Natural Resources

The availability of accessible ground-water for irrigation enabled agriculture to become established and flourish in the County over the last 50 to 65 years. As a result, agriculture has played a major role in Lea County's economy. Sales of beef cattle and milk are currently the primary agricultural incomes. Current major cash crops include cotton, hay (including alfalfa), peanuts, and chile.

Large active oil and gas fields have existed in Lea County for more than 50 years. The New Mexico portion of the Permian Basin contains 1,112 designated, discovered oil reservoirs and 672 designated, discovered gas reservoirs. Production zones are found in rocks as old as Ordovician age, through Permian age[3]. Mined potash and gypsum deposits are located in the southern portions of the County. Both have played major economic roles since their discovery. Other natural resources include sand and gravel, cultural resources, and other minerals.

4.1.5 Major Surface Water and Ground-water Sources

4.1.5.1 Surface Water

Surface water within Lea County is limited to intermittent streams, lakes, and small playa lakes that result from heavy rainfall during summer months. These intermittent surface water sources are used primarily for livestock purposes. In such cases, small, manmade earthen structures have been constructed to collect surface runoff.

4.1.5.2 Ground-water

Ground-water sources in Lea County include hydrogeologic strata within five underground-water basins declared by the NMOSE. The basins, from north to south, are the Lea County Underground-water Basin (UWB), the Capitan UWB, the Carlsbad UWB, and the Jal UWB (FIGURE 4). A small area (approximately 55 square miles) of a fifth, the Roswell UWB, exists within west-central and northwest Lea County. It is important to note that the NMOSE has designated these basins based on their distinct hydrogeologic configurations, which do not typically end at county or state boundaries. In fact, several of the basins found within Lea County extend across county lines in New Mexico and the State Line into Texas.

New Mexico statutes provide that all underground-waters of the State belong to the public, and are subject to appropriation for beneficial use. The New Mexico Office of the State Engineer (NMOSE) is charged with inventorying and accounting for the many waters of the State, including ground-water. To aid this task, the NMOSE may declare certain areas of underground-water in the State as Underground-water Basins (UWB). The NMOSE has jurisdiction over the wells drilled in UWBs. No such jurisdiction exists in undeclared subsurface water basins. In order to declare UWBs the NMOSE has evaluated the surface topography, sub-surface inclination of rock and sediment beds, and water-bearing properties of geologic units in many areas of the State. Lea County spans parts of five separate NMOSE-declared UWBs and one undeclared basin (FIGURE 4).

Lea County UWB

The Lea County UWB is approximately 2,180 square miles in size. The Lea County UWB extends east to west across the width of Lea County and generally terminates to the south along the Mescalero Ridge and its associated escarpment. The primary aquifer of the Lea County UWB, as well as the primary ground-water source in Lea County, is the Ogallala Formation. Sediments found within this formation include sands, silts, clay, and gravel. The maximum saturated thickness of the Ogallala aquifer in the Lea County UWB is approximately 250 feet. Cretaceous and Triassic rocks underlying the Ogallala Formation limit downward percolation from the Ogallala aquifer. Ground-

[3] Broadhead and Speer, 1993

water flow in the Ogallala aquifer is generally to the southeast. The primary uses of ground-water from the Lea County UWB are irrigation and public water supply. The cities and towns of Hobbs, Lovington, and Tatum are located within the Lea County UWB and have municipal well fields that withdraw potable water from the Ogallala aquifer.

Capitan UWB

The Capitan UWB covers approximately 1,100 square miles and occupies the south-central portion of Lea County. The Capitan UWB is located within a geologic province known as the Delaware Basin, a subdivision of the Permian Basin. The Capitan UWB is aerially oriented in a northwest-southeast alignment above an arc shaped section of a formation known as the Capitan Reef Complex. The Capitan aquifer occurs within dolomite and limestone strata deposited as an ancient reef. The ground-water quality of the Capitan in Lea County is very poor. Other aquifers in the Capitan UWB are found in the overlying Rustler Formation[4], Santa Rosa Sandstone[5], and Cenozoic Alluvium. The primary uses of ground-water from the Capitan UWB are mining, oil recovery, industry, livestock, and domestic use. The towns of Eunice and Jal are located within the Capitan UWB, but currently tap beds of saturated Quaternary alluvium located within the Lea County UWB and Jal UWB respectively.

Jal UWB

The Jal UWB is approximately 15 square miles in size and is located at the southwest corner of the Capitan UWB. Cenozoic Alluvium, approximately 550 to 750 feet thick, is the principal water-bearing zone in the Jal UWB. No cities or towns are located within the Jal UWB, although the Town of Jal and El Paso Natural Gas have drilled wells within the UWB.

Carlsbad UWB

The Carlsbad UWB, located in the southwestern portion of Lea County, is approximately 477 square miles in size. The principal aquifer in the Carlsbad UWB is in the Santa Rosa Sandstone, which is approximately 200 feet thick in this area. General ground-water flow in the Carlsbad UWB is in a southerly direction. The primary use of water from the Carlsbad UWB is mining. The area within the Carlsbad UWB is sparsely inhabited.

Approximately 550 square miles of northernmost Lea County lie within a larger undeclared subsurface water basin. The Ogallala Formation occurs in some of this area, however, little information is known due to the scarcity of population and permitted water wells. Previous oil exploration activity in this area may have created conduits for upward migration of ground-water from the Cretaceous Tucumcari Formation to the thin overlying Ogallala beds at the expense of artesian pressure within the Tucumcari unit.

4.1.6 Demographic

The largest portion of the Lea County population is located in the County's eastern half, at or near the cities and towns of Hobbs, Lovington, Eunice, Jal, and Tatum. Lea County's historical population characteristics, from 1940 until 1990, are shown in TABLE 4-2. The population of Lea County increased substantially from 1940 until 1960, decreased slightly from 1960 to 1970, increased during 1970 to 1980, and then declined again from 1980 to 1990.

[4] The Rustler Formation underlies most of the Delaware Basin. Ground-water from the Rustler formation within Lea County is of poor quality and is used only for irrigation, livestock, or oil recovery enhancement.

[5] The Santa Rosa Sandstone, a specific unit of the Lower Dockum Group, is the principal potable water aquifer in the southwestern third of Lea County. The Santa Rosa was formerly tapped by the Town of Jal's municipal wells until they were abandoned due to low yield.

TABLE 4-2: LEA COUNTY HISTORICAL POPULATION

Year	1940	1950	1960	1970	1980	1990
Population	21,154	30,717	53,429	49,554	55,993	55,765
Change	---	+45%	+74%	-7%	+13%	-1%

Source: U.S. Census

Dramatic changes in population may be attributed to needs and requirements of the oil and gas industry. Demographics by city and town (not shown) indicate sustained population growth in the City of Hobbs from 1940 to 1990. The population in the cities and towns of Eunice, Jal, Lovington, and Tatum increased from 1940 till 1970, but decreased from 1970 to 1990. In 1995 the estimated population of Lea County was 56,793 and the estimated population of Hobbs in 1994 was 29,712. Growth in Lea County is expected to be less than 1% every 5 years throughout the 40-year horizon of this Plan.

4.1.7 Economic Picture

The economy of Lea County is generally stable[6] with the median family income in Lea County rising from $26,620 to $33,200 from 1989 to 1996. Decreases in the price of oil, such as occurred during the late 1990's, have caused and may in the future cause economic setbacks. These setbacks tend to be cyclic, following the price of oil. Currently, oil prices are again on the rise in response to production limits in the Middle East and in South America. The unemployment rate in 1996 was 4.7%. In 1990 the major areas of employment were mining, retail trade, and services; each of these employed in more than 17% of the County's workforce. Agricultural employment accounted for only 3% of the workforce. Between 1990 and 1996 nonagricultural jobs increased in the areas of retail trade, services, and government. During that same period of time, the number of persons employed in mining declined approximately 13%. Most other job markets remained stable. Total gross receipts for 1996 were $1.39 billion, an increase of 5.2% from 1995. Primary gross receipt sectors for 1996 were retail trade (26% of total), services (20% of total), and mining (18% of total). Agriculture gross receipts of $5 million in 1996 were 0.4% of the County's total gross receipts. Of the $5 million generated by agriculture in 1996, 71% was from livestock and 29 % was from crops. Promotion of industrial and large-scale commercial property is currently prevalent in Lea County, primarily in the cities and towns of Hobbs, Lovington and Jal. Future development of this nature could greatly improve the County's economic outlook.

4.1.8 Land Ownership and Land Use

Lea County is approximately 2.8 million acres in size. Property ownership is 17% federal government, 31% state government, and 52% private (FIGURE 5). The federally owned land is primarily located in the southwestern portion of the County, the state-owned land is predominately located throughout the middle, and the privately owned land primarily extends from north to south in the County's eastern portion. Large tracts of land in Lea County are privately owned by farmers, ranchers, oil, gas, and mining companies. Urbanized areas near cities and towns include ownership of smaller tracts of land for residential, municipal, and commercial purposes (FIGURE 6). Expected continued growth within the City of Hobbs will require an increase in the number of residential properties and likely a limited increase of commercial properties as well. Approximately 93% of Lea County is used as range land for grazing and approximately 4% is used for crop farming. Urban areas and the roadway system account for the County's remaining land use. Most of the land actively farmed in Lea County is irrigated.

[6] Lea County Fact Book, Economic Development Corporation of Lea County, January 2000

4.2 HISTORICAL OVERVIEW OF WATER USE IN REGION

Until 1890, Lea County was sparsely populated and occupied only by nomadic bands of Comanche and Apache Indians. Limited ranching extended into the area with the spread of Texas cattlemen into the Pecos Valley. Homesteading of the area occurred during the early 1900's. As a result, Lea County was formed in 1917 from parts of Eddy and Chaves Counties.

During the developing stages of Lea County, water use was limited to withdrawals from shallow hand dug or drilled wells. Periods of drought during the 1910's, 1930's, and 1950's reduced the scale of dryland farming and the number of farms in Lea County. With the advent of advanced well drilling and pumping technology, ground-water irrigation began in the late 1930's in the northeastern portion of the County. Development was fairly limited from 1937 to 1939, averaging about 1,900 acre-feet per annum (ac-ft/an), but increased significantly from 1940, when 3,200 ac-ft/an were pumped, to 1950, when 95,000 ac-ft/an were pumped. Pumping for irrigation varied from 1951 to 1960 and ranged from 105,000 ac-ft/an in 1960 to 170,000 ac-ft/an in 1955 (Ash, 1963). The combination of pumps, increased population, and increased livestock herds (and their feed requirements) caused a dramatic increases in water use throughout the 1940's till the 1980's, with the bulk of that use going for irrigation. The irrigated acreage in the County increased from 1,970 acres to 119,240 acres during 1940 to 1982. Fluctuations in the ground-water level, periods of above-average rainfall, and drops in agricultural market prices resulted in a decrease of total irrigated acreage in the 1980's. As of 1997, Lea County had 104,600 acres of cropland, of which 83,500 acres were irrigated and 21,000 acres were dryland. This is illustrated in TABLE 4-3 which presents a time line summarizing the history of development and water use in Lea County. While the largest type of water use in Lea County, past and present, is agricultural irrigation[7], many other types of activities are dependent on the area's water resources.

Historically, two of the most dynamic are oil and livestock. Oil has been instrumental in building the County's economy. The first oil well in the County was drilled near Maljamar in 1926. Oil exploration and production quickly spread through other parts of Lea County. Subsequent development of oil and gas fields supported increases in population. Water required for oil production[8] is used to pressurize subsurface deposits so production rates will increase and probably ranges from 3-9% of all water used.

[7] 65-80% of all water used each year since 1975

[8] Oil and Gas water use is reported under Amining@ water use category by the NMOSE.

TABLE 4-3: HISTORICAL DEVELOPMENT OF WATER USE IN LEA COUNTY

Time Line	
Early 1920's	Lea County residents first use ground-water. (Clark, 1987).
Late 1920's to recent	Trend from stock raising and dry-farming (pasture grasses and seasonal precipitation-irrigated crops) to economy based on irrigated farming and production of oil and gas.
1926	First Lea County oil well drilled, near Maljamar. Initial oil fields (until 1954) were drilled along the edge of the Delaware Basin on shallow structures (Nicholson and Clebsch, 1961).
By 1929	41 irrigation wells drilled on the Llano Estacado. 17 unused and 24 used occasionally (NMOSE, 1959).
Early 1930's	Drought increases ground-water irrigation around Lovington and Hobbs. Estimated irrigation pumping for 1930 was 500 ac-ft, for 1931 was 850 ac-ft, for 1932 was 950 ac-ft, and for 1933 was 1,225 ac-ft (NMOSE, 1959).
1931	Lea County UWB declared with 1,270-square-miles. It was closed to further appropriations at end of 1948, and not earlier because of its relatively slow development (Clark, 1987).
1940's	Livestock and cattle production increasing since 1929. Wells in northeastern Lea County that tapped Cretaceous beds stopped producing artesian flow following widespread drilling of uncased seismic shot holes, which allowed excess hydraulic head from the Cretaceous unit to dissipate into the overlying Ogallala. Limits of oil fields greatly enlarged (Clark, 1987).
1940 B 1950	Ogallala rises with above-average precip., except near Hobbs, Lovington, Humble City, and McDonald, where pumping increased (1947-1950). Water pumped from Cenozoic deposits rises from 3,200 ac-ft (1940) to 95,000 ac-ft (1950).
During W.W.II	Critical need for rubber led to construction of four carbon black plants in southern Lea County, near Eunice. Oil production develops rapidly in 1944 (Nicholson and Clebsch, 1961).
1946 B 1954	Amount of irrigated acreage rose, by 1954 there were 93,000 total irrigated acres. Subsequent increase in irrigation pumping quantities: 1946 B 3,500 ac-ft, 1947 B 19,000 ac-ft, 1948 B 39,000 ac-ft, 1949 B 60,000 ac-ft, 1950 B 95,000 ac-ft, 1951 B 153,000 ac-ft, 1952 B 166,000 ac-ft, 1953 B 165,000 ac-ft, 1954 B 163,000 ac-ft, 1955 B 170,000 ac-ft.
1948	Acreage with water rights reaches 117,700-acre total and estimated net recharge is 4,000 ac-ft annually (Clark, 1987). December 29, the basin was closed to further appropriation.
1950 B 1960	Below-average precipitation and increased pumpage results in Ogallala decline. Water pumped from Cenozoic deposits rises from 95,000 ac-ft in 1950, to 105,000 ac-ft in 1960. Early 1950=s drought cut down size of herds (Nicholson and Clebsch, 1961). Oil wells drilled at 3 mile intervals in Moore-Devonian Pool. Proportion of saline water production increases with continued development of field (Stephens and Spalding, 1984).
1952	Lea County UWB extended to current 2,180 square miles, and opened to further appropriations in 1952 and 1953. USGS and NMOSE begin work to define thickness of saturated sediments in northern Lea County. J.C. Yates made intensive township-by-township investigation in 1952. Pumping was concentrated in 20 of the 71 townships in the basin. Yates Aestimated the supply in each township and the total which could be withdrawn annually from each to make water available for irrigation for forty years, leaving one-third of the basin=s waters. These would be reserved for domestic and municipal purposes thereafter@ (Clark, 1987).
1954	Increases in irrigated land slowed in 1954 as most cropland was between Tatum and Hobbs, and in a NW-trending line, 15 miles W. of Tatum and Lovington. By 1954 there were 1,000 irrigation wells. First oil well drilled in a deeper part of the Delaware Basin (rather than along fringe), near Bell Lake (Nicholson and Clebsch, 1961). 2,400 ac-ft of water from Paleozoic units pumped out in the producing oil. 20,500 acre-feet water pumped since start of oil production. Annual average of 7.35 acre-feet water produced per well.
1955	3,000 operating oil wells; almost 570 million barrels oil and 940 million cubic feet natural gas produced since 1926. Highest year on record from 1937 to 1960 for irrigation pumping - 170,000 acre-feet.
1958 1960 1961	Apparent wet growing season; reported irrigation down to 107,000 acre-feet for year. Apparent wet growing season; reported irrigation down to 105,000 acre-feet for year. Jal Underground-water Basin is declared.
1965	NMOSE declares Capitan UWB. Oilfield withdrawals from Capitan Basin and reefs may adversely effect Pecos River and ground-water supply in valley (Carlsbad and Roswell Basins), so basin declared in 1965 (Clark, 1987).
1967 B 1968	New Mexico Oil Conservation Commission enters Order No. R-3221, prohibiting salt-water disposal in unlined surface pits. Use of salt-water disposal wells and lined evaporation pits allowed.
1972	State engineer reports that 16 percent of all diversions in Lea County were made up of withdrawals for municipal and industrial uses, more than three times the average for other underground basins (Clark, 1987).
1978	New Mexico began performing annual bradenhead tests to check mechanical integrity of all salt-water disposal wells (Class II wells) in southeastern New Mexico (Stephens and Spalding, 1984).

Source: Ash 1963 unless indicated otherwise

Livestock, while always present has never exerted a large direct demand on the County's water resources, is now increasing its demand. The Lea County livestock industry has changed since the mid1900's when dry conditions in the early 1950's reduced the size of many Lea County cattle herds. Today, the beef cow has largely given way to the milk cow. The number of milk cows increased 127% from 1995 to 1998[9]. The total number of current mature and immature dairy cattle has been estimated to be 30,000[10] to 40,000[11]. This data suggests increases in total herd size of 200% to 300% since 1995. Lea County dairy farmers indicate that up to 100 gallons per day per cow are required for consumption and processing. Plus, in order to meet the increasing demand for feed, continued dairy industry growth in the County is likely to increase irrigated agricultural water use.

TABLE 4-4 presents recent water use for the County by NMOSE water use category in 1975, 1985, 1995 [12], and 1998[13]. During the period from 1975 to 1985, large increases in water use occurred in most categories, with exceptions for irrigation, livestock, and power. A 13% increase in population in Lea County during this period of time (see Section 6) may account for much of the increased water use. Above-average rainfall in 1985 may account for the reported decrease in irrigated agriculture and livestock use.

Water use increased in Lea County from 1985 until 1995 by 22%. During this period, increases in water use occurred in all categories, except mining and power. Public water supply use and domestic use increased 26% and 40%, respectively, even though the population of Lea County increased only 1% (see Section 5). The primary water use categories in 1995 were irrigated agriculture (74% of total), public water supply (11% of total), mining (11% of total), and power (3% of total). Water use by the remaining categories was less than 1% of the total water use in Lea County for 1995.

Recent water use in Lea County, from 1995 until 1998 can not be completely addressed as the NMOSE total use data for 1998 has not yet been compiled. The 1998 NMOSE data shown in TABLE 4 is primarily collected from the Lea County UWB and uses on the other UWBs have not yet been accounted. Still the partial 1998 data compared to the complete 1995 data indicates a 10% increase in public water supply use, a 6% increase in irrigated agricultural use, and a 69% increase in industrial use. Using these figures, the total water use in Lea County increased by approximately 1% from 1995 to 1998, even though the 1998 data is incomplete.

4.3 NMOSE WATER USE RECORDS

The completeness and accuracy of the NMOSE reported water use data, shown in TABLE 4-4, depends on water users providing accurate meter records, estimates, and other data to the NMOSE. Discrepancies in data do occur when inaccurate information is provided.

Water use by agriculture is determined by multiplying the amount of irrigated acres by a factor of water use per acre. This factor is called the farm delivery requirement (FDR) (Calculated by the NMOSE). For example, if the FDR is 2.0

[9] USDA and New Mexico Agricultural Statistics Service **(see APPENDIX T)**

[10] Mr. Bob Carter, Lovington City Manager, reporting on a survey of dairy farmers.

[11] NMSU Cooperative Extension Service

[12] Data for 1975, 1985, and 1995 are derived from water use inventories published by the New Mexico Office of the State Engineer (Sorenson, 1977, Wilson, 1986, and Wilson, 1997).

[13] Data for 1998 are derived primarily from the *Lea County Underground-water Basin Annual Report 1998* (NMOSE, 1998). The 1998 report is an unpublished report prepared at the NMOSE District No. 2 Office in Roswell by the Lea County Underground-water Basin Supervisor and Assistant Basin Supervisor (Johnny Hernandez and Fred McMinn, respectively). It is important to note that the 1998 report data is primarily for the LEA County UWB and does not represent total use in all Lea County basins. The Lea County total use report for 1998 has not been completed at this time.

TABLE 4-4: LEA COUNTY HISTORICAL WATER USE: 1975-1998 (ACRE-FEET)

Water Use Category	1975	1985	1995	1998[a]	Change 1975-1985 (%)	Change 1985-1995 (%)	Change 1995-1998[b] (%)
Public Water Supply	9,966	12,818	16,153	17,790[c]	+29	+26	+10
Domestic	714	949	1,331	n/a[d]	+33	+40	n/a
Irrigated Agricultural	191,290	98,409	131,163	138,601[e]	-49	+33	+6
Livestock	1,025	727	1,497	1,111[f]	-29	+106	-26
Commercial	555	1,111	1,346	606	+100	+21	-55
Industrial	no report	0	1,497	2,524[g]	n/a	n/a	+69
Mining	21,612	25,783	18,975	12,439[h]	+19	-26	-34
Power	13,876	5,708	4,445	4,485	-59	-22	<1
Reservoir Evaporation	100	0	0	0	-100	0	0
Recreation	0	887	no report	966[i]	n/a	n/a	n/a
Total Use	239,138	146,392	176,407	178,522	-39	+21	+1

Source: Sorenson, 1977, Wilson, 1986, Wilson, 1997, and NMOSE, 1998

a. Data for 1998 is incomplete. Figures are based on withdrawals from the Lea County UWB only.
b. Actual increases and decreases for this period are yet to be determined due to incomplete NMOSE data.
c. The value includes 1,608 ac-ft of commercial, domesticm, and industrial use by the City of Carlsbad and 725 ac-ft of municipal non-cities use.
d. Domestic use has not been estimated.
e. This figure reflects an estimated area of 83,500 acres irrigated at 1.6 ac-ft per acre plus metered irrigation at 5,001 ac-ft.
f. This value includes dairies and cattle feed lots, but does not include livestock use in the Jal or Capitan UWBs.
g. This figure includes manufacturing and petroleum processing.
h. This value includes secondary recovery of oil, mining of ore, and oil well dwellings.
i. Recreation was eliminated as a separate category by the NMOSE Technical Report 47 (Wilson, 1992).

acre-feet per acre and 2,000 acres are irrigated, then the total withdrawal is equal to 4,000 acre-feet. The FDR is not constant because it is calculated from components that vary based on climate, crop type, cropping patterns, and other conditions.

Specifically, the FDR is computed[14] by dividing the consumptive irrigation requirement (CIR) by the on-farm irrigation efficiency (E_f). The consumptive irrigation requirement (CIR) is determined by subtracting the effective rainfall (R_e) from the consumptive use (U). Besides the obvious variance in rainfall, consumptive use (U) is also calculated from variable factors such as temperature, daylight hours, and latitude. Furthermore, on-farm efficiency (E_f) is also based on elements that are affected by farm and field conditions that can vary and change. Therefore, it is important to note that the FDR varies yearly as seasons, climate, crops, farm methods, and cropping patterns change. A copy of the detailed procedure for quantifying irrigation withdrawals and depletions is provided in APPENDIX R.

[14] The calculation is set forth in the NMOSE's Technical Report 49 (Wilson, 1997a).