8. WATER PLAN ALTERNATIVES

8.1 WATER PLAN ALTERNATIVES

Water supply alternatives for Lea County contained in this Plan are intended to accomplish one or more of three things: 1) conserve water, 2) develop additional water supplies, and 3) improve water management. The LCWUA has carefully selected and crafted each alternative listed herein for possible implementation according to the schedule given in Section 8.3. Areas where water can be saved through conservation include: irrigated agriculture, urban and suburban landscaping, indoor use, and the systems of large users. Alternatives that increase supplies are: developing deep aquifers, treatment of lower quality water, importing water, recharging aquifers, and seeding clouds. Each of these alternatives must be carefully planned and managed to assure the best results, the lowest cost, and the least adverse impact on the quality of life enjoyed by Lea County residents.

TABLE 8-1: WATER CONSERVATION MEASURES

Conservation Measure	Suitability	Annual Water Savings (ac-ft)	Implementation Time
Irrigated Agriculture	Very Good	35,000	5years
Urban/Suburban Landscaping	Moderate	5,000	20 years
Residential	Moderate	2,500	20 years
Wastewater Reuse[a]	Good	7,000	3 years
Large User	Good	5-20%	3 years

[a]4,500 ac-ft of effluent is already being reused.

8.1.1 Water Conservation

Reduction of demand through conservation does not create new water, but does provide a way to extend or sustain the life of aquifers by consuming less water. Water rights holders often view conservation as an effort to reduce their right --when instead-- it is an enhancement that allows their right to become a long-term benefit. A summary of the water conservation measures discussed here is presented in TABLE 8-1.

8.1.1.1 Irrigated Agriculture

Since irrigated agriculture is the largest single use of ground water in Lea County, reducing the water used for irrigation is essential to preserve the Ogallala Aquifer as a resource. Alternatives to be implemented include the items listed below.

- use LEPA attachments on center pivots
- monitor soil moisture so that water is applied only when needed
- use tillage methods which promote soil water retention
- use crop types compatible with the climate and soil type
- encourage dryland farming

New high efficiency drop tube apparatuses known as Low Energy Precision Applicators (LEPA) are now available to retrofit existing center pivot systems. Retrofitting center-pivot irrigation systems with LEPA attachments will most likely be the single most significant conservation measure undertaken in Lea County. More than 90% of the irrigated acreage of Lea County uses center pivot sprinkler systems. The estimated efficiency of a traditional center pivot system is 60%.[1] LEPA fitted center-pivot systems are capable of achieving efficiencies as high as 95%. For this

PT[1]P Efficiency measures the amount of applied water that makes it into the soil ,where it is available for plants.

reason, converting to LEPA attachments should be one the LCWUA main priorities. Today, less than 10% of these center pivot systems are equipped with LEPAs. Converting to LEPA attachments should cause few technical problems. Assuming all 1998 irrigation water in the Lea County UWB was applied by center pivot systems, a conversion of those systems to LEPA systems would result in a water savings of 35,000 acre-feet per year. Since about 10% of agricultural irrigation users already utilize LEPA systems,[2] the actual annual savings would be closer to 31,000 acre-feet. Although funding specifically for such conversions is currently not available, cost sharing programs are in the process of being developed by the Farm Service Agency[3] and low interest loans can be made available.

Soil moisture data can be used by farmers to determine the necessary irrigation frequency. Soil monitoring can occur on-site at each farm parcel or by a network of stations located strategically throughout the County. Network derived soil moisture can be disseminated to farmers via daily public service announcements and/or Internet bulletin boards. The small amount of monitoring for soil moisture that is being performed in Lea County today is not coordinated. A network project could be financed by federal or state grants with the assistance of universities or local soil and water conservation districts. Rebates or other incentives could be provided for on-site monitoring stations.

Farmers are becoming more and more aware of age-old methods for collecting and storing precipitation in the soil. This together with soil monitoring and modern/efficient techniques for soil working can allow irrigation requirements to be offset by natural soil moisture. Information on techniques for optimizing natural soil moisture will be made available throughout the County with updates on the latest research and innovative methods being highlighted. When precipitation collection and soil management are done correctly, large decreases in the amount of irrigation water that is required to produce a crop are realized. For instance - if 33% of the average annual rainfall (in the area between Hobbs and Tatum) is retained in the soil, a wheat crop can be grown with a yield that is 70% of what would be produce by an adjacent irrigated field using 10-times as much water.[4]

Collecting and storing precipitation in the soil is an essential component of dryland farming. Many eastern parts of Lea County were at one time dryland farmed. Conserving irrigation water will mean that large portions of the County's agricultural lands will be returned to dryland farming and/or producing irrigable crops that require substantially less water. Because these changeovers will result in very significant water savings, everything possible will be done to facilitate their implementation. Dryland farming can reduce the amount of irrigation water required by 50 to 100 percent per acre converted. Much research is currently occurring in the field of dryland farming and many new strains of low water use crops are being introduced. With the recent advent of dryland farming as a separate agricultural discipline, significant technical resources are now available to assist dryland endeavors. New dryland farming technology and crop strains continue to be developed by various universities[5] and agencies as many western agricultural areas face decreasing water supplies.

Because conserving irrigation water will also reduce power costs for operating pumps and sprinkler systems, economics will be a positive contributing influence for all alternatives design to lower irrigation use. To specifically encourage the conversion of acreage to dryland farming, lower tax rates may be set for parcels that use little or no irrigation. On a federal level, New Mexico's legislative delegation will be informed of the irrigation savings that are occurring because of the USDA's CRP program, in an attempt to keep the program funded. Also, subsidies for crops produced by dryland methods will be proposed.

It should be mentioned Lea County farmers have invested large amounts of money in pumps and irrigation equipment. As much as we would like to convert the irrigated farms to dryland operations, it has to rain to make this possible. Unfortunately, the recent trend in precipitation has been less rainfall rather than more. Because of this, the objective here should be one of conservation rather than one of mandating or requiring farmers to cease irrigating all together.

P[2]P Lea County Farm Service Agency (1999)
P[3]P This may qualify for federal funding as an energy conservation program, because pumping less water means using less energy.
P[4]P Widstoe (1999)
P[5]P especially Texas Tech University in Lubbock.

8.1.1.2 Municipal & Industrial

Urban/Suburban Landscaping

TABLE 8-2: INCLINING-BLOCK RATE STRUCTURE

Water Quantity (gallons/month)	Cost of Water in the Specified Quantity Range ($ per 1000 gallons)	Maximum Monthly Bill
0-25,000	0.50	$12.50
25,000-50,000	0.75	$31.25
50,000-75,000	1.00	$56.25
75,000-100,000	1.25	$87.50
Over 100,000	1.5	$125.00+

By far the most effective way to encourage residents to reduce the water they use on landscaping, is to develop an Inclining-Block rate structure. An Inclining-Block structure increases rates in steps, which correspond to increasing amounts of water used. The cost of water for each tier of use is more expensive. Water bills for residents who use water for essential household activities are not increased. However, homeowners who use larger than average amounts of water (usually as a result of inefficient landscape irrigation) will have water bills that are much larger than average. A sample Inclining-Block rate structure is shown in TABLE 8-2.

The first step in implementing the inclining-block rate structure is a thorough audit of the existing water uses. Several residential users currently “sell” a large portion of their water to industrial users in Lea County and elsewhere. The system audit will determine actual usage and create a better picture of where the water is actually being consumed.

Landscaping and watering ordinances together with efficient landscaping and irrigation practices and incentive programs are another effective way to assure conservation of landscaping irrigation. The most common conservation ordinances include restrictions on the size of areas that may be planted in turf and the hours during which watering may occur. However, establishing regulations that restrict people’s choice is politically unpopular and often difficult. Efficient landscaping practices include xeri-scaping, using other appropriate plants, using mulches, and performing regular irrigation system maintenance. Efficient landscaping irrigation methods include conversion from sprinkler to drip systems, daily public service announcements during summer months regarding appropriate watering rates, and irrigating only when needed and during nighttime hours.

If half the homes in Lea County were to change out their turf and install drip irrigation systems about 500 acre-feet of water a year would be saved. These savings will accumulate slowly over time if incentives are given to residents. But large, timely, savings would occur if all municipal facilities and new suburban development installed more water efficient grass and shrubs. Studies indicate that the use of buffalo grass in the City of Hobbs, as compared to Kentucky bluegrass and Bermuda grass, results in a water savings of 26 and 12 gallons per square foot per year, respectively.[6] Changing from Kentucky bluegrass to Bermuda grass results in a water savings of 14 gallons per square foot per year, or a savings of 1.9 acre-feet per year per acre changed. Effects of using drip irrigation, rather than flood or sprinkler irrigation, for trees and horticulture results in a water savings of 9 to 10 gallons per square foot per year.

Indoor Residential

Reduction of indoor water use is a readily accepted and significant means of water conservation. The National Energy Policy Act of 1992, requires that toilets manufactured for residential use after January 1994 use no greater than 1.6 gallons per flush. In comparison with toilets manufactured prior to the 1950's that used 7 to 8 gallons per flush and toilets manufactured in the 1980's that used 3.5 gallons per flush. The new toilets can save 1.9 to 6.4 gallons per flush. Reduction of indoor water can also occur by reducing flowrates at showerheads and faucets. New showerheads with flows of 2.5 gpm are more efficient than the 3 gpm and 5 to 8 gpm showerheads of yesteryear.

P[6]P Wilson (1996)

The federal flow requirement for new bathroom and kitchen faucets is 2.5 gpm, and faucets with even lower flowrates are available. Former bathroom and kitchen faucets had flows of 3 to 7 gpm. Indoor water use can also be reduced by the installation of new appliances including: dish washers, hot water heaters, and washing machines. Education is an important step in obtaining conservation by using efficient fixtures and appliances.

Reducing indoor water use is compatible with Lea County, as with most any community in the southwest, because of a heightened public awareness about water supply issues.[7] Since the majority of the County's houses and buildings were constructed prior to 1980 and since major appliances are costly to replace, the most feasible way to conservation indoor water is by replacing older toilets, showerheads, and faucets with new low flow/low volume alternatives. Approximately 21,000 housing units in Lea County were built prior to 1980. Assuming 90% of these households have older toilets, an average household population of 3 people, 6 flushes per capita per day, and an excess flush (greater than 1.6 gallons) of 6.4 gallons, approximately 2.2 million gallons of water could be conserved per day by retrofitting with low flow toilets. This volume of water is equivalent to 6.8 acre-feet per day, or approximately 2,500 acre-feet per year. A conservation plan for replacement of older toilets could result in significant water savings within a year of implementation, but the full benefit will only be realized over time - as homes exchange hands or are remodeled. This type of conservation plan is best implemented with some type of user incentive, such as matching funds or rebates applied to customer water bills. Lea County governments should aggressively seek federal dollars for programs that encourage conservation. Several communities in New Mexico similar to those in Lea County have been very successful in obtaining federal funds for conservation programs.

Large Users

Many municipalities have devised strategies and established/installed programs to promote conservation amongst large water users, including water use auditing and reuse infrastructure. Cities in low rainfall areas have established programs that create conservation incentives for large water users. One of these programs, water audits, examines a facility to find ways to conserve water without substantially changing the facility's processes and without reductions to production efficiency.

A common large user of water for any community is the parks and recreation department. Methods of conservation for recreation facilities include adjusting watering rates, times, and intervals and changing the variety of trees, shrubs, and turf. Another method used to conserve water is to provide infrastructure so that wastewater treatment plant effluent can be used for irrigation at golf courses and parks, thereby allowing large amounts of fresh water to be conserved.

With few exceptions, water user fees in Lea County do not promote conservation and water use audits of large users are not performed. Special inclining-block rates can be set to meet the needs of commercial and industrial users and at the same time promote water conservation. If water fees are based on an inclining-block rate structure, the increased proceeds could be used to offset the cost of water audits, reuse and disinfection facilities, and improved metering. There is no current estimate of water use by large users in Lea County. However, water savings of approximately 5 to 20% of total use for appropriate categories have been achieved with similar "Large User" programs at other locations within New Mexico.

8.1.2 Water Development

P[7]P The Southern Public Service Company (SPS) sponsored a recent indoor water use conservation program in southeastern New Mexico and West Texas. Owners of electric water heaters were offered kits containing low flow showerheads and low flow kitchen and bathroom faucet aerators. A spokesman reported that approximately 36,000 kits were sent out to SPS customers but the number sent to Lea County was unknown. This type of program increases public awareness and allows for greater acceptance of additional programs.

Lea County's existing ground-water sources include the four UWBs: Lea County, Capitan, Carlsbad, and Jal. The primary water deposits in these basins include the Ogallala Aquifer, the Capitan Aquifer, the Santa Rosa Aquifer and the Alluvial Aquifer. Each of these sources will continue to be used in the future. Methods which can be used to increase future supplies may include piping water to Lea County, developing aquifers that are currently not used, offsetting withdrawals through aquifer storage and recovery (ASR) projects, and increasing precipitation through cloud seeding. Water stored in portions of the undeclared basin north of Tatum may also be tapped. Water saved through conservation measures, while originating in existing water sources, can be considered a new water supply, but conservation is addressed separately in Section 8.1.1 of this Plan. Surface supplies of a size large enough to provide water for distribution cannot be developed by traditional methods. However, increasing precipitation through cloud seeding is been proven to be a means of increasing water supply in arid agricultural areas.

8.1.2.1 Development of Deep Aquifers

While the Ogallala is the primary aquifer in Lea County, there exist several others that could produce quality water with some effort. One of these is the Santa Rosa, located under the Ogallala. The Dockum Group, Rustler, and Capitan Reef are other aquifers that may provide a new water source in the Lea County. In particular, areas where faulting may have fractured the rocks and increased the effective porosity of these aquifers should be investigated. Wells at these locations may prove more productive and sustainable. The Dockum Group aquifer has the potential to provide adequate quantities of water to wells for domestic and stock uses, even in areas where it is essentially unfractured. The Dockum Group, Rustler, Capitan Reef, and other deep aquifers in Lea County will need to be characterized in more detail, before the feasibility of using these deposits can be know and before large-scale water production can begin; oil company drilling records can provide much of the needed information. Costs to recover water from deep aquifers will depend on the production available from each well and the pumping level. Exploration costs to drill and complete wells in deep aquifers may range from $50 to $60 per foot.

8.1.2.2 Treatment of Lower Quality Water

Lea County has two significant sources of lower quality water. These are produced waters associated with oil and natural gas deposits and aquifers high in saline. Produced waters in Lea County are generally high in hydrocarbons and other solubles. Poor quality water usually contains high amounts of total dissolved solids (TDS). Most dissolved solids are ionic compounds called salts. While salts vary in chemical composition, they act the similarly and have the much the same affects when dissolved in water. In Lea County large quantities of saline water occur in both the Rustler and Capitan aquifers. These waters can be used in place of higher quality water for activities with low sensitivity. If the quality of these waters can be increased sufficiently, they can meet a variety of other needs.

For instance, produced or saline water could be supplied to non-potable users serviced by the City of Carlsbad's Double Eagle System. Large amounts of high quality water from the Double Eagle are now used to re-pressurize deep, saline oil-production zones.[8] Once the water is injected into these oil zones it becomes contaminated. If produced water or saline water could be used for oil pressurization instead of Double Eagle water, then the quality water would remain available for more sensitive uses. Incentives may be given to encourage Double Eagle or petroleum companies to drill deeper wells into saline aquifers. Alternately, the County may drill wells and supply water to Double Eagle or may compete for the system's customers.

Desalinization refers to reducing the TDS concentration of water. Desalination of poor quality water is commonly practiced throughout the world and is becoming more widespread in the U.S., particularly in Florida and California. Alamogordo, New Mexico is considering such a program to provide for future needs. In 1998 there were over 10,000

P[8]P NMOSE records tabulated by Miller (1994) indicate that of the 38 water-supply wells used for secondary recovery of oil in the Capitan UWA, 17 produced water containing potable levels of chloride. Many of the 21 others have chloride concentration of less than 500 ml/l. The wells are primarily located immediately east of Eunice and south of Eunice along Monument Draw and Cheyenne Draw.

desalination plants worldwide with more than 80% of them treating brackish water, not seawater. The Rustler and Capitan aquifers store large quantities of high TDS water that, without treatment, will continue to have limited uses.

8.1.2.3 Importing Water

Occasionally, it has been proposed to pipe water to Lea County from Ute Reservoir or from the Pecos River. Recently, a project called the La Mesa Pipeline[9] (which is intended to convey water from the Ogallala, north of Amarillo, Texas to El Paso – passing near or through Lea County) has been posed as a water importing opportunity. It is possible that these waters could be injected into the Ogallala Aquifer in areas experiencing the greatest drawdowns. However, pipeline projects, by their nature, are very expensive. The quantity of water still available (or unclaimed) from Ute Reservoir is limited and treatment will be required prior to potable use. Treating the water will add to its cost. To acquire rights to Ute water a beneficial use needs to be identified and the NMOSE does not recognize the storage of water in an aquifer as a beneficial use. The La Mesa Pipeline is still seeking financial backing and regulatory permitting, but the quality is excellent and little treatment would be required.

8.1.2.4 Aquifer Recharge

Aquifer recharge refers to taking water from the surface and injecting it into an aquifer for storage. The water may be withdrawn at a later time for irrigation, municipal, or other use. Storing water in an aquifer allows for a vast quantity of water to be deposited without evaporation losses or the construction of surface lakes or tanks. Aquifer recharge is being performed in neighboring states to limit water-table declines, replenish areas where declines have been severe, and to increase supplies. Potential sources of recharge water in Lea County include, treated wastewater streams and storm runoff. Treated municipal wastewater could be re-injected up-gradient of well fields to reduce ground-water drawdowns and infiltration galleries can be installed to help detained storm water or runoff in drainages percolate into the Ogallala or other aquifers.[10] Imported water from outside the County can be injected, and --while expensive-- poor quality water found in various shallow formations in Lea County, can be pumped to the surface, desalinized, and injected into source aquifers.

If 50% of the average annual rainfall (about 8 of the 16 inches) in the Lea County UWB was collected and stored in the Ogallala Aquifer, approximately 0.7 feet of water per acre of surface collection area could be added to the aquifer annually. Under this scenario, a series of surface collection areas totaling 18 square miles could recharge about one-half of the 1998 Public Water Supply use in Lea County. Aquifer recharge in the Lea County UWB from runoff collection will most likely occur in existing or constructed storm channels and be placed into the Ogallala Aquifer via infiltration wells which penetrate the overlying caprock. Recharge would have to be carefully executed to ensure that local users would reap the benefit of the efforts of the recharge and not the users of the aquifer in distant areas.

8.1.2.5 Cloud Seeding

Cloud seeding is the process of stimulating clouds to enhance rainfall. Since 1971 cloud seeding has been used in portions of Texas to augment runoff to its reservoirs.[11] Cloud seeding experiments in the Big Spring area of Texas indicated that silver iodide more than doubled the amount of rain, the seeded clouds lived 36 percent longer, and the rain fell over an area 43 percent larger than clouds that were not.[12] Experimental cloud seeding in Thailand and Cuba also had positive results with precipitation increases of 27 and 65 percent, respectively.[13] Because of Lea County's caprock formation, little natural recharge may occur from cloud seeding, but the additional precipitation would reduce the need for pumping ground water for irrigation. In addition, aquifer recharge areas can be developed

P[9]P Mesa Water, Inc., 8117 Preston Road, Suite 260W, Dallas, TX 75225, (214)265-4165, FAX (214)750-9773

P[10]P Environmental concerns regarding potential changes to habitat sometimes need to be addressed, when natural drainage patterns are altered.

P[11]P Bomar (1997)

P[12]P Bomar (1997)

P[13]P Bomar (1997)

along drainage ways and playas to capture the runoff and infiltrate it into the underlying aquifers. The High Plains Underground Water Conservation District No. 1 in Western Texas,[14] operates a successful cloud seeding program. Several New Mexico Counties already participate in this program (i.e. Quay, Curry, & Roosevelt). Lea County will explore the possibility of working with the High Plains District to expand its program to cover Lea County. The cost for Lea County's participation is estimated to be $40,000 (or 10 cents per acre), based on what the current New Mexico participants are paying.

8.1.3 Water Management

In order to preserve the area's water supply and –thereby-- the residents quality of life, Lea County water users will take an active roll in managing their remaining ground water resources, especially in the Lea County UWB. The available water in Lea County will not be able to sustain the current withdrawal rates indefinitely. If in the future withdrawal rates increase, as projected by this Plan, the lives of the area's aquifers will be reduced even more quickly. Of particular concern is the pressure being placed on the Ogallala Aquifer by pumping in Texas and the possibility that Ogallala water may be piped out of the County. Proper management of the remaining water and the available water rights will allow the life of the aquifer to be extended or even preserved.

8.1.3.1 Interstate Alternatives

Along the Lea County-Texas Line, water in the Ogallala Aquifer is flowing from New Mexico into Texas. While Ogallala water has historically flowed into Texas, however, because of extensive pumping in Texas, the ground-water gradient from New Mexico into Texas has become more steep. Unlike the allocation of surface water use via interstate compacts, there is no agreement to coordinate the interstate use of ground water. It seems reasonable to assume that the same kind of equitability should be applied to the use of ground water along the State Line. Therefore, the creation of a Regional Management Plan with the neighboring counties in Texas (Cochran, Yoakum, Gaines, and Andrews), which details the future use of the remaining water in the Ogallala Aquifer, would be advantageous for Lea County and Texas. Cooperative regional management of the remaining Ogallala water will help extend the life of (or preserve) the aquifer and assure its future availability to both New Mexico and Texas. An interstate water management plan for the Ogallala Aquifer along the Lea County-Texas line is envisioned to be essentially a "good neighbor agreement" arrived at by mutual analysis of water use and its impacts on the Ogallala. A Regional Management Plan should include coordination on at least the following issues: well spacing along the line, distance of wells from the line, pumping rates and scheduling, and restricting use in large drawdown areas.

The LCWUA has already initiated this effort by attending several ground water resource meetings in Texas. Also, in combination with the New Mexico Interstate Stream Commission, the LCWUA has meet with representatives from the High Plains Groundwater Conservation District No.1 and the Texas Water Development Board. As a first step in interstate water management the LCWUA and the attending Texas interests have agreed to work towards better understanding the Ogallala by exchanging information. To date, the first seven chapters of this Plan have been provided to the Texas interests and many maps and reports issued by the High Plains District have been provided to the LCWUA.

8.1.3.2 State Involvement

The future demand for water, as predicted by this report, will drastically deplete Lea County's water supply. Even at demands of 40% less than those predicted herein, models show the Ogallala Aquifer will be completely dewatered in areas by the year 2040.[15] In response, the water users of Lea County (by this report and other steps) are preparing to take action to stop the depletion, especially in areas overlying the Ogallala. Since the Ogallala lies almost completely within the Lea County UWB, effective administration of the Basin by the NMOSE can contribute to the

P[14]P High Plains Underground Water District No. 1, 2930 Avenue Q, Lubbock, TX 79405-1499, (806)762-0181, FAX (806)762-1834
P[15]P Musharrafieh and Chudnoff (1999)

County's efforts. This Plan and subsequent water planning within the County will be based on predictions of future withdrawals from the Ogallala. These predicted withdrawals are based on currently held water rights and water diversions. The accuracy of these predictions and the ability of the County to plan for water usage will be impaired if additional water rights are attained in the Lea County UWB. To prevent the development of additional rights in the Lea County UWB, the NMOSE should immediately close the Basin to new appropriations.

8.1.3.3 County-Wide Programs

If the Lea County UWB is not closed, another issue of concern is created when a farmer (or other user) uses new more efficient application methods which causes less water to be used. The amount of water saved or artificially recharged by the farmer could be available for appropriation by new users. Closing the basin will allow the County to develop alternatives to increase supply and decrease demand, without having to be concerned about new appropriators developing water made available through conservation or diverting water added through artificial recharge projects. Basin closure will help extend the life of the aquifer, with the ultimate goal being to develop a sustainable supply. In addition to basin closure, the County should also consider passing ordinances discouraging exportation of appropriated water to users outside the county. Other municipalities have been successful in passing such ordinances and they have reported a significant reduction in exportation of their water.

The residents of Lea County have already initiated management of the County's water by the forming the LCWUA. The LCWUA will play a major role in future water management. However, the work required to manage water throughout the County will be extensive and continuous. In order to implement county-wide water management programs, it will be necessary for the LCWUA to have technical assistance. A few options to accomplish this include the following. Engineering consultants could be utilized much as they are now. The level of their involvement would depend on the funding available and could vary from year to year. Another option is a full-time technical employee. This person may be an employee of the LCWUA[16] or an employee of Lea County. A County employee could direct a Lea County Water Resources Department under the administration of the Lea County Manager and coordinate water management efforts between the many water-using entities within the County. Such entities will include municipalities who will likely wish to manage portions of any water management plan at their local level. Other local entities include domestic water systems and cooperatives, the local soil conservation district, and large water users and water using industry associations. Some of the water resource programs, which are anticipated to require management on a county-wide basis, are listed below.

<u>Aquifer Monitoring</u>

Measurement of ground water supplies can be performed by periodically recording depth to water in selected wells across the County. Since such a method may be sporadic and unreliable if left to individual well owners, implementation would be most effective if performed under a countywide program with trained personnel. This way the information would be more precisely and consistently measured, recorded, analyzed, and disseminated. Areas where ground-water declines are large should be monitored most often. Monitoring should include comprehensive geographical locating and water source (i.e. aquifer) referencing, perhaps with GIS computer software. If changes in water depth information are recorded correctly, updating numerical models to simulate and predict water-level changes can be performed more quickly, allowing changes to be made in the management of the aquifer, if necessary. Making information available on the fluctuations in ground water will help all parties in Lea County understand how the aquifers are responding to conservation efforts.

Water quality is also important to assess the amount of water resources available in the County. While measuring aquifer levels regular water samples can be taken and subsequently tested in a laboratory, or making field measurements of specific conductance, and other parameters. Such a sampling/testing program would describe the

P[16]P In which case, LCWUA's legal status will need to change.

aquifer's quality. The complete program to monitor aquifer storage and quality is more specifically described in TABLE 8-3.

Ground-Water Flow Modeling

Future ground water availability and saturated thickness of the aquifers in the Lea County can be estimated using the ground water flow model developed by the NMOSE.[17] Model simulation can be performed to assess different pumping scenarios and account for existing and potential wells in Texas and New Mexico, as well as the addition of water to the aquifer via artificial storage projects. The model will allow for informed management when deciding where ground water development should be increased or decreased in order to make the supply sustainable.

Well Inventorying & Sealing

By constructing an inventory of producing and abandoned water and oil wells across Lea County many instances of aquifer contamination can be avoided. Abandoned wells need to be plugged because their completions may be poor. Deeper wells with poor completions can allow high-head, poor-quality water to discharge into overlying aquifers of high quality water. A plugging and abandonment program will reduce the mixing of water between aquifers. The goal of a well plugging program is to prevent contamination and restore, as far as possible, the aquifer to original hydrogeologic conditions. A well inventory can recorded wells with latitude and longitude locations in a GIS format to help geographically identify possible sources when contamination is detected. A well inventory in GIS format will also facilitate the Aquifer Monitoring and Ground-Water Flow Monitoring programs as described above.

Irrigation Efficiency

Several County-wide programs can help conserve irrigation water. Any program to make irrigation more efficient will need to be coordinated with the Lea County Soil Conservation District, because the District has already developed channels of communication and rapport within the area's irrigation industry. A program to find and disseminate funding to farmers for changing center-pivot sprinklers to LEPA systems will be important. Monitoring soil moisture throughout the County and reporting the data to farmers so they can adjust their irrigation rates will also be important. In addition, information on the most recent methods for efficient irrigation and drought-resistant crops need to continue to be made available.

Public Information/Education

A public awareness program can inform the public of the need and methods for water management and conservation. The program will need to include public information announcements for various conservation programs, soil moisture reports, and suggested irrigation frequencies. The program should be organized in such a way that facilitates individual water management and conservation plans for the towns and cities located within Lea County.

8.1.3.4 Municipal Management

Fundamental municipal water management practices include accurate measurement of water use and water supplies, and establishing water rates to pay for system maintenance. Progressive water management will occur when individual water systems take responsibility for not only obtaining and supplying water, but for making sure it is efficiently used as well. The water use audit that this plan advocates will be the first step the municipalities can take in better tracking the water consumption in Lea County. Conservation measures such as inclining-block rate

P[17]P Musharrafieh and Chudnoff (1999)

structures and elimination of leaks in distribution systems are often managed best by each municipality or water association. In addition, effluent reuse is best administered by each treatment facility.

Water Pricing

While inclining-block rate structures have shown to be one of the best means to conserve water, it will be up to each municipality to determine what those rates are. An inclining-block rate structure, as well as an accompanying water system audit, is discussed in Section 8.1.1.2 above.

Reducing System Losses

Infrastructure maintenance and operation, which must be performed by local water systems, can also be important conservation programs. Water systems need to monitor quantities of water pumped verses quantities of water metered (at the point of use) and look for areas that have high discrepancies between the two. Differences between what's pumped and what's used indicate leaking distribution lines or fittings. Areas where leaky lines are known or suspected should be repaired or replaced. In addition, some systems have reported leaking storage tanks and high (>250 gpd) per capita water use. High per capita water use can indicate inadequate metering. Many municipal water systems in Lea County have recently performed major upgrades/repairs or are planning such improvements. Close contact between the various water systems in Lea County and municipal personnel will be maintained in order to compare quantities of per capita water use and the effectiveness of different water conservation measures. In addition, Lea County communities can work together to obtain utility upgrade funding grants that are available from state and federal agencies.

Wastewater Reuse

There are six WWTPs in Lea County that serve over 500 people each. Combined they serve a population of about 55,000 and produce somewhere between 6,000 to 7,000 acre-feet of effluent per year. If this effluent can be used to replace high quality water, currently used for irrigation, the high quality water can be saved. About 5,500 acre-feet of municipal wastewater effluent in Lea County is now being used for non-edible crop irrigation, so reuse is not a new idea to residents. However, to deliver effluent to places of application, pumps and pipelines are usually required. In addition, before effluent can be used on golf courses or parks, or any other place with public access, it must be disinfected. Maintenance and operation must be performed on pumps and disinfection facilities. Communities will need to alter their staffing and budgets to provide manpower and money. Several communities in New Mexico make use of readily available federal dollars for these types of expenses. If the remaining effluent and any new effluent were diverted to irrigation uses an additional 1,500 acre-feet of high quality water will be saved per year.

TABLE 8-3: WATER MONITORING PROGRAM

	[a]	[b]

[a]The cost for a good well sounder, calibrated in 0.01 foot increments, ranges from $600 to $1,000.

[b]Field-grade Specific Conductance and pH meters cost from $350 to $500 and from $400 to $600 respectively. Temperature can be measured with a good $35 thermometer or a $115 thermocouple.

8.2 ALTERNATIVE EVALUATIONS

8.2.1 Conservation Alternatives

Because of their similarity, the conservation alternatives for irrigated agriculture and municipal and industrial use are evaluated together below. Their evaluations are summarized individually in TABLE 8-4.

Technical Feasibility

Whether it be for irrigated agriculture, urban landscaping, indoor residential use, or large water users, the conservation alternatives discussed in this Plan are non-complicated, technically feasible steps that have the potential to save large amounts of water.

Political Feasibility

Political resistance to new initiatives is often directly related to the inconvenience residents feel or anticipate from a program. The inconvenience felt by most Lea County residents will be small for many of the conservation programs with the highest returns, such as such as those for irrigation and large users. Careful education and aggressive funding incentives will help to make such initiatives feasible not only to urban/suburban residents, but to farmers and large water using business owners as well.

Social And Cultural Impacts

The replacement of high water consuming landscaping with low water vegetation can have an unpleasant aesthetic impact on some residents. Many inhabitants of the western United States have come to associate green, lush landscaping with affluence and a high quality of living. However, if care is taken when designing and placing new landscaping, particularly at public facilities, people will see and appreciate the beauty and tastefulness that can be embodied in southwestern landscaping.

Conflicts can occur when some users spend time and expenses to implement conservation methods, while their neighbor(s) does not.

Financial Feasibility

In the long run most all conservation methods are financially feasible, because future savings in pumping energy and water supply longevity offset initial costs. Aggressively seeking funding and finding innovative ways to finance or subsidize conservation investments can help to reduce the impact of initial costs. For instance, tax rebates or cash-back programs for installing LEPA systems or for changing out high water using appliances and residential water fixtures can lesson the financial blow. The public must be educated and informed about the financial assistance available for conservation programs to be effective.

Implementation Schedule

Conservation measures can be implemented over a range of intervals. LEPA conversions, dryland-cropping changes, landscaping irrigation changes, water pricing structures and residential water fixture/appliance replacements can be planned and initiated within several years of acceptance of a water management plan. The programs setup to facilitate these occurrences will need to be actively pursued for many years, as changes in use will take time to occur. Other programs such as public education, moisture monitoring and irrigation frequency announcements will need to be a permanent fixture in the lives of Lea County residents.

Physical, Hydrological, and Environmental Impacts

Reducing the amount of water used for irrigation will reduce the quantity of return flow. As a 35% reduction in water use may be obtained through the use of LEPA systems, and as the application of excess water will be minimized through irrigation modifications based on soil moisture monitoring, it is conceivable that the return flow from agricultural irrigation could be reduced by more than 35%. However - instead of being pumped and returned to the aquifer, this water (the reduced return flow amount) will simply remain stored in the aquifer because it was never pumped in the first place.

TABLE 8-4: EVALUATION OF WATER CONSERVATION ALTERNATIVES

Entity	Technical Feasibility	Political Feasibility	Adverse Social and Cultural Impacts	Financial Feasibility	Suggested Implementation Schedule (year)	Adverse Physical, Hydrological, and Environmental Impacts
Irrigated Agriculture	Good - non-complicated, technically feasible	Good – potential energy savings will act as an incentive	Low – no impact expected	Fair - Costs to change to LEPA can be prohibitive to some	2002 - planning period in initial year, pilot programs may be required	Low - none expected
Urban/ Suburban Landscaping	Good - non-complicated, technically feasible	Fair – conservation measures can cause inconvenience for users	Medium – southwestern landscaping is not aesthetically pleasing to some people	Good - cost to change watering system is moderate, cost to change landscaping is moderate	2002 - planning period should identify priority areas	Low - none expected
Residential	Good - non-complicated, technically feasible	Fair – conservation measures can cause inconvenience for users	Medium – low water flow can cause inconvenience for users	Good - costs are low and can be funded	2002 - educational programs in year 2001 can precede implementation	Low - none expected
Large Users	Good – can be complicated, technically feasible	Good - potential savings in cost and energy will act as an incentive	Low – no to little impact expected	Fair - depending on scale required, impact to overhead costs can be phased	2003 to 2005 - audits conducted in 2002	Low - none expected

8.2.2 Development Alternatives

The alternatives dealing with increased water supply (saline aquifers, importing water, aquifer recharge, deep aquifers, and cloud seeding) are discussed separately below, because of their uniqueness. Their evaluations are summarized in TABLE 8-5.

8.2.2.1 Deep Aquifers

Technical Feasibility

Development of deep aquifers, such as the Dockum Group and Capitan Reef aquifers, is technically feasible through the use of common drilling techniques. Some hydrogeological investigation will be required, however, as little is known about these aquifers. For instance, there is conflicting data on the yields that can be expected.

Political Feasibility

Since the Dockum Group is not developed, the political problems associated with its use are believed to be few. However, there are some indications that areas of the aquifer may have been contaminated. Political issues could arise if development of the aquifer is hindered due to contamination by the oil and gas or other industries.

Social And Cultural Impacts

Social and cultural impacts associated with the development of this aquifer should be positive, as it could improve the longevity of other water sources in Lea County.

Financial Feasibility

Since wells may have to be drilled to over 700 feet, the cost of developing deep aquifers will be more expensive than the Ogallala. While this depth is greater than most current wells in Lea County, the cost is still much cheaper than a few of the alternatives that will be mentioned later. While data indicates that the water quality of the Dockum Group is good, if treatment is required it will lessen the financial feasibility of this option.

Implementation Schedule

In order to determine the potential for future development of the Dockum Aquifer pilot studies at several locations should begin in the next 5 years. If pilot studies indicate that development will be beneficial, the observed depletion rates of the Ogallala could determine an implementation schedule.

Physical, Hydrological, and Environmental Impacts

Physical impacts caused by development of the Dockum Aquifer will most likely be limited to areas of well and pipeline installations. A hydrological impact that could occur is drawdown of the Ogallala Aquifer in areas where the two aquifers are connected. This effect can be observed by monitoring the Ogallala in areas of Dockum development. Environmental impacts that might occur include mobilization of existing contamination in the aquifer, if it exists.

8.2.2.2 Treatment of Lower Quality Water

Technical Feasibility

The technology for drilling wells into deep saline water deposits has been around for many years and is commonly used. Wells could also be dug into deposits known to be contaminated with hydrocarbons and other solubles. Care must be taken that the wells are completed properly so that mixing of water between different aquifers does not occur by short-circuiting through the well annulus. A pilot project is proposed early on to determine the technical feasibility of treating produced waters.

Desalinization processes are an established and well-used technology. Many pre-packaged plants are sold pre-assembled or with minor assembly are available for small to medium flow rates.

Political Feasibility

Because of the extra costs involved, oil and gas companies may resist initiatives to use lower quality aquifers for secondary oil recovery water. However, transitioning to lower quality water sources would give the companies good public exposure.

Since Lea County would like to ensure that all the high quality waters in the County are used for appropriate purposes, an agreement may be required between the LCWUA and end users regarding the exchange of water from within the County.

Social And Cultural Impacts

The use of lower quality water for non-potable uses will have no impact on social or cultural aspects of the lives of Lea County residents. However, lower quality water may have unpleasant tastes and odors when compared to the "sweet" waters of the Ogallala.

Financial Feasibility

Wells that go deeper are more expensive, but with the oil and gas industry and its associated deep drilling ability already present in Lea County, prices for drilling deep wells will be much more reasonable than for most other locations. Actual costs will vary depending on location and depth.

Water desalinization is expensive. Current costs for desalination plants range from $300K for 25,000 gpd (28 ac-ft/yr) to $20 million for a 10 mgpd (11,200 ac-ft/yr) Los Angeles built a $15.5 million plant and raised household bills from $11/month to $29 a month. In St. Petersburg, Florida the $20 million plant producing 10 mgpd is expected to cost users about $5 per 1000 gal. (The original estimate was $1.50 per 1000 gal.).

Implementation Schedule

A state funded pilot project will determine the feasibility and possible implementation of the treatment of produced waters.

Physical, Hydrological, and Environmental Impacts

Installation of new wells could result in some short-term physical and environmental impact.

The waste brine will have to be disposed from a desalination plant. Deep well injection of brine is a common alternative, although lined evaporative and disposal pits or landfills may be more cost effective.

Hydrologically, the extent of groundwater depletions in the area of secondary recovery of oil would subside or cease to exist. Reduction in use by the Double Eagle system would reduce the rate of groundwater decline in the system's well field area. However, installation of an adjoining or competitive system would likely cause some short-term environmental impacts during system construction.

8.2.2.3 Importing Water

Technical Feasibility

It is technically feasible to pipe water to Lea County from an outside source, such as the Ute Reservoir or the Pecos River; however, appropriations are not available from either of locations. There are few appropriations available from other UWAs outside of Lea County.

Political Feasibility

Piping water to Lea County from outside sources will be politically difficult, as depleting water tables throughout New Mexico has made water a sensitive public and legal issue. Attempts to move water from one area to another have typically met with strong opposition.

Social And Cultural Impacts

No direct social or economic impacts are foreseen. However, such a project could cause indirect social impacts as the economic gain from additional water in one area may result in an economic loss where the water supply is decreased.

Financial Feasibility

The costs for such a project are very high and would require outside funding. Costs have been estimated to be $4 to $6 for every 1000 gallons. Environmental impacts studies for similar projects have approached $1 million alone.

Implementation Schedule

Piping water on a large scale will take many years of planning and funding preparation.

Physical, Hydrological, and Environmental Impacts

Physical impacts of such a project would most likely be limited to construction phase of an underground pipeline. Hydrological impact would occur to the area from which water would be withdrawn. Environmental impacts would most likely occur during the construction phase and might require mitigation.

8.2.2.4 Aquifer Recharge

Technical Feasibility

Increasing available water supply through aquifer recharge is widespread throughout the southwestern United States. El Paso, Texas and Tucson, Arizona are now injecting treated wastewater into their aquifer supply. If recharge is performed with wastewater, care needs to be taken to assure the water has been treated well, including removal of any pathogenic organisms or viruses. Chemical compatibility between water in the aquifer and reclaimed effluent is also a concern. Wastewater treating technology is common, well understood, and widely used. For either wastewater or stormwater, the major problem that occurs is clogging the subsurface soil surrounding injection wells with fines that settle/filter out of the injection water. A carefully engineered system must be used to avoid this problem. Proper operation and maintenance of the system is required to keep the system working. Since the average rainfall is 12 to 16 inches throughout the county and there are large expanses of vacant land at locations where the aquifer is within 200 feet of the land surface, storm water recharge seems particularly feasible. Storm recharge areas can be large or small scale and should be sited in areas of natural runoff or accumulation and, ideally, near high water use areas, such as irrigated farmland and municipal well fields.

Political Feasibility

Public fear of contagious disease may hinder recharge with wastewater. If this occurs as an obstacle, public education can be used to ease concerns. Coordination with landowners is the only political obstacle foreseen for recharge from storm water.

Social And Cultural Impacts

No significant social or cultural impacts are anticipated.

Financial Feasibility

The construction cost of an unlined system that could capture and recharge 40 ac-ft/yr is about $250,000. This system would use 4 injection wells and a 200-gpm-injection pump with filter system. The use of a 40-acre gravity system will have decreased recharge ability, due to evaporation losses, and will cost about $180,000 to construct.

Implementation Schedule

A 5 to 10 acre pilot study project could be implemented. If this were to occur in the next two years, then 24 months of data could be obtained and made available for full-scale design by the year 2005. Land/right-of-way acquisition, design, and construction can be performed within 18 to 24 months.

Physical, Hydrological, and Environmental Impacts

Loss of habitat and environmental concerns should be studied prior to siting recharge areas. Recharge should be studied to assure that the existing water quality of the aquifer and recharge area is not adversely impacted.

8.2.2.5 Cloud Seeding

Technical Feasibility

Cloud seeding weather modifications have been performed in parts of the U.S. for over 30 years. Many western states currently have active programs. Roosevelt, Curry, and Quay Counties, New Mexico have been part of the Texas High Plains Underground Water Conservation District No. 1 precipitation enhancement program since 1997. Although it is difficult to fully identify and measure the effects of cloud seeding programs, most report positive results.

Political Feasibility

Political opposition may be generated if it is felt that precipitation is being taken from one area and given to another. If cloud seeding is performed according to specific regulations, as is the case in Texas and many other states, the political feasibility is greatly increased. Texas considers the recent expansion of the cloud seeding into the three previously referenced New Mexico counties as a benefit to farms located in Texas near the border with New Mexico.

TABLE 8-5: EVALUATION OF WATER DEVELOPMENT ALTERNATIVES

Alternative	Technical Feasibility	Political Feasibility	Adverse Social and Cultural Impacts	Financial Feasibility	Suggested Implementation Schedule (year)	Adverse Physical, Hydrological and Environment Impacts
Develop-ment of Deep Aquifers	Good - deep drilling is commonplace in Lea County	Good - would be a benefit to those served	Low - none expected	Good - costs for deep well drilling in Lea County are competitive	Pilot Study (2001) - a pilot study should prove effectiveness for future program	Low - impacts not expected
Treatment of Lower Quality Waters	Good - used extensively throughout the world	Good - no adverse responses to this topic during public meetings	Medium - taste and odor of public supply would change and some might find objectionable	Poor - small scale desalination plants are affordable, large scale systems may be cost prohibitive	Pilot study (2001) – results of pilot study to determine costs in order to determine feasibility of future programs.	Medium – brine from process must be disposed. Specific hydrologic effects of pumping saline aquifers are not known.
Importing Water	Good - pipeline transport is common	Poor - impacts the area from which water is taken	High - transporting water from an area can impact its socioeconomic outlook	Poor - costs exceed the capability of Lea County, outside funding required	Long-term, a lot of planning, funding, and construction required.	High - impacts would occur as result of pipeline construction.
Aquifer Recharge	Good - properly engineered systems are used throughout the U.S.	Good - would be a benefit to all areas served	Low - use of precipitation is much less objectionable than treated wastewater	Good - small to medium scale projects are affordable	Pilot study (2003) - a pilot study should prove effectiveness for future program	Medium - landforms would be altered for collection areas.
Cloud Seeding	Good - most western states have had active plans for a number of years	Good - Texas has been seeding for 30 years, all farming areas in LCUWA should be included	Medium - some view cloud seeding as un-natural or water robbing.	Fair to Good – participation in Texas High Plain program is affordable. Implementation of new program is cost prohibitive.	2002 - The Texas High Plain program should first be contacted regarding the potential for Lea County to become a participant	Medium - increased precipitation can cause damaging runoff in unprotected areas.

Social And Cultural Impacts

Opponents to cloud seeding may arise due to philosophical issues of altering natural weather patterns.

Financial Feasibility

Curry, Roosevelt, and Quay counties pay a percentage of the cost of the Texas program based on the number of acres each has in the whole target area. If Lea County were to target 400,000 acres for clouding seeding and was able to enter the Texas-based program, the Lea County target area would comprise approximately 4 percent of the total Texas program target area. At an estimated $1 million cost per season for the entire cloud seeding program, the cost to Lea County would be $40,000 per year or $0.10 per acre. If Lea County were required to start its own program the costs would likely be too high to implement. Funding for the program in the other referenced New Mexico counties is through the Soil Conservation Service. Funding may also be available for Lea County.

Implementation Schedule

The Texas High Plains Underground Water Conservation District No. 1 precipitation enhancement program should be contacted during 2001 to determine if Lea County could become a member of the program. It is possible that Lea County could be part of a precipitation program as early as year 2002.

Physical, Hydrological, and Environmental Impacts

Potential impacts include flooding and silver iodide residues; however, a properly regulated and managed program will minimize the potential for either of these impacts to occur.

8.2.3 Management Alternatives

Probably the most important role to be played by water resource management in Lea County will be the securing of funding for the required programs and initiatives. Support will be available from state and federal agencies, but the County - and the municipalities, businesses, and people of Lea County must pay for a large portion. Each layer of management is discussed separately. Evaluations of the management alternatives are summarized in TABLE 8-8.

8.2.3.1 Interstate Alternatives

Technical Feasibility

There is no technical reason why interstate management of the Ogallala cannot take place. It would be beneficial to both Lea County and adjoining Texas counties if ground-water information were shared. Cooperation between all entities would produce the best results.

Political Feasibility

Arranging for an interstate compact is complicated and time consuming. Many people need to be involved, including politicians, engineers/hydrogeologists, bureaucrats, and lawyers. Many issues have the potential to create roadblocks. Still more benefits than impacts are available – even for Texas.

Social And Cultural Impacts

No social or cultural impacts are known.

Financial Feasibility

Since Texas pumps more water than New Mexico, the largest financial impact will be in Texas. However, technical and legal consultants will need to be employed and County staff will need to commit considerable resources.

Implementation Schedule

Planning for interstate discussion can begin immediately.

Physical, Hydrological, and Environmental Impacts

No negative impacts are foreseen.

8.2.3.2 State Involvement

Technical Feasibility

The State has been pro-active in creating models of known aquifers in Lea County.

Political Feasibility

This 40-Year Water Plan in being prepared in response to State recommendations. State agencies are very eager for municipalities to become more active in conserving water.

Social and Cultural Impacts

No social or cultural impacts are foreseen.

Financial Feasibility

The Interstate Stream Commission and the State Engineer have appropriated funds for Plans such as this one and other programs to encourage water conservation.

Implementation Schedule

Approval of this Plan is anticipated to occur later this year.

Physical, Hydrological, and Environmental Impacts

No impacts are foreseen.

8.2.3.3 County Management

The LCWUA, or Lea County itself, is ideal to implement and oversee a water use management program for the County. Personnel, either consultants or county staff, will be required to address future water issues and implement the program, including (but not limited to) conservation practices, aquifer monitoring, testing for water quality, soil moisture and drought monitoring, and implementing drought contingency plans.

Technical Feasibility

There will be technical obstacles to overcome in piecing together a County-wide management program, such as making sure collected data is in a format that can be used by hydraulic and geographic computer software. However, all of the technology required is used and proven.

Political Feasibility

The biggest political problem will likely occur if propositions for increasing taxes to raise needed money are made. For other issues, the LCWUA consists of representatives from most all water resource stakeholders in Lea County, so communication pathways are established if political conflicts should arise within the County. Further, incentive is given to all segments of the County's business and civic enterprises to cooperate towards water resource goals, because they all will benefit from dependable long-term water supplies. Together the County and the LCWUA have the tools required to pull together the area's varied political and business interests to achieve effective water management.

Social And Cultural Impacts

Water management and conservation can foster a wide variety of reactionary attitudes within the populace affected. This can be especially true in rural areas. It will be more difficult to get education and public information programs to the rural parts of Lea County than it will be to get those same programs to residents of municipalities or members of water cooperatives. Keeping the rural population informed and educated will likely fall to the County/LCWUA.

Financial Feasibility

Costs to staff a fulltime water resources department are substantial and recurring. Some of the items include salary ($35-45K), transportation, office space, office equipment, laboratory space and equipment or independent laboratory fees, and tools. These costs can be shared by all in Lea County through the use of water bill surcharges, property taxes, or sales taxes, to name a few.

Implementation Schedule

A ground-water data collection program can be implemented within the first year of plan approval, but it may take 3 to five years to develop a sufficient well network. Ground-water flow modeling should be implemented within 2 years after a preliminary well network is arranged.

Physical, Hydrological, and Environmental Impacts

Hydrologically, a better understanding of the Lea County aquifers will result from this alternative. Information obtained will greatly increase the ability of hydrogeologists/engineers to assess the sustainability of water supplies in Lea County.

Management and conservation measures afforded by a County staff person(s) are expected to decrease the rate at which aquifers in Lea County are depleting. Environmental impacts are unclear, but a technical staff person will be able to perform/coordinate their identification and mitigation if necessary.

8.2.3.4 *Municipal*

Technical Feasibility

Reduction of municipal water use is very feasible, as illustrated by many cities in the U.S. over the last 10-15 years.[18] Water efficient fixtures and appliances are now commonly available and even required in many cases by federal law. Several cities across the southwest have also offered incentives for homeowners to remove high-water use landscaping and replace it with xeri-scaping. The challenge in Lea County is to get older established homeowners to make the effort to change out existing fixtures and established landscaping. The municipal water audits that will

P[18]P Maybe the best example is Tucson, Arizona.

occur in 2001 will help the LCWUA see where the water is being consumed and will be an invaluable tool in encouraging conservation.

Political Feasibility

Each community will face resistance to increasing prices of water. Large users who will be especially hard hit by an escalating Inclining-Block pricing scheme may be especially vocal. However, if all the municipal systems in Lea County set rates in a like manner price increases will appear fair.

Social And Cultural Impacts

No social or cultural impacts are expected.

Financial Feasibility

Methods of reducing municipal water use tend to be low cost alternatives. The more expensive programs may offer financial incentives to users, such as water bill reductions, so the city does not need to come up with cash in advance. The impact of water bill reductions needs to be figured into water rates when establishing a new Inclining-Block rate system. State and federal grants are available for education programs and a large amount of educational information is available free on the Internet.

Implementation Schedule

City specific analysis will need to be made before introducing many of the suggested alternatives. However, municipal waster use reduction programs should begin as soon as possible after they are planned. Once initiated, reductions can normally be measured within the first year of an implementing the programs.

Physical, Hydrological, and Environmental Impacts

Negative impacts are not foreseen.

TABLE 8-6: EVALUATION OF WATER MANAGEMENT ALTERNATIVES

Entity	Technical Feasibility	Political Feasibility	Adverse Social and Cultural Impacts	Financial Feasibility	Suggested Implementation Schedule (year)	Adverse Physical, Hydrological, and Environmental Impacts
Interstate	Good - Texas and New Mexico are both working towards the same goals, using the same technology	Fair - legal issues concerning water have occurred between New Mexico and Texas in the past. Local prejudices must be overcome.	Low - impacts to social and cultural groups are not expected.	Good - interaction between entities in Texas & New Mexico has occurred. Costs for future coordination should be low.	2002 - Meetings and planning should be conducted in 2001.	Low - none are expected
State	Good - The NMOSE has already prepared historic and future models of the LC-UWA	Good - The Regional Water Plan is being prepared in response to the ISC/NMOSE.	Low - impacts are not expected	Good - The ISC and NMOSE have a mandate and funding to be involved in such programs.	2001 - Approval of the Water Plan and closure of the LC-UWA are essential steps.	Low - none are expected
County	Good – Continued utilization of consultants or addition of an in-house technical professional will solidify the County's and the LCWUA's capabilities.	Good – Most local political interests are represented on the LCWUA.	Low - impacts are not expected	Fair – while Lea County/LCWUA are capable of supporting and soliciting funding, tax increases are never popular.	2001 - The acceptance and implementation of the Water Plan will be the County's first step to managing the County's water.	Low - none are expected
Municipal	Good - experienced staff and consultants serve Lea County municipalities.	Good - Lea County municipalities are small scale well operated entities.	Low – resistance will occur, but education will increase need awareness & gain support	Fair - Management programs will impact local budgets. Funding may best be provided at the county level.	2001 - Management at local levels can begin even before approval of the Water Plan.	Low - none are expected

8.3 SAMPLE IMPLEMENTATION SCHEDULE

Major tasks and timetable for the recommended plan is as follows. This schedule is provided as an example only. The LCWUB will determine actual implementation schedule. All capital projects implementation will depend on available funding.

Year	Task
2000	1) Final approval and acceptance of the 40-Year Water Plan.
2001	1) Prioritize alternatives and schedule implementation. 2) Assess and pursue funding for prioritized alternatives. 3) Perform municipal water usage audits. 4) Begin public awareness educational program. 5) Begin assessment of deep aquifer development. 6) Assess oil recovery water use in Lea County 7) Address ownership of manufactured water 8) Assess groundwater data collection and flow modeling program
2002	1) Assess municipal water conservation measures 2) Assess County Drought Management Plan 3) Start Water Plan implementation funding measures 4) Pursue entrance into existing cloud seeding program 5) Assess audit results and make recommendations. 6) Add possible technical staff.
2003	1) Implement municipal water conservation measures 2) Implement County Drought Management Plan 3) Plan best-method irrigation practices program 4) Start cloud seeding program if viable option in 2001 5) Plan alternatives for oil recovery water use in Lea County
2004	1) Pursue best-method irrigation program pilot studies 2) Plan precipitation collection and aquifer recharge pilot study 3) Pursue alternatives for oil recovery water use in Lea County
2005	1) Plan small-scale desalination plant. 2) Conduct additional best-method irrigation program pilot studies 3) Construct precipitation collection and aquifer recharge pilot study 4) Continue implementation of alternatives for oil recovery water use in Lea County
2006	1) Construct small-scale desalination plant with new well(s). 2) Begin precipitation collection and aquifer recharge pilot study

8.4 DROUGHT MANAGEMENT PLAN

Acute periods of drought have occurred in Lea County during 1917, 1924, 1938, 1945, 1954, 1967, and 2000, once every decade. But, longer less intense variances occur also. Precipitation records for Hobbs and Tatum indicate that rainfall has been below average for Hobbs during the past 10 years and for Tatum during the past 25 years (FIGURE 43). The most recent acute drought in Lea County occurred in 1998; correspondingly a sharp rise in water use occurred during that same year (FIGURE 34). Because Lea County relies on ground water for its water supply, acute droughts have less immediate impact on supplies than they do in surface water dependent areas. However, long-term affects of drought, acute or chronic, are just as real for Lea County as anywhere, and their mitigation should be carefully planned.

The American Water Works Association (AWWA) and the State of New Mexico have developed drought management planning guidelines. Primary tasks involved in developing a drought plan are: defining mitigation goals and objectives, researching historical drought conditions to define drought indicators and the amount of mitigation required, identifying and evaluating mitigation alternatives, seeking public input, and establishing actions required by various drought levels. Implementing a drought plan includes formally adopting the plan, providing for public information and education, and enforcing the plan's restrictions.

Mitigation alternatives should include –at a minimum-- public education and information, a phased or staged approach to water use restrictions, contingency plans for large water users, alternative pricing structures, rationing schemes, and steps to implement and enforce compliance with the Drought Plan. Application of the alternatives may vary depending on the type of water use.[19] Feasible alternatives should be evaluated against: economics, legality, public acceptance, and liability. Typical drought management phases/stages with their corresponding actions are shown in TABLE 8-7.

Drought indicators used in drought plans include the Palmer Index (PI) and ground water levels in supply wells.[20] The PI, a widely used and accepted scale for measuring drought conditions, is based on soil moisture and long term climatic data. PI values typically range from -6 to 6. Normal weather conditions have a PI value of zero. Values greater than zero indicate moist spells and values less than zeros indicate dry spells. Major drawbacks of the PI are its inability to detect fast-emerging droughts and neglecting the effect of snowpack.

Using historical ground-water levels in supply wells, monthly predictions of water-table elevation can be made. Considering both monthly ground-water levels and the storage capacity of the aquifer, percentiles of normal elevation can be assigned with which to indicate drought action levels. For example, a drought warning may be issued when stored water drops below the 75th percentile[21] of normal, and a drought emergency may be declared when a monthly level drops below the 50th percentile.

The State of New Mexico has created a Drought Plan and a Drought Task Force (DTF). The Drought Plan is State resource document intended to compliment local and regional water planning efforts.[22] The DTF includes two assigned groups of water planning professionals. The Monitoring Work Group (MWG) monitors climatic and other data provided by federal and state agencies. The Impact Assessment Work Group (IAWG) assesses and mitigates vulnerabilities to drought.

TABLE 8-7: DROUGHT PLAN PHASING

Phase/ Stage	Action Level	Action
1	Watch	Voluntary water conservation measures
2	Warning	Voluntary water conservation measures
3	Emergency	Mandatory water use restrictions
4	Critical	Water rationing

The MWG assesses collected data and determines the status of drought in each of the eight climatic zones occurring within New Mexico. Drought status phases include Normal, Advisory, Alert, Warning, and Emergency. Lea County is located in climatic zone No. 7. Smaller subzones are to be delineated within each climatic zone sometime in the near future. A Drought Status/Monitoring report is published weekly.

During periods of drought, the IAWG assesses and acts to alleviate drought impacts. The IAWG is comprised of four subgroups that focus on specific impact sectors. The four sectors include 1) Agriculture, 2) Drinking Water, Health, and Energy, 3) Wildlife and Wildfire Protection, and 4) Tourism and Economic Impact. The IAWG is responsible for initiation of all drought responses and drought mitigation actions, including public service announcements and emergency funding. A copy of the New Mexico Drought Plan is provided in Appendix S and can be accessed via the internet at *http://weather.nmsu.edu/drought.*

P[19]P Types of water use include: residential, commercial, and industrial. Water conservation measures may be different for each classification during plan implementation, depending on specific needs and requirements.

P[20]P Other indicators of drought are also used for planning and management purposes. The National Drought Mitigation Center (NDMC) constantly monitors drought conditions in the United States. Drought monitor indices used by the NDMC include the Palmer Drought Severity Index (PDSI), the Surface Water Supply Index (SWSI), the Standardized Precipitation Index (SPI), the Crop Moisture Index, (CMI), and the National Rainfall Index (RI). Drought monitor index maps are updated daily and are viewable on the NDMC website at *enso.unl.edu/monitor/monitor.html*. The current and future drought monitor forecasts provided by NDMC are valuable tools in drought management and planning.

P[21]P Seventy-fifth percentile means that the amount of water calculated to be in storage is less than or equal to 75% of what would normally be expected.

P[22]P New Mexico Drought Plan

In conjunction with the Drought Plan, and of particular interest in Lea County, the New Mexico Department of Agriculture provides a weekly and monthly statewide analysis of crop status and soil moisture information. This data may be found in a published newsletter or at the web site http://www.nass.usda.gov.nmT.

The Lea County Drought Management Plan is to be monitored and implemented within the areas and municipalities of Lea County to address drought conditions. The Drought Management Plan is intended to be coordinated with the State of New Mexico Drought Plan and the National Drought Mitigation Center.

TABLE 8-8: DROUGHT MANAGEMENT PLAN OUTLINE

Phase	Action Level	Determinants (State of New Mexico)	Actions
1	Advisory	1) State designation 2) Palmer Drought Severity Index 3) Crop Moisture Index (CMI) 4) Groundwater levels 5) Standard Precipitation Index	1) Public notifications 2) Voluntary conservation measures
2	Alert	same as above	1) Public notifications 2) Enact Alert level mandatory water use ordinances
3	Warning	same as above	1) Public notifications 2) Enact Warning level mandatory water use ordinances 3) Enact State response actions
4	Emergency	same as above	1) Public notifications 2) Enact Emergency level water use ordinances 3) Enact State response actions

TABLE 8-9: RECOMMENDED ACTION LEVEL DETERMINING FACTORS

Phase-Action Level	New Mexico Drought Monitoring Work Group Designation	Palmer Drought Severity Index (PDSI)	Crop Moisture Index (CMI)	Ground Water Levels (% below normal)	Standard Precipitation Index (SPI)
1-Advisory	as reported	-1.00 to -1.99 for 4 weeks minimum and 8 weeks maximum	0.00 to -0.99 for 4 weeks	3	0 to -0.99, or less than 0.25 for 8 weeks, or continuously declining for 6 months
2-Alert	as reported	-2.00 to -2.99 for 4 weeks or Advisory PSDI for more than 8 weeks	-1.00 to -1.99 for 3 weeks	5	-1.0 to -1.49 for 8 weeks or Advisory status for 6 months
3-Warning	as reported	-3.00 to -3.99 for 4 weeks, or Alert PDSI for 8 weeks, or Advisory PDSI for 9 months	-2.00 to -2.99 for 2 weeks	10	-1.5 to -1.99, or a 6 month declining Alert SPI
4-Emergency	as reported	-4.00 or less for 4 weeks, or Warning PDSI for 8 weeks, or Alert PDSI for 9 months	-3.00 or less for one week	15	-2.00 or less, or a 6 month declining Warning SPI

Note: CMI is a short-term indicator for developing crops during the growing season and should not be used for long term monitoring

TABLE 8-10: RECOMMENDED ACTIONS

Phase/Action Level	Actions
1-Advisory	1) Notify public and State of Phase 1 Advisory drought condition 2) Issue public request for voluntary reductions in water use 3) Implement county ordinance for landscape watering interval of twice per week only between the hours of 7:00 pm to 10:00 am 4) Increase public announcements for water conservation
2-Alert	1) Notify public and State of Phase 2 Alert drought condition 2) Implement county ordinance for mandatory reductions of water use: Landscape watering interval of once per week only between the hours of 7:00 pm to 10:00 am No ornamental water use that doesn't incorporate recycling Wash cars only from bucket or at commercial car wash Fire hydrants used for fire fighting only No watering of golf course fairways with potable water No water use for dust control No surface (sidewalks, parking lot, building, etc.) washdowns No use of herbicides No filling of swimming pools Water only served by request at restaurants 4) Continue public announcements for water conservation 5) Expand municipal leak detection, surveillance, and repair programs
3-Warning	1) Notify public and State of Phase 3 Warning drought condition 2) Implement other county ordinances in addition to Alert level mandatory reductions of water use: Landscape watering interval of once every two weeks only between the hours of 7:00 pm to 10:00 am No water use for fountains, ponds, lakes, etc. All water user allocations reduced by 20%. Billing surcharge imposed for exceeding allocations. No watering of golf courses with potable water. Reduce elevations in water tanks and throttle at pumping stations to reduce line pressure by 5 psi 3) Continue public announcements for water conservation 4) Coordinate with State of New Mexico Drought Task Force to Implement State of New Mexico Planned Mitigation Actions
4-Emergency	1) Notify public and State of Phase 4 Emergency drought condition 2) Implement other county ordinances in addition to Alert and Warning level mandatory reductions of water use: No landscape watering allowed All water user allocations reduced by 30%. Billing surcharge imposed for exceeding allocations. No new connections to water systems allowed 3) Continue public announcements for water conservation 4) Coordinate with State of New Mexico Drought Task Force to Implement State of New Mexico Planned Mitigation Actions