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WATER RESOURCES RESEARCH INSTITUTE

CITIZENS' CONFERENCES ON WATER

1971

A CONSIDERATION OF THE PRESSING WATER PROBLEMS OF NEW MEXICO... WITH CITIZENS' RECOMMENDATIONS

Report Prepared by

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Robert R. Lansford

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Conferences sponsored and directed by the Water Resources Research Institute in cooperation with New Mexico Agricultural Extension Service and the New Mexico Agricultural Experiment Station

NEW MEXICO STATE UNIVERSITY

LAS CRUCES, NEW MEXICO

ACKNOWLEDGMENTS

Appreciation is expressed to the citizens who participated in the area Citizens' Conferences on Water and especially to the 16 representatives elected from the eight conference areas who contributed so much to the state meeting. Appreciation is also expressed to Director E. E. Triviz and Dr. James Kirby of the New Mexico Cooperative Extension Service who assisted with setting up the area meetings; to each of the county extension agents who supplied the names of leaders interested in water who were invited to the conferences; to those county agents who assisted in the area and state conferences; and to Dr. William P. Stephens, Assistant Director, Agricultural Experiment Station, and Professor John W. Clark, Director-Designate of the Water Resources Research Institute, who assisted in the conduct of several of the area conferences. The conferences could not have succeeded as they did without the special attention given by Jessie Holguin and Helen Hudson in typing, mailing, and checking the letters, schedules, and questionnaires to the many conference participants.

TABLE OF CONTENTS

LIST OF FIGURES

Delegates elected from each of the eight Citizens' Conferences on Water together with the Extension Agents who attended the State Conference.

Left to right: Morris Robertson, Southcentral Area; Bobby Creel, Agricultural Economics Department, NMSU; Herman Baca, County Extension Service; Mrs. Dee Bibb, Northeastern Area; H. Ralph Stucky, Director, Water Resources Research Institute; John M. Oglesby, Extension Service (Indian); John Hinrichs, County Extension Service; John T. McMillen, Southwestern Area; John R. Hakanson, Southwestern Area.

Delegates elected from each of the eight Citizens' Conferences on Water together with the Extension Agents who attended the State Conference.

Left to right: Arthur Jernigan, Northeastern Area; John W. Clark, Director-Elect, Water Resources Research Institute; Duce D. Bivins, Southeast Central Area; Chas. C. McGee, Northwestern Area; F. F. Montoya, Northwestern Area; Robert R. Lansford, Agriculture Economics Department, NMSU; Richard G. Marek, County Extension Service, Cooper Malone, Southeast Central Area.

Delegates elected from each of the eight Citizens' Conferences on Water together with the Extension Agents who attended the State Conference.

Left to right: Mrs. Fred Ribe, Northcentral Area; Herbert Quintana, Northcentral Area; George W. Murray, Southcentral Area; Marion Foster, Southeastern Area; Darrel McCauley, Southwestern Area; Ernest L. Alary, Central Area; Solomon Martinez, Central Area; Anthony Romo, County Extension Service.

CITIZENS' CONFERENCES ON WATER -- 1971

A Consideration
of the
Pressing Water Problems
of New Mexico --
With Citizens' Recommendations

Report prepared by

H. R. Stucky, Robert R. Lansford, Bobby J. Creel[1]

INTRODUCTION

A series of two Citizens' Water Conferences was held in eight areas of New Mexico (figure 1) in April and May, 1971, under the sponsorship of the New Mexico Water Resources Research Institute. The New Mexico Cooperative Extension Service assisted in contacting leaders in each county who have an interest in water problems, and in establishing the location for each of the area meetings. Two delegates were elected from each area conference to attend a two-day meeting at New Mexico State University. These delegates met for a one-half day work session and then met one and one-half days with the Water Resources Research Institute's statewide Advisory Committee and the directors of the several units conducting water research at the university. Resources for the conduct of these conferences were made available through a University of New Mexico grant, under the Educational Act Section I, to the Water Resources Research Institute.

Heretofore, no one publication has contained information on the water situations and problems in each area in New Mexico. This report includes a statement for each of the eight areas and one for the state. Information provided to conference participants on the general water situation and problems such as population projection, water law, water depletions by various uses, import proposals, and land ownership is also included.

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1 Director, New Mexico Water Resources Research Institute, October 1963-July 1971; Associate Professor of Agricultural Economics, New Mexico State University; Agricultural Economics Research Associate, New Mexico State University, respectively.

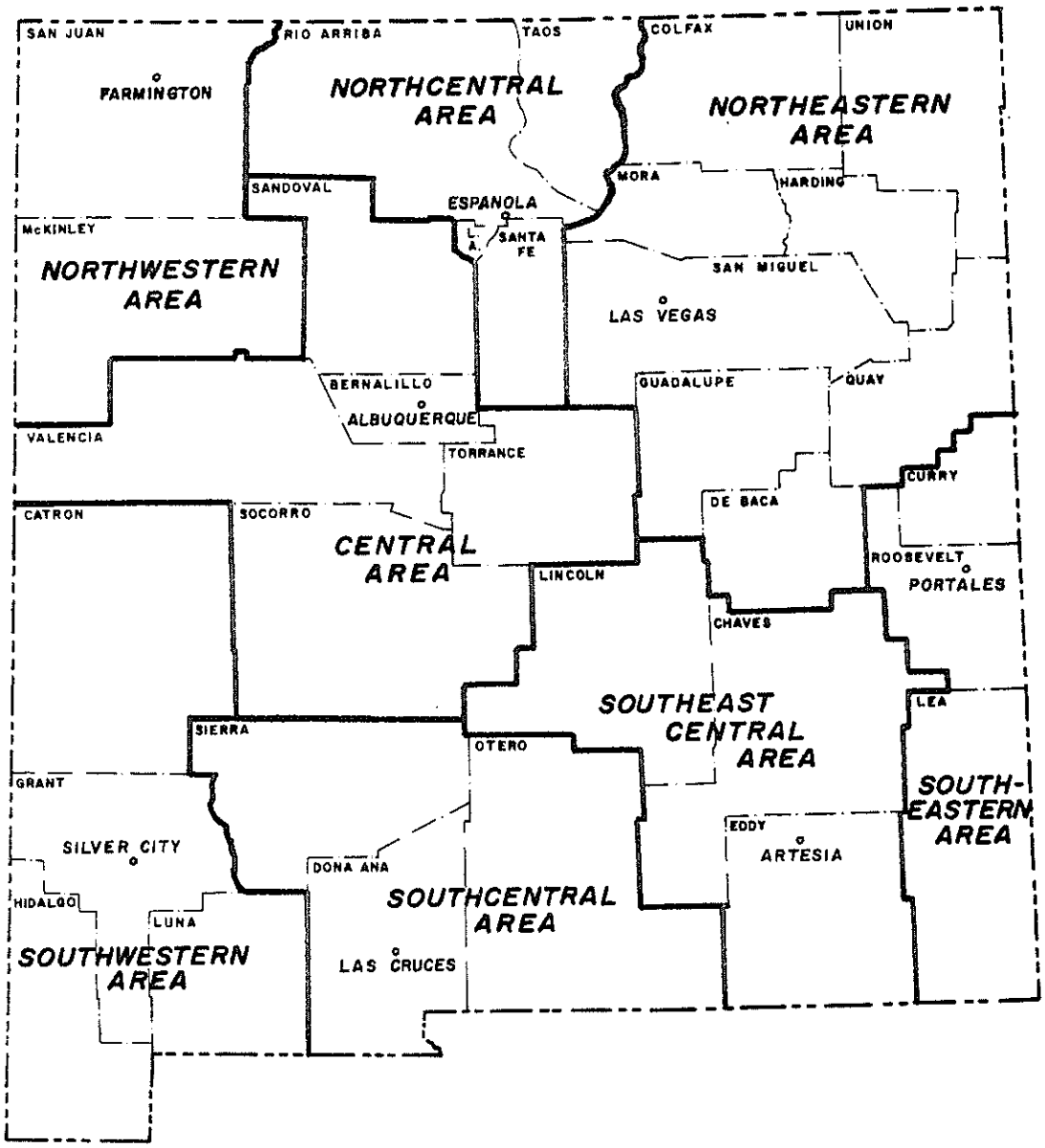

Figure 1. Location of the eight areas for the Citizens' Conferences on Water.

It is hoped that the information in this report may be used by the numerous local and state organizations, boards, and commissions having interest and responsibility for the solution of New Mexico water problems. No further Citizens' Conferences on Water are scheduled in the near future.

Purpose of the Conferences

These conferences were sponsored by the Water Resources Research Institute in cooperation with the New Mexico Cooperative Extension Service and Agricultural Experiment Station to accomplish the following purposes:

To provide an opportunity for a wide cross-section of citizens interested in water to discuss some of the most pressing water situations and problems of their communities and of the State of New Mexico.

To have those attending the Citizens' Water Conferences make suggestions and recommendations on which problems they believe to be the most important in their areas and in the state, and what they believe might be done to solve these problems.

To publish a report on these conferences which may serve as a reference for the citizens generally; county, state, and federal agency personnel; state senators and state representatives who receive many proposals from groups and individuals for water legislation, and which may serve as a guide to the future research programs of the New Mexico Water Resources Research Institute and other research organizations.

Procedures

Background Data

An extensive set of background information was developed for each of eight areas of New Mexico and for the state as a whole. This included water depletions by major use, location of declared water basins, extent of ground-water draw-down, acreages of irrigated crops, and population data and trends. This information was available for reference during the area conferences.

Participation

A request was mailed to each county extension agent in New Mexico asking for a list of up to 25 persons in the county who had an interest in water and who, as a group, would represent a cross-section of various water users. A list was received from every county. Letters and questionnaires were mailed to the approximately 700 names included on these lists. Usable questionnaires were received from 211 persons,

and 206 different individuals attended the 16 area and the state conferences. Numerous letters and some telephone calls were received from persons who were unable to attend.

Area Conferences

Two Citizens' Conferences on Water were held in each area. The first was to discuss the general water situation in the area and to develop a list of the water problems which those attending felt were the most important in their area. The second was held about two weeks later. During the period between the meetings, many persons talked with their neighbors and gathered information which was brought back to the second meeting. At the second meeting the area water problems were ranked in order of importance by the group and further discussion followed this ranking. At each conference those attending were assembled in small discussion groups to permit everyone to participate. Extensive notes were taken in these discussion sessions and in the general discussion. At the end of the second meeting two delegates were elected by the group to attend a State Citizens' Conference on Water and present the problems for their areas.

State Meeting

The 16 area delegates met for one-half day together and discussed the recommendations from each of the eight areas. They then met for one and one-half days with the Advisory Committee of the Water Resources Research Institute. Also attending the state meeting were the leaders of the several research units in the state and five county extension agents.

Questionnaires

A six-page questionnaire was mailed to about 700 persons, representing a cross-section of the water user and interest groups in the state. A total of 211 were returned and tabulated. The results of the more important questions are given in Appendix A.

GENERAL INFORMATION ON WATER IN NEW MEXICO

GENERAL AVAILABILITY OF WATER

The United States as a whole gets adequate rainfall, but the habits of nature and men combine to make its distribution uneven. The eastern United States receives about 75 percent of the total water supply but consumes only about 2 percent of that available. The western United States, which receives the remaining 25 percent of the total supply, consumes 65 percent of that supply.

Three primary geographic divisions in New Mexico, according to the general availability of water, are the Upper Rio Grande and Pecos Basin, the Colorado Basin, and the Upper Arkansas and Red Basin (figure 2). According to a report of the U. S. Senate Select Committee in 1961, the Upper Rio Grande and Pecos Basin is the shortest of water in relation to projected demand to 1980 of any basin in the continental United States. On the map (figure 2) the major basins within the state are shown as numbered by the U. S. Senate Select Committee in order of water scarcity for all basins in the United States. The Upper Rio Grande and Pecos Basin, which includes over one-half of New Mexico, is designated as No. 1, indicating it has the least water in relation to demand. The Colorado Basin, which accounts for over one-fourth of the state, is No. 2 in shortage of water.

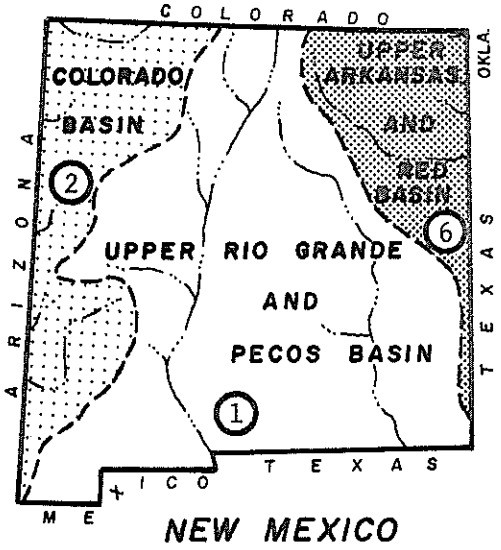

Figure 2. New Mexico geographic divisions by general availability of water.

Source: Senate Select Committee on Water Report, 1961.

It is this shortage of water in relation to the demand which has caused, and will cause, many of New Mexico's water problems.

NEW MEXICO WATER LAW

The scarcity of water in New Mexico was recognized by the Indians who occupied this area long before any migrations from Spain and other parts of Europe. There are remnants of old ditch systems which date back to the year 900 A.D. and before, and Indians have maintained irrigation ditches to the present time. The land grants from the kings of Spain recognized water rights.

Some Basic Points About New Mexico Water Law

The following basic points about New Mexico Water Law up through January 10, 1966, were assembled by H. R. Stucky in connection with a panel discussion before the New Mexico Cattle Growers Association annual convention in 1966. S. E. Reynolds, State Engineer, and John F. Russell, attorney at Roswell, participated on the panel. These points on Water Law are included here as a reference, so the New Mexico water problems and plans may be more fully interpreted.

Surface Water Basic Points

A. Water Law - 1907 - The Territorial Legislature in 1907 enacted a comprehensive surface-water Control Act, Section 1 of which provides that:

> All natural waters flowing in streams and water courses, whether such is perennial or torrential within the limits of the Territory of New Mexico, belong to the public and are subject to appropriation for beneficial use.

Note: The Constitution of New Mexico in 1911, Article XVI, Section 2, reaffirmed and expanded the provision of the Act of 1907.

B. State Constitution - The Proclamation of the President admitting New Mexico to statehood signed January 6, 1912, (37 Stat. L 1723), sections (Article XVI).[2]

1. All existing rights to the use of any waters in this state for any useful or beneficial purpose are hereby recognized and confirmed.

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2 Hutchins, Wells A., The New Mexico Law of Water Rights, Technical Report No. 4, Agricultural Research Service, USDA, Santa Fe, 1955.

2. The unappropriated water of every natural stream, perennial or torrential, within the State of New Mexico, is hereby declared to belong to the public and to be subject to appropriation for beneficial use, in accordance with the laws of the State. Priority of appropriation shall give the better right.

3. Beneficial use shall be the basis, the measure and the limit of the right to the use of water.

C. The New Mexico Supreme Court has held that the provision in Section 3 relating to beneficial use "merely declares the basis of the right to the use of water, and in no manner prohibits the regulation of the enjoyment of that right," (Harkey v. Smith, 31 N. Mex. 521, 526-527, 247 Pac. 550 (1926)).

D. The Supreme Court has held also that the provision in Section 2 relating to public ownership and appropriability of the unappropriated water of natural streams, is only declaratory of prior existing law and always had been the rule and practice under Spanish and Mexican domination of the territory embraced within the present State, (State ex rel. State Game Commission v. Red River Valley Co., 51 N. Mex. 207, 217, 182 Pac. (2d) 421 (1945-1947)).

E. Completion of Appropriation - To Constitute a valid prior appropriation of water, there must be (1) a rightful diversion and (2) an application of the water to some beneficial use, (Albuquerque Land & Irr. Co. v. Gutierrez, 10 N. Mex. 177, 240, 61 Pac. 357 (1900)). See also Murphy v. Kerr, 296 Fed. 536, 542 (D. N. Mex., 1923); Hinderlider v. La Plata River & Cherry Creek Ditch Co., 304 U. S. 92, 98 (1938)).

F. The Appropriative Right - Property Characteristics - The right obtainable with reference to the water of a public stream in New Mexico is the right to appropriate so much thereof as is actually used for some beneficial and legal purpose. (Albuquerque Land & Irr. Co. v. Gutierrez, 10 N. Mex. 177, 236-237, 61 Pac. 357 (1900). Murphy v. Kerr, 296 Fed. 536, 541 (D. N. Mex., 1923)).

The courts recognize -- and the State constitution so provides -- that benericial use is the basis, the measure, and the limit of the right to use of water. (Holloway v. Evans, 55 N. Mex. 601, 607, 238 Pac. (2d) 457 (1951); N. Mex. Const., art. XVI, sec. 3. See Middle Rio Grande Water Users Assn. v. Middle Rio Grande Conservancy Dist., 57 N. Mex. 287, 299, 258 Pac. (2d) 391 (1953)).

The Appropriative Right as Property - The appropriative right, which is a usufructuary* right, is property, (Murphy v. Kerr,

296 Fed. 536, 541 (D. N. Mex., 1923); New Mexico Products Co. v. New Mexico Power Co., 42 N. Mex. 311, 321, 77 Pac. (2d) 634 (1937, 1938); Lindsey v. McClure, 136 Fed. (2d) 65, 70 (C.C.A. 10th, 1943)).

*Note: Defined in the dictionary as "the legal right of using and enjoying the fruits or profits of something belonging to another."

It is a property right of high order, (Posey v. Dove, 57 N. Mex. 200, 210, 257 Pac. (2d) 541 (1953)).

G. Adjudication of Surface Water Rights - "Hope Decree" - This suit, entered as United States v. Hope Community Ditch, et al., resulted in a major adjudication of water rights of lands in the Pecos Basin. The results of the action, commonly called the "Hope Decree," were issued in 1933 and defined rights of water use in most areas above Lake McMillan. Subsequently, areas outside those covered by the Hope Decree were adjudicated until, at present, practically all lands irrigated from surface water in the Pecos Basin have been covered by court decrees that define the rights of use. Similar adjudications of surface water have been made in other parts of New Mexico.

Ground-Water Basic Points

A. First Ground-Water Act passed in 1927, (N. Mex. Laws 1927 Ch. 182). This Act was declared unconstitutional in 1929 on a technicality. (Yoe v. Tweedy, 34 N. Mex. 611, 615-617 619-621, 286 Pac. 970 (1929-1930)). The Act was re-enacted in 1931.

B. Ground-Water Act - 1931 - This Act provides -

"That all underground waters of the State of New Mexico are hereby declared to be public waters and belong to the public of the State of New Mexico and to be subject to appropriation for beneficial use within the State of New Mexico." (Sec. 75-11-18)

"All existing rights to the beneficial use of such waters are hereby recognized." (Sec. 75-11-18)

"Existing water rights based upon application to beneficial use are hereby recognized. Nothing herein contained is intended to impair the same or disturb the priorities thereof." (Sec. 75-11-4)

"Beneficial use is the basis, the measure and the limit to the right to the use of water." (Sec. 75-11-2)

C. Ground-Water Act of 1931 - Is modeled after the surface water statute of 1907 and the State Constitution of 1912. It accepts the doctrine of prior appropriation.

In 1949 -

The Ground-Water Code of 1931 was challenged by the case, State ex. rel. Bliss v. Dority.

The constitutionality of the 1931 Act was upheld by the New Mexico Supreme Court in 1950 and by the United States Supreme Court in 1951, State v. Dority, 55 N. Mex. 12, and Dority v. State, 341 U. S. 924.

D. Declared Underground Water Basins - When the State Engineer determines that underground streams, channels, artesian basins, reservoirs or lakes have reasonably ascertainable boundaries, and he so proclaims, he assumes jurisdiction over the drilling of wells for the appropriation of ground water in such declared basins. The State Engineer has declared 23 such areas to prevent the impairment of existing rights to the use of ground water, to insure beneficial use of the water, and to provide for the orderly development of the underground-water resources of the state.

A total of 22,241,280 acres, or almost one-third of the state's total acreage, is now included within ground-water basins declared by the State Engineer.

E. Ground-Water Adjudication - Roswell Underground Water Basin - 1966 - The Pecos Valley Artesian Conservancy District and the State Engineer in 1956 filed a petition asking the court to adjudicate and determine all ground-water rights in the Roswell Underground Water Basin.

On January 10, 1966, a partial final judgment and decree on all lands for which water rights have been adjudicated within the Roswell Underground Water Basin located within Eddy and Chaves counties, New Mexico, was issued. This decree required that a meter be installed by the water right holder on each well, other than domestic wells, no later than January 1, 1967. The annual duty of water of 3 acre-feet per acre in each sub-file was permitted provided that the total amount of water diverted in any consecutive five years should not exceed five times the annual duty of water, or 15 acre-feet.

The meters were installed and have been in use for each crop season including 1967. The U. S. Supreme Court, in connection with the Arizona v. California decree of 1964, required a limitation on the irrigated acreage and the consumptive use of water in the Lower Colorado River Basin. As a result, the

Virden Valley, Gila River, and the San Francisco River were affected. All wells and streams in the Gila and San Francisco rivers in New Mexico must be metered.

Declared Underground Water Basins in New Mexico

An adequate water supply is a vital factor in the continued economic development in New Mexico. Large areas in the state remain relatively undeveloped, in most instances because of the scarcity or inferior quality of available water. Ground-water supplies are large but not inexhaustible, and their proper management assumes ever-increasing importance.

Figure 3 shows areas wherein the State Engineer has assumed jurisdiction over the appropriation, development, and use of ground water, under authority vested in him by law. As of December 31, 1970, appropriation and use of ground water in 23 areas embracing 22,241,280 acres had been brought under state control.

STATE WATER PLAN

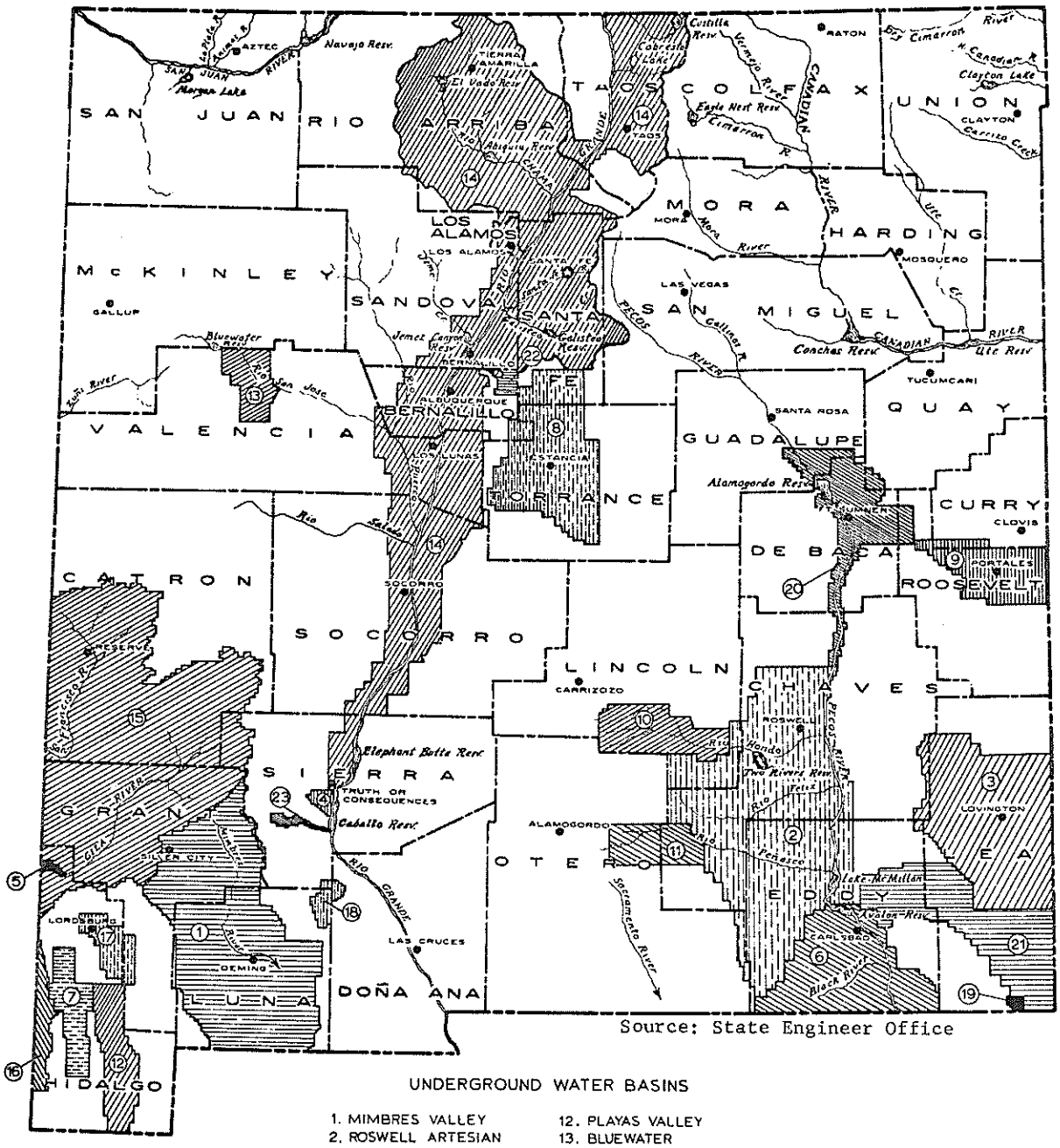
A State Water Plan for New Mexico is being prepared under the leadership of the Bureau of Reclamation, U. S. Department of Interior, and the New Mexico Interstate Stream Commission.

Roland W. Fife, Area Engineer, Bureau of Reclamation, Albuquerque Development Office, prepared the following statement regarding the progress of the State Water Plan. This statement was read at each of the eight area Citizens' Water Conferences.

Summary of Investigations
New Mexico State Water Plan
April 1, 1971

Explanation

Investigation to develop a State Water Plan for New Mexico is underway by the New Mexico Interstate Stream Commission and Bureau of Reclamation, with participation of other appropriate state and federal agencies. The plan, when completed, will offer guidelines for the future development and utilization of New Mexico's water and related land resources. The investigations will include an inventory of water and related natural resources of the state and the current level of development and use of those resources. Development of projections of the distribution of population



UNDERGROUND WATER BASINS

1. MIMBRES VALLEY
2. ROSWELL ARTESIAN
3. LEA COUNTY
4. HOT SPRINGS
5. VIRDEN VALLEY
6. CARLSBAD
7. ANIMAS VALLEY
8. ESTANCIA
9. PORTALES
10. HONDO
11. PEÑASCO
12. PLAYAS VALLEY
13. BLUEWATER
14. RIO GRANDE
15. GILA-SAN FRANCISCO
16. SAN SIMON
17. LORDSBURG VALLEY
18. NUTT - HOCKETT
19. JAL
20. FORT SUMNER
21. CAPITAN
22. SANDIA
23. LAS ANIMAS CREEK

Figure 3. Declared underground water basins in New Mexico.

and economic activities for the state are also included. Projections will be made for the years 1980, 2000, and 2020. The State Water Plan will include measures to meet the water requirements for these time frames.

The plan formulation studies will include possible ways in which water requirements for the projected needs might be met with supplies available to the state under existing interstate agreements and court decrees. This portion of the program will include studies of alternatives for use of surplus water not now being used, ways and means of improving the efficiency of present uses, possible redistribution of water among types of use within the framework of New Mexico law, and possible storage and transmission facilities needed to serve the projected distributions of population and economic activity. The investigations will also include a determination of the prospects for augmenting the water supply of the state by importation, weather modification, and desalting.

Progress

Population and employment projections, by county and river basins including urban and rural, have been completed by the University of New Mexico's Bureau of Business Research and the U. S. Office of Business Economics and Economic Research Service. Estimates of water requirements for these two levels of projections for 1980, 2000, and 2020, present water uses and future requirements for irrigation, electrical energy production, mineral industry, fish and wildlife, and recreation are essentially complete. Surface water available under existing compacts and court decrees has been determined and an estimate of ground-water supplies is in progress. A land ownership and administration map is in the process of being printed. A land-use map is being prepared. Irrigability land classification is being accomplished cooperatively by the New Mexico Water Resources Institute, New Mexico State University, Soil Conservation Service, Bureau of Reclamation, Bureau of Indian Affairs, Forest Service, New Mexico Property Appraisal Department, and New Mexico Interstate Stream Commission. The Department of Agriculture has reoriented its on-going Type IV investigations to include the entire state on a reconnaissance basis to furnish pertinent information relating to the Department of Agriculture program. Participation by the Corps of Engineers in identifying flood control needs is underway. The report of the New Mexico State Water Plan is scheduled for completion in fiscal year 1973.

POPULATION AND WATER RESOURCES

Johansen pointed out that population changes are of considerable political, economic, and social importance, especially to a state such as New Mexico. Political representation and influence, economic and industrial activity, education, welfare and many other spheres of activity are affected by changes in the size and distribution of a population (10).

Population is especially important from the water resources standpoint, since each element is dependent upon the other. New Mexico's high rate of population growth (figure 4) from just over 300,000 in 1910 to almost 1 million in 1960 (an average rate of increase of about 42 percent) was slowed from 1960 to 1970 when the population only grew to 1,016,000 (an increase of 6.8 percent). This was an average increase of about 6,500 inhabitants per year (1960-1970) compared with an average increase of about 12,470 per year between 1910 and 1960.

Of the 32 counties in New Mexico, 15 gained population and 17 lost population from 1960 to 1970 (figure 5). The gains ranged from 1.7 percent in Roosevelt County to 23.2 percent in Sandoval County. The losses ranged from 1.5 percent in San Juan County to 28.1 percent in Harding County. The percentage change for each county are presented in figure 5.

Population projections for the years 1980, 2000, and 2020 indicate that the population of New Mexico should reach between 2.7 and 4.6 million depending on whether the OBERS or Edgel projections are used. The population census for 1950 through 1970 and the OBERS and Edgel projections for 1980, 2000, and 2020 are presented in table 1 by county and for the state in figure 4.

The largest population gains are expected to occur in the Rio Grande Basin, the Pecos Basin, and the San Juan Basin, and the Southern High Plains counties. The Northeastern counties are expected to have a slight to moderate increase in population and most of the remaining counties to experience generally moderate growth in population. Most counties where the largest increases are expected are areas where water problems are becoming more critical.

If the population increases as projected, the demands for water for municipal, industrial, domestic, and recreational purposes in New Mexico will increase greatly. Presently, agricultural depletions account for about 90 percent of all water depleted in the state for beneficial uses. The water resources of the state are almost fully appropriated under the doctrine of prior appropriation under the state water laws. Increases, therefore, in the use of water for municipal, industrial, and recreation must, in general, come from agriculture, which in most cases presently has prior rights for irrigation purposes.

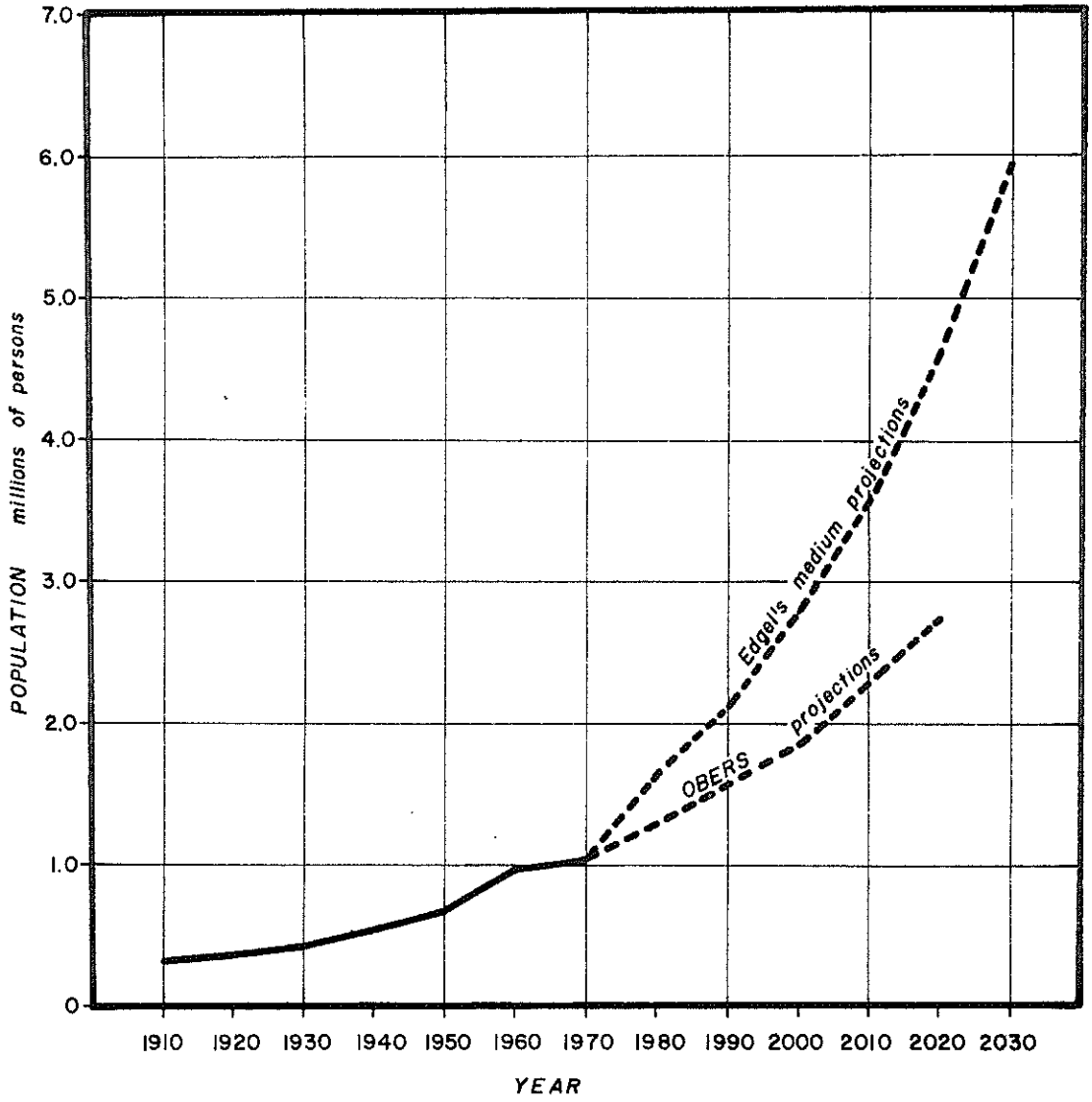


Figure 4. Total population of New Mexico, 1910-1970 with Edgel's medium projections and OBERS projections for 1980 through 2030.

Source: 1910-1970: Johansen, Sigurd, Population Changes in New Mexico, Research Report 191, Agricultural Experiment Station, New Mexico State University.

Edgel's medium projections; from "Projections of the Population of New Mexico and its Counties to the Year 2070," by Ralph L. Edgel; compiled by New Mexico State Planning Office, 1968.

OBERS projections; Office of Business Economics of the Commerce Department and Economic Research Service, USDA.

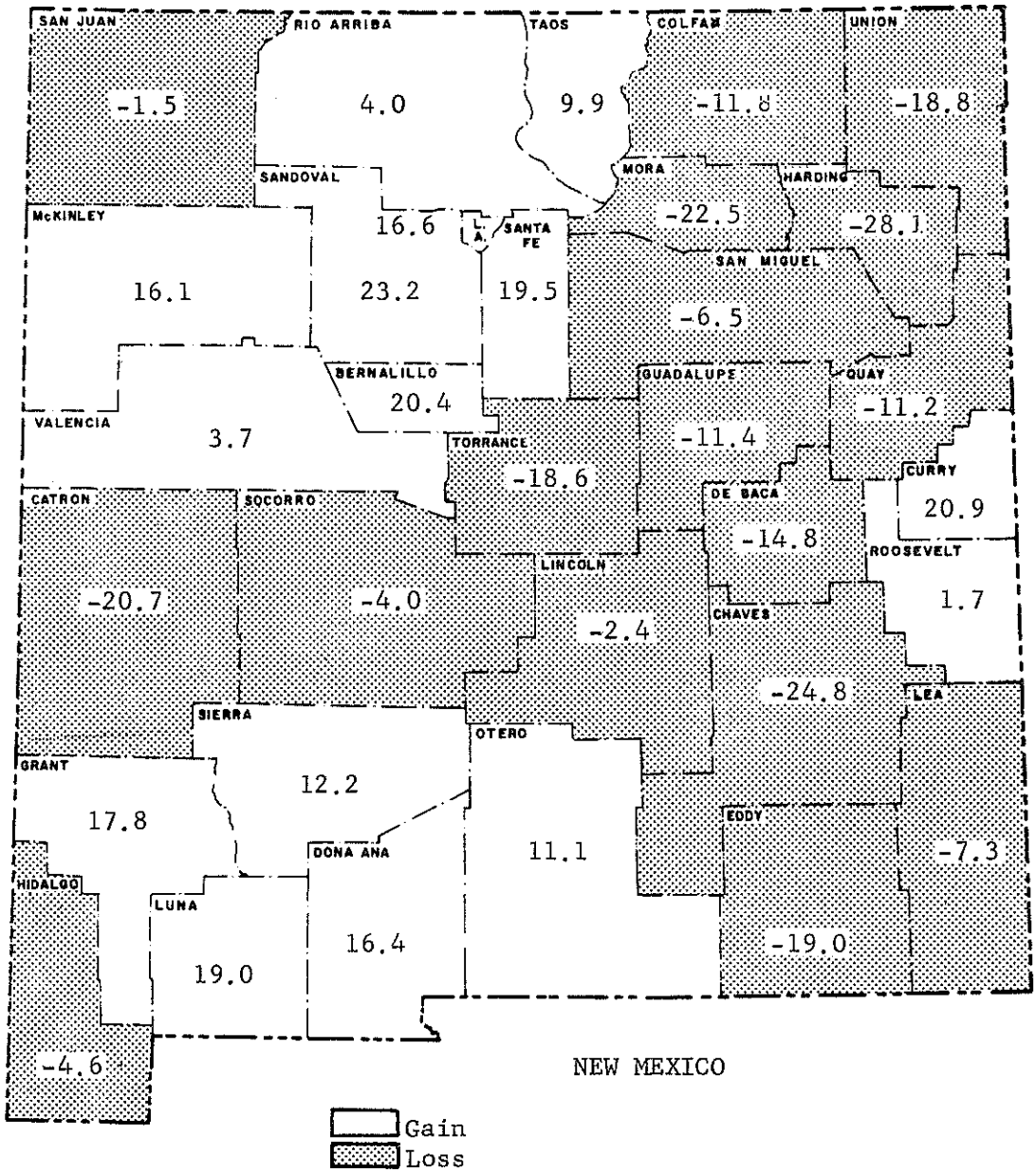


Figure 5. Map of New Mexico showing counties losing and gaining in population, and the percentage change in total population, 1960-1970.

Source: Johansen, Sigurd, Population Changes in New Mexico, Research Report 191, Agricultural Experiment Station, New Mexico State University, June 1971, figure 2, p. 6.

Table 1. Total population of New Mexico counties for 1950, 1960, and 1970 and projections for 1980, 2000, and 2020 by Edgel[1] and OBERS[2]

County	1950	1960	1970	1980		2000		2020	
				Edgel	OBERS	Edgel	OBERS	Edgel	OBERS
Bernalillo	145,673	262,199	315,774	531,500	424,300	948,000	632,300	1,546,600	919,200
Catron	3,533	2,773	2,198	4,200	3,900	9,300	5,600	11,900	8,200
Chaves	40,605	57,649	43,335	92,400	74,200	151,400	100,100	253,100	150,900
Colfax	16,761	13,806	12,170	18,000	14,300	26,400	18,600	39,200	22,000
Curry	23,351	32,691	39,517	68,100	54,600	123,700	81,600	215,600	129,000
De Baca	3,464	2,991	2,547	4,600	3,900	10,100	7,400	12,900	8,200
Dona Ana	39,557	59,948	69,773	136,300	109,300	224,000	148,400	425,000	252,400
Eddy	40,640	50,783	41,119	66,500	53,400	104,200	68,700	171,900	101,500
Grant	21,649	18,700	22,030	28,600	23,400	44,800	29,700	73,100	43,900
Guadalupe	6,772	5,610	4,969	8,000	6,500	16,000	11,100	21,800	13,700
Harding	3,013	1,874	1,348	3,800	2,600	8,100	5,600	10,400	5,500
Hidalgo	5,095	4,961	4,734	7,900	6,500	11,800	7,400	19,800	11,000
Lea	30,717	53,429	49,554	84,600	67,700	140,300	92,700	245,400	145,400
Lincoln	7,409	7,744	7,560	13,900	11,700	23,900	16,700	30,500	19,200
Los Alamos	10,476	13,037	15,198	34,700	27,300	56,300	37,100	92,300	54,900
Luna	8,753	9,839	11,706	17,400	14,300	30,600	20,400	51,100	30,200
McKinley	27,451	37,209	43,208	58,700	46,900	88,200	59,300	145,000	85,100
Mora	8,720	6,028	4,673	5,300	3,900	10,200	7,400	13,100	8,200
Otero	14,909	36,976	41,097	60,800	48,200	102,600	68,600	194,000	115,200
Quay	13,971	12,279	10,903	16,200	13,000	26,500	18,500	35,500	22,000
Rio Arriba	24,997	24,193	25,170	26,600	20,800	43,600	29,700	70,500	41,200
Roosevelt	16,409	16,198	16,479	26,200	20,800	38,700	26,000	77,400	46,600
Sandoval	12,438	14,201	17,492	18,600	14,300	26,500	18,500	51,000	30,200
San Juan	18,292	53,306	52,517	66,200	53,400	100,500	66,700	175,000	104,300
San Miguel	26,512	23,468	21,951	30,100	23,400	49,000	33,400	69,200	41,200
Santa Fe	38,153	44,970	53,756	82,200	65,100	178,500	118,700	287,200	170,100
Sierra	7,186	6,409	7,189	9,900	7,800	18,000	11,100	24,700	13,700
Socorro	9,670	10,168	9,763	12,700	10,400	21,200	14,800	29,400	16,500
Taos	17,146	15,934	17,516	24,800	19,500	37,900	26,000	15,900	30,200
Torrance	8,012	6,497	5,290	6,500	5,200	10,400	7,400	13,200	8,200
Union	7,372	6,068	4,925	7,200	5,200	10,800	7,400	15,300	8,200
Valencia	22,481	39,085	40,539	57,500	45,600	86,500	57,500	147,400	87,800
Totals	681,187	951,023	1,016,000	1,630,000	1,301,400	2,778,000	1,854,400	4,621,400	2,743,900

1 Edgel's Medium Projections, from "Projections of the Population of New Mexico and its Counties to the Year 2070" by Ralph L. Edgel; compiled by New Mexico State Planning Office, 1968.

2 OBERS Projections, Office of Business Economics of the Commerce Department and Economic Research Service, USDA.

Irrigated Cropland

The largest depletions of the water of New Mexico are for agricultural purposes, including the amount needed for livestock. Increasing acreages of irrigated cropland and the development of new agricultural areas in some regions of the state have resulted in increased annual depletions. The acreage of irrigated cropland increased by about 40 percent from 1940 to 1950, increased slightly from 1950 to 1960, and increased about 37 percent from 1960 to 1970 (table 2). Projections of irrigated cropland acreage indicate that the acreage will increase by almost 240,000 acres over the 1970 acreage to about 1.5 million acres by the year 2000, but will decline to about 1.4 million acres by 2020 (table 2).

Land Quality and Farm Size for Irrigation

Any projected increase of land in irrigated agriculture in New Mexico should be made in relation to the quality of land to be irrigated and the size of farm units to be considered.

Land Quality

The following statements based on a study of the relative value of water in various uses by Wollman, Stucky, Thomas, and others (29) show the relative net repayment capacity per acre for four land classes based on a 120-acre farm unit (figure 6).

This points out that only the 1 and 2 class lands will return anything above operating costs to be used for water repayment and family living costs.

Farm Size

The size of unit is also important. Small farms, as the only source of income no longer can produce a living for a family. The following net repayment capacity was calculated for Class A land in the proposed Navajo Indian Project, for farms from 40 acres to 200 acres in size (figure 7).

This points out that a farm of 120 acres or larger is required to maintain a family and make reasonable payments on the project costs under 1954 conditions.

These same relationships would prevail under 1970 prices as compared to the above 1954 prices, except that the poorer quality land

Table 2. Acres of irrigated cropland including idle, fallow, and diverted acreage in New Mexico, 1940-1970, and projections for 1980, 2000, and 2020 by county

County	Years[1]						
	1940	1950	1960	1970	1980	2000	2020
	acres						
Bernalillo	20,600	34,600	10,900	13,240	13,240	13,240	13,240
Catron	2,600	2,200	1,900	2,440	2,440	2,440	2,440
Chaves	72,600	89,200	97,600	105,730	105,730	105,730	105,730
Colfax	31,300	32,500	31,000	34,780	34,780	34,780	34,780
Curry	0	3,000	87,000	190,000	199,190	89,190	49,190
De Baca	3,300	4,300	5,600	9,790	12,120	12,120	12,120
Dona Ana	76,500	86,000	90,800	98,310	98,890	98,890	98,890
Eddy	57,700	70,100	73,800	78,000	78,000	78,000	78,000
Grant	7,500	8,000	7,000	8,010	9,880	10,380	10,880
Guadalupe	3,200	3,100	3,300	3,830	3,830	3,830	3,830
Harding	0	100	2,100	6,270	10,220	14,020	14,020
Hidalgo	3,000	12,000	21,200	35,240	47,340	53,140	58,140
Lea	3,200	73,000	97,500	113,500	170,750	195,450	153,750
Lincoln	4,800	5,900	4,600	4,600	4,100	4,100	4,100
Luna	11,700	25,800	37,000	68,460	75,010	75,010	75,010
McKinley	4,000	3,500	3,300	5,290	9,500	9,500	9,500
Mora	21,300	19,900	12,000	18,000	18,000	18,000	18,000
Otero	4,600	11,700	14,300	13,130	16,900	19,900	22,900
Quay	200	32,600	32,700	50,620	53,700	60,500	64,800
Rio Arriba	35,600	36,800	38,900	38,860	41,030	41,030	41,030
Roosevelt	11,300	30,000	62,000	103,700	109,580	84,580	34,580
Sandoval	18,600	19,400	15,000	15,200	17,050	17,050	17,050
San Juan	34,800	42,300	47,600	53,000	106,700	180,800	180,800
San Miguel	15,000	18,000	11,400	12,380	12,900	12,900	12,900
Santa Fe	10,400	6,100	9,900	15,840	19,720	18,570	16,490
Sierra	4,800	5,200	7,000	8,840	9,470	9,470	9,470
Socorro	13,300	17,200	12,300	16,500	16,200	16,200	16,200
Taos	37,100	36,000	36,800	40,860	47,890	47,890	47,890
Torrance	1,400	7,100	15,000	33,330	53,630	70,660	68,710
Union	5,800	6,700	9,200	35,000	60,370	71,870	87,370
Valencia	37,000	25,700	34,300	43,300	44,680	44,680	44,680
Totals	553,200	768,000	933,000	1,276,050	1,502,840	1,514,500	1,406,500

1 1940-1970 acreage compiled by U.S. Soil Conservation Service; Agricultural Economics Department, New Mexico State University; and the New Mexico State Engineer Office, 1970.
Projections for 1980, 2000, and 2020 compiled from estimates of changes in irrigated cropland by the New Mexico State Engineer Office, 1971, 11 pp.

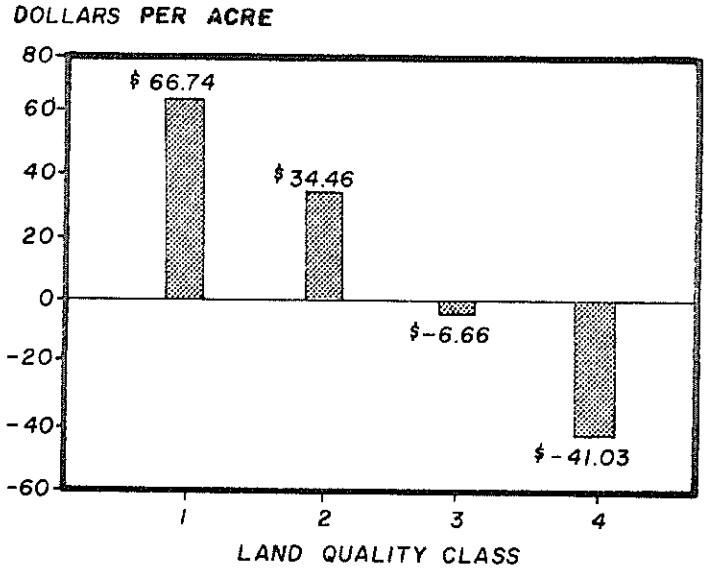


Figure 6. Net repayment capacity per acre based on land quality classes in the Elephant Butte Irrigation Project, 1954 prices and costs, and 120-acre farm unit.

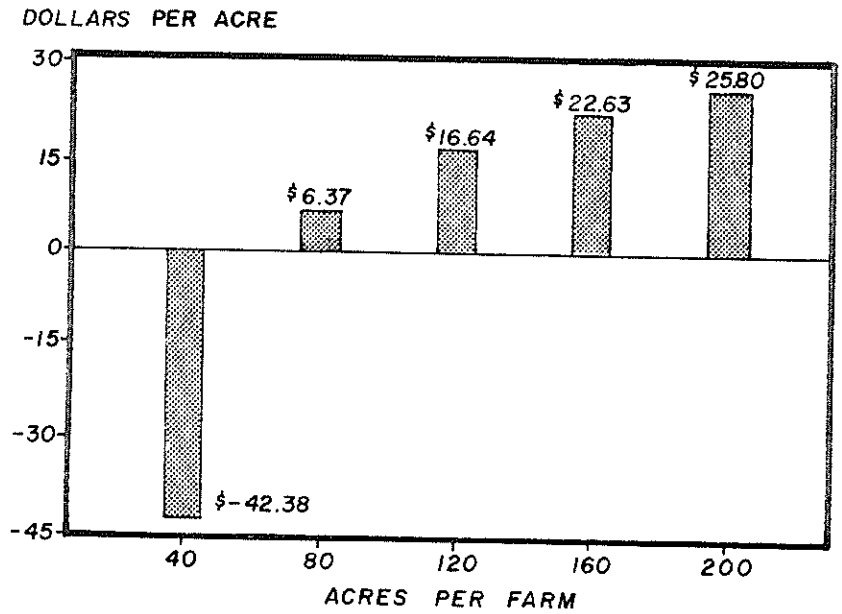


Figure 7. Net repayment capacity per acre by size of farm for class A land in the Navajo Indian Irrigation Project, 1954 prices and costs.

Source: Wollman, Nathaniel, et al., The Value of Water in Alternative Uses, with special application to water use in the San Juan and Rio Grande Basins of New Mexico, University of New Mexico Press, Albuquerque, 1962.

and the smaller units would be at a greater disadvantage from a cost and returns standpoint.

Quality of the land and size of farm unit must be major considerations in the development or re-development of any projected increases in irrigated acreage in New Mexico. Water and the quality of living for the family are paramount factors over increased acreages under irrigation.

Irrigability Classification Maps

The Water Resources Research Institute, the New Mexico Agricultural Experiment Station, Soil Conservation Service, Bureau of Reclamation, Forest Service, Bureau of Land Management, Bureau of Indian Affairs, New Mexico Property Appraisal Department, State Engineer's Office and others are cooperating to publish colored soil association and colored irrigability classification maps for each county in New Mexico, except Bernalillo County. These maps will be invaluable in determining where No. 1 and No. 2 quality lands, suitable for irrigation, are located in New Mexico.

As of October 1, 1971, New Mexico Agricultural Experiment Station has published Research Reports for the following counties:

County	Research Report No.	County	Research Report No.
Chaves	192	Luna	176
Curry	162	Mora	205
Dona Ana	183	Quay	202
Eddy	170	Roosevelt	163
Grant	200	Sandoval - Los Alamos	188
Harding	165	San Juan	161
Hidalgo	177	Santa Fe	185
Lea	178	Torrance	187

The remaining counties and a state report are scheduled for completion in 1972.

Land Ownership

Over one-third of the total land area of the state is public land held for the use of federal agencies (table 3). State lands account for about 12 percent and Indian lands about 10 percent. The land in private ownership accounts for 44 percent of the total land area of the state.

Land ownership is important both from the standpoint of the rights to the use of the land resource as well as the use of the water in the

state. The management of the land and forage resources affects the quantity and quality of water flowing from those lands available for other uses.

Table 3. Land ownership in New Mexico, 1970

Item	Acres	Percentage
Federal lands:		
Forest Service	9,090,819	11.7
Bureau of Land Management	13,613,566	17.5
Defense	2,802,473	3.6
Other	1,224,245	1.6
Total federal	26,731,103	34.4
State lands:		
Trust	9,067,233	11.7
Deeded	345,784	0.4
Total state	9,413,017	12.1
Total federal and state	36,144,120	46.5
Private lands	34,232,057	44.0
Indian lands	7,348,563	9.5
Total land area	77,724,740	100.0
Inland water area	141,500	
Total area of state	77,866,240	

Source: Unpublished data compiled by Department of Agricultural Economics, New Mexico State University, 1971.

WATER USES IN NEW MEXICO

Agricultural Depletions

Agricultural uses of water deplete the largest amounts of water of all uses. Total annual depletions by agriculture have been estimated to be about 90 percent of the total depletions for beneficial use (26). The current agricultural depletions were estimated to be about 1.55 million acre-feet for the state and are projected to reach a high

of 2.28 million acre-feet by 2000, and decrease slightly 2.12 million acre-feet by 2020 (table 4). Irrigated agriculture accounts for approximately 99 percent of the current and projected agricultural depletions.

Municipal Depletions

Closely related to the population, municipal depletions have been increasing in the state. The weighted average annual urban depletions of water were about 80 gallons per capita daily in 1965 for the state and are projected to reach 160 gpcd by 2020 (table 5).

Based on the projected rate of population growth and projection of per capita urban depletions of water, the total urban depletions of water are estimated to reach over 500 thousand acre-feet per year by 2020. This is an increase of more than 400 percent over 1965 (figure 8).

Mineral Depletions

In certain areas of the state, where petroleum production and the extraction of base minerals have expanded, mineral industry depletions are becoming more important. Projections of mineral industry depletions of water for 1980, 2000, and 2020 are reported in table 6. Grant and San Juan counties, in the southwestern and northwestern areas of the state, respectively, are expected to lead in the depletion of water for the mineral industry, followed by Eddy and Valencia counties. Total depletions of water by the mineral industry for the state are expected to exceed 277,000 acre-feet by the year 2020.

Water Supply

New Mexico's water supply may be broken into three primary categories according to the source of the water: surface, ground, and combined surface and ground. The depletions and diversions for New Mexico by source of water and use are reported in table 7. Agriculture accounts for about 90 percent of the total water depletions for beneficial uses in New Mexico, most of which (98 percent) is for irrigation. Nearly 10 percent is depleted by all nonagricultural uses. With respect to the total amount depleted, about 43 percent of the total supply is depleted by reservoir evaporation and nonbeneficial uses.

WATER IMPORT PROPOSALS

Water import proposals seem to be a long way in the future. However, in 1971, water from the Colorado River Basin started flowing

Table 4. Agricultural depletions of water for 1969 and projections for 1980, 2000, and 2020 in New Mexico by county

County	1969[1]		1980		2000		2020	
	Irrigated cropland[2]	Livestock[3]	Irrigated cropland[2]	Livestock[3]	Irrigated cropland[2]	Livestock[3]	Irrigated cropland[2]	Livestock[3]
	acre-feet							
Bernalillo	19,860	723	26,480	849	25,690	1,073	24,490	1,301
Catron	2,310	534	3,830	599	3,760	640	3,680	673
Chavez	186,340	1,519	192,430	2,435	189,260	2,695	182,910	2,866
Colfax	32,540	752	41,740	731	41,390	785	40,340	814
Curry	153,170	797	193,210	926	85,620	1,767	45,250	1,858
De Baca	14,460	370	20,730	456	20,480	460	19,630	472
Dona Ana	176,050	463	181,960	667	178,990	706	172,070	802
Eddy	126,370	883	153,660	984	151,320	1,047	145,860	1,108
Grant	9,130	644	15,020	665	15,570	706	15,670	731
Guadalupe	5,420	458	6,430	457	6,360	465	6,200	473
Harding	4,800	434	11,650	426	15,840	459	15,700	480
Hidalgo	40,070	485	76,220	540	84,490	577	88,950	590
Lea	99,990	1,011	213,440	1,236	238,450	1,785	181,430	1,922
Lincoln	6,790	793	7,220	753	7,090	785	6,930	824
Luna	92,930	390	120,770	517	119,270	582	114,020	654
McKinley	4,270	455	13,970	482	13,680	483	13,400	558
Mora	14,360	348	19,980	325	19,800	339	19,260	369
Otero	20,080	508	34,480	526	40,000	554	44,200	628
Quay	51,440	806	77,330	903	86,520	994	91,370	1,035
Rio Arriba	35,660	465	40,880	448	50,060	455	49,240	483
Roosevelt	95,060	990	117,250	1,139	88,810	1,236	34,930	1,324
Sandoval	21,490	191	28,470	244	27,620	272	26,260	398
San Juan	64,650	538	212,330	523	350,750	726	350,750	913
San Miguel	13,510	629	15,480	728	15,220	750	14,840	772
Santa Fe	17,070	342	26,620	447	24,700	465	21,600	523
Sierra	15,870	357	18,370	435	18,090	480	17,330	536
Socorro	35,610	622	35,800	693	34,670	758	33,050	796
Taos	40,740	194	55,550	223	54,590	264	53,160	309
Torrance	23,470	423	61,670	453	80,550	450	76,270	530
Union	33,600	967	68,820	1,098	81,210	1,166	97,850	1,234
Valencia	71,370	758	91,150	823	88,020	945	84,450	1,165
Totals	1,528,480	18,849	2,192,940	21,731	2,257,870	24,869	2,091,450	27,141

1 For livestock - 1965.

2 Consumptive irrigation requirements, based on irrigated acreages reported in table 2, compiled by Agricultural Economics Department, New Mexico State University.

3 Source: Capener, William N., and Earl F. Sorensen; "Memorandum August, 1971 - Water Requirements for Livestock in New Mexico in 1980, 2000, and 2020," New Mexico State Engineer Office in consultation with Agricultural Experiment Station; 19 pp.

Table 5. Urban depletions of water for 1965 and projections for 1980, 2000, and 2020 in New Mexico by county

County	Urban[1] Depletions			
	1965	1980	2000	2020
	gallons per capita day			
Bernalillo	80	100	130	175
Catron	-	-	75	95
Chaves	135	150	160	175
Colfax	88	95	120	150
Curry	110	130	150	175
De Baca	-	75	95	125
Dona Ana	98	120	130	175
Eddy	125	150	160	175
Grant	54	75	95	125
Guadalupe	-	75	95	125
Harding	-	-	75	95
Hidalgo	92	100	135	155
Lea	100	120	135	155
Lincoln	40	75	95	125
Los Alamos	86	110	130	155
Luna	124	150	160	175
McKinley	35	75	95	125
Mora	-	-	75	95
Otero	86	115	130	150
Quay	80	95	120	150
Rio Arriba	36	75	95	125
Roosevelt	83	115	130	150
Sandoval	49	75	95	125
San Juan	80	100	125	155
San Miguel	35	75	95	125
Santa Fe	48	95	120	150
Sierra	92	115	130	150
Socorro	98	120	130	150
Taos	48	75	95	125
Torrance	-	-	75	95
Union	66	95	120	150
Valencia	48	75	95	125
Weighted average[2]	80	105	127	160

1 Urban is defined as all persons living in incorporated towns, villages, cities, etc., or in densely settled urban fringe areas, whether incorporated or unincorporated, having a population of 2,500 inhabitants or more.

2 Based on OBERS population projections for 1980, 2000, and 2020.

Source: Memo from Earl F. Sorensen, "Projected Urban, Rural and Self-Supplied (Manufacture and Industrial) Water Requirements in 1980, 2000, and 2020 in New Mexico," New Mexico State Engineer Office, 1971, 2 pp.

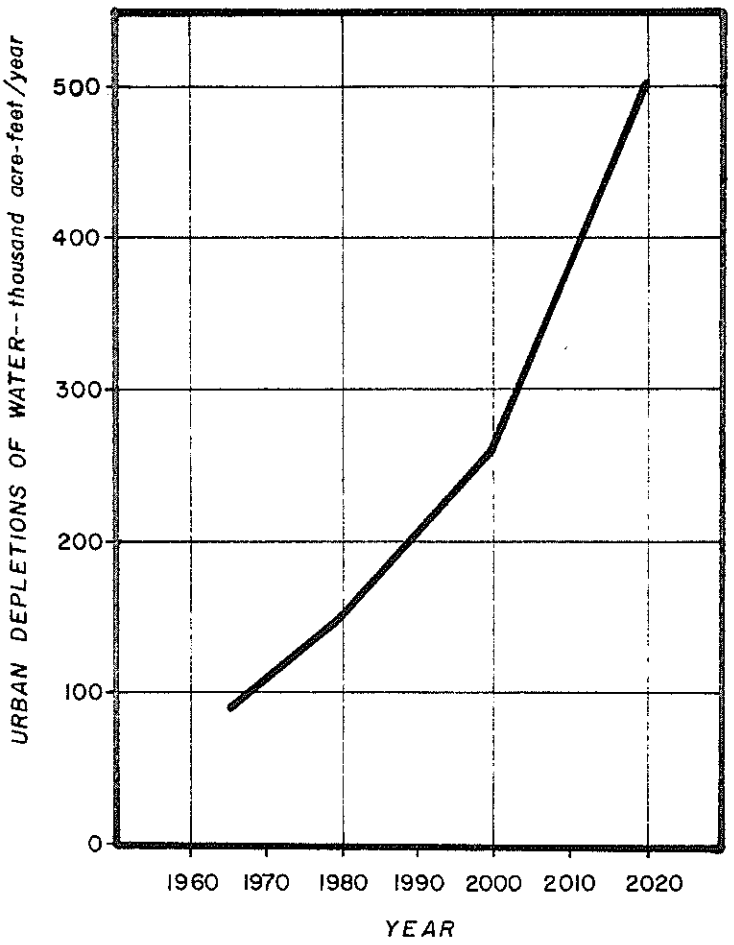


Figure 8. Urban depletions of water for New Mexico, based on population projections (OBERS) and projected depletions per capita.

Table 6. Projections of New Mexico Mineral Industry depletions of water for 1980, 2000, and 2020 by county

County	Mineral Industries Depletions		
	1980	2000	2020
	acre-feet		
Bernalillo	475	2,030	4,460
Catron	580	2,680	9,630
Chaves	865	2,140	9,450
Colfax	840	1,910	4,350
Curry	525	1,425	2,225
De Baca	325	1,405	2,545
Dona Ana	275	1,410	4,200
Eddy	8,280	17,540	24,180
Grant	12,060	26,045	34,700
Guadalupe	95	1,025	1,880
Harding	270	670	2,585
Hidalgo	465	1,360	10,085
Lea	2,575	5,720	24,770
Lincoln	960	2,625	6,700
Los Alamos	0	0	1,875
Luna	315	1,560	5,860
McKinley	4,815	8,175	20,350
Mora	10	180	1,240
Otero	45	140	2,150
Quay	100	1,090	2,100
Rio Arriba	820	3,070	12,630
Roosevelt	1,650	3,145	3,800
Sandoval	405	3,350	8,690
San Juan	11,465	16,640	29,040
San Miguel	180	400	3,580
Santa Fe	315	1,225	3,955
Sierra	370	1,610	6,120
Socorro	490	2,180	4,840
Taos	5,000	8,815	12,040
Torrance	5	260	1,035
Union	5	105	505
Valencia	8,140	11,930	15,330
Totals	62,720	131,990	277,320

Source: Sorensen, Earl F., and Stotelmeyer, Ronald B., "Projected Water Requirements for New Mexico Mineral Industries for the Years 1980, 2000, and 2020," memorandum: New Mexico State Engineer Office, April, 1970, 17 pp.

Table 7. Summary of estimated water diversions and depletions in New Mexico, 1960-1964

Item	Surface Water		Ground Water		Combined Surface and Ground Water		Total	
	Diversion	Depletion	Diversion	Depletion	Diversion	Depletion	Diversion	Depletion
	acre-feet							
Irrigation	1,160,200	559,000	1,248,850	767,030	667,670	327,600	3,076,720	1,653,630
(Sewage used for irrigation)		(10)		(17,185)		(815)		(18,010)
Urban	7,210	3,180	88,300	42,290	14,570	6,220	110,080	51,690
Self-supplied uses:								
Industrial			7,140	3,810			7,140	3,810
Commercial			3,930	2,170			3,930	2,170
Minerals	10,130	9,390	53,260	35,710			63,390	45,100
Power production	47,900	12,200	7,980	5,230			55,880	17,430
Subtotal of self-supplied	58,030	21,590	72,310	46,920			130,340	68,510
Military			7,130	3,590	1,500	750	8,630	4,340
Rural domestic	1,740	690	14,510	6,580	290	120	16,540	7,390
Livestock		8,420		8,420				16,840
Fish, wildlife, and recreation		36,960		12,830				49,790
Reservoir evaporation		432,900		52,200		21,500		506,600
Stock pond evaporation		21,290						21,290
Nonbeneficial		863,100						863,100
State totals		1,947,130		939,860		356,190		3,243,180

Source: State Planning Office, 1967, Water Resources of New Mexico, Occurrence, Development and Use, compiled by New Mexico State Engineer Office in cooperation with New Mexico Interstate Stream Commission and United States Geological Survey, Santa Fe, New Mexico, 1967, table 4, page 9.

through the canals and tunnels of the San Juan-Chama project into the Rio Grande Basin. The flow through this system would average 110,000 acre-feet per year under present allocation agreements.

Water, Inc., an organization of citizens in West Texas (Lubbock and Amarillo area) and in the several eastern New Mexico counties, is working with the Bureau of Reclamation and the Corps of Engineers, U. S. Army, on a plan to bring water from the Mississippi River to the High Plains of West Texas and eastern New Mexico. A report on this proposal is due to be completed in 1973.

The North American Water and Power Alliance, a development of the Ralph M. Parsons Company, proposes to bring water from Alaska and western Canada to the western United States, including Utah, Arizona, and New Mexico. This proposal has not received very favorable comments from the people in western Canada. They believe it would interfere too much with the timber, mining, power development, recreation, and transportation industries in that area.

The Central North American Project proposal was developed in concept by Dr. Roy E. Tinney in 1967, who at that time was at Washington State University. Dr. Tinney had lived east of the Rocky Mountains in Canada in the vicinity of the Great Slave and Great Bear Lakes. He remembered the abundance of water and that there was a very sparce population and virtually no transportation system or commercial activities in the region. He decided to go to Ottawa, Canada, to discuss his proposal with the national government of Canada. Dr. Tinney was hired in 1968 by the Canadian government as chief of the planning division for resources. This proposal would bring water down through the lakes and rivers to Lake Winnepeg and then into the United States to either the Mississippi or the Missouri rivers, or both. Water would flow down these rivers to about the South Dakota-Nebraska state line before diversions would start to bring this water up to the Plains area and then on to the High Plains of Texas and New Mexico.

It seems unlikely that either the North American Water and Power Alliance proposal or the Central North American Project will be developed as a single project. However, there appear to be possibilities for various portions to be developed and ultimately these portions joined together as a more or less coordinated unit in the course of 40 to 50 years.

New Mexico must pin its present hopes on conserving its existing water supply and making the best possible use of its water. The state will never have any cheaper water than it has now, so this water has a greater net value than water from any future import source. The economy of New Mexico might be greatly improved if portions of these proposals, particularly the Central North American Project, were found to be feasible. Without imported water, it appears that the economy of New Mexico will be greatly changed over the next 50 years. Areas now being irrigated by pump irrigation methods from ground-water sources will be the most affected.

STATE MEETING

PROCEDURE

Two delegates were elected by those attending each area conference to attend a state meeting held May 24 and 25, 1971. In addition to the elected delegates, five county agents were asked to attend the state meeting. The delegates met together on the first morning of the state meeting. On the afternoon of May 24 and all day May 25, members of the Water Resources Research Institute Advisory Committee and respresentatives of various state research units met with the 16 area delegates and the five extension agents.

Delegates from each area presented a report on the meetings held in their area. After these presentations, participants were asked to rank the 10 most important problem areas. The results were summarized, with the following overall statewide rankings.

THE STATE'S TEN MOST IMPORTANT WATER PROBLEMS

1. Declining ground-water table and diminishing surface-water supply

These were considered the most important of all items discussed.

Ground water. Lowering of the water table in many areas of the state has been caused by large scale pumping of ground water for irrigated acreage as well as by increasing requirements of industrial and municipal uses. In many areas of the state, ground-water mining conditions exist which may limit the future development of New Mexico. Currently about 58 percent of the irrigated land is supplied from ground-water sources (747,450 acres). An additional 14 percent (174,310 acres) receive both surface and ground water. Almost all of the municipal and industrial water comes from ground-water sources.

Surface water. Full appropriation and court decree limit surface-water development, and many areas have experienced shortages of surface water for agriculture and some municipal and industrial uses.

2. Need for improved irrigation systems and water-use management in irrigated agriculture

In some areas of northern New Mexico only 20 to 30 percent of the water diverted from rivers and streams reaches the cropland to be irrigated. Small obsolete ditches, poorly designed and constructed, and lack

of adequate maintenance cause transportation losses with excessive seepage losses, and silting of irrigation ditches from arroyos and streams. These small ditches need to be consolidated in larger, better designed conveyance ditches to conserve and deliver an adequate amount of irrigation water to the cropland. Many instances of over-irrigation were cited in most areas of the state.

On-farm management of ground water could be more efficient through lining ditches, improving field layout, using better irrigation systems such as sprinklers, trickle irrigation, or subsurface irrigation.

Meters are now used on irrigation wells in the Roswell-Artesian Basin, and in the Gila and San Francisco drainages to the Colorado River. If irrigation efficiency could be increased by 10 percent, a large amount of water currently being used by agriculture could be made available to industries, municipalities, recreation or on additional irrigated land without decreasing the overall productivity of the presently irrigated land.

3. Water pollution

Among the forms of pollution mentioned were sewage pollution of both surface and ground water, and industrial pollution of both surface and ground water, sediment pollution of surface water streams and rivers, and salt water encroachment in ground and surface waters. In many areas of the state, septic tanks and domestic wells are spaced too close together in subdivisions and in trailer parks, with pollution from septic tanks being recycled into domestic wells. Some sewage plants discharge improperly treated wastes into rivers and streams. This is largely due to improperly designed, installed, and operated sewage plants. In many areas the population is increasing faster than sewer developments are installed. It was recommended that developers in rural areas be required to provide adequate water and sewage systems for their housing developments.

Sediment can be controlled by constructing flood control dams to reduce the silt and sediment reaching the major streams and rivers. In addition, proper range and watershed management can help to hold the soil in place, thus resulting in less sediment reaching streams and rivers.

4. Need for knowledge of present and future supplies and demands of water

In many areas of the state, information is lacking on the conditions and amounts of water actually available. Studies of ground-water hydrology are lacking in almost all areas, and this restricts planning by community and state agencies. Information is needed not only about ground water but about surface water and the relationships between the

two. Projections are needed on expected future requirements of water for agricultural, industrial, municipal, and other uses that will allow long-range planning on a realistic basis. The amount of water required for future uses within the state, under varying time frames and conditions must be considered.

5. Shortage of water for industrial, recreational, and municipal uses

Many municipalities are faced with shortages of water. Provisions will have to be made to ensure an adequate amount of water for municipal uses in the future. As population increases, there will be increased pressures for more water for municipal and industrial uses and for water-based recreation. New Mexico now has only a small allocation of water for recreational purposes. Currently a few new projects are being developed to alleviate this situation, notably Cochiti Lake, between Albuquerque and Santa Fe. Provisions should be developed for an orderly transfer of water rights between alternative uses.

6. Adjudication of water rights

The opinion expressed by many of those attending the state citizens' conference was that all claims for water rights in New Mexico should be fairly and equitably adjudicated. Most of the streams in the state were over-appropriated originally. Adjudications have been completed in a number of areas and some are now in process. This is a court procedure through which each claimant is asked to present his claim for water, following which the court determines and records the amount of water which is to be the right for each claimant. Provision should be made to transfer the financial burden of adjudication from the individual water right owner to the State of New Mexico. These rights help to provide stability to the agricultural, municipal, industrial, and recreational uses which are dependent on such rights.

7. Improvement of water laws

Items discussed under this topic included possible re-evaluation of river compacts to permit larger storage facilities to control flooding and silting and to provide additional recreational facilities; interstate compacts for ground-water basins; uniform water right laws between states; more control over New Mexico's water resources by the State Engineer; and the provisions of facilities for an orderly transfer of water rights between uses and within a single use and for the protection of existing rights.

8. Salinity of water and its effect on human and plant life

Participants pointed out that the general quality of both surface and ground water seems to be decreasing. Part of the problem in surface

water may be from increased sewage flows (where ground water was the original source of water), leaching of salts from the soil and return to streams and rivers, increasing use and reuse of water, and industrial wastes being dumped in streams and rivers.

Salt water encroachment in ground water comes primarily from declining water tables due to overdrafts. Other sources such as abandoned livestock and irrigation wells in high salt areas, and salt pollution from oilfield brines and from leaky oil well casings were listed.

9. Reuse of water, where practical, by recycling

Recycled water, properly treated, can be used for golf courses, swimming pools, or put back into the municipal water systems. In some cities in the nation, as much as 40 to 50 percent of the city water supply is recycled water. By recycling water, the gross amount of water for city needs--either surface or ground water--can be reduced.

10. Land and water planning and zoning

Through adequate planning and zoning, water needs can be anticipated before problems become acute. Ground and surface water pollution can be better controlled. For example, housing and trailer park developments can be more closely supervised and controlled to lessen the probability of ground-water pollution.

OTHER TOPICS DISCUSSED

(Not listed in order of importance)

a. A continuous and orderly supply of water through the construction of adequate storage facilities;

b. Flood control;

c. Importation of water;

d. Desalinization of saline water for municipal and industrial uses;

e. Evaporation control on lakes and reservoirs and need for research to find new methods of suppressing evaporation;

f. Improved methods for transporting water--through underground pipe, lining rivers, and canals;

g. Priorities of water use where supply is limited;

h. Improved livestock tanks and irrigation reservoirs to reduce seepage;

i. Elimination of nonbeneficial uses of water;

j. Need for public awareness of the water situation in New Mexico--its problems, potentials, and possible solutions;

k. Weather modification;

l. Hydrology investigations in urban areas to control flooding, erosion, and pollution.

STATE WATER PLAN

An overall thread passing through all of the discussion was the importance of the State Water Plan, which is now being developed by the U. S. Bureau of Reclamation and the New Mexico Interstate Stream Commission. It is vital to the ultimate usefulness of this plan that the citizens of the state be fully informed regarding the plan while it is in the process of completion. It is understood that meetings will be held in several locations in New Mexico in 1972 by the Bureau and the Stream Commission to discuss with the people the various aspects of the plan as it is being finalized. The State Plan is to be published in 1973.

A water plan for New Mexico has long been needed to guide the development and use of the state's most vital natural resource. The Interstate Stream Commission and the Bureau of Reclamation are to be commended for their leadership in the development of the state's first comprehensive water plan. Private citizens, business, industrial, and agricultural interests as well as local, state, and federal agencies will have many occasions to refer to the State Water Plan in future years.

AREA CITIZENS' WATER CONFERENCES

Topics discussed at the eight Citizens' Water Conferences held throughout the state included the use of water for agricultural, municipal, and industrial purposes; the sources of water; and the development potential of the area.

During the second meeting of each conference, participants were asked to rank the most important items discussed. Solutions for the problems brought out in the conferences may be considered by Resource Conservation and Development Committees, Extension Service, Soil Conservation Service, credit institutions, and other groups over the next few years. Many of these problems will be the subjects for research and investigation through the several agencies conducting such work.

A description and results of discussions at each of the eight Citizens' Water Conferences follow.

SOUTHWESTERN NEW MEXICO AREA

CATRON, GRANT, HIDALGO, AND LUNA COUNTIES

Introduction

Citizens' Water Conferences were held in Silver City for the Southwestern Area, which includes the counties of Catron, Grant, Hidalgo, and Luna (figure 9). The area encompasses about 14 percent of the total land area of the state and has about 4 percent of the 1970 population. The major population centers are Silver City, Deming, and Lordsburg.

The climate of the area ranges from semiarid to humid and the annual precipitation normally averages from 10 to 20 inches in the area.

The principal streams in the area are the San Francisco, Gila, and Mimbres Rivers, and the Animas and San Simon Creeks. The San Francisco and San Simon are Gila River tributaries, but do not join the Gila within the state. The Mimbres River rises in the Black Range and follows a distinct channel, generally southward to the flats about 8 miles east of Deming where it terminates as sheet flow. The Animas Creek runoff collects from the Animas Basin in the upper valley, and spreads northward across the lower valley in a wide indistinct channel which terminates in broad playas near Animas and Lordsburg (figure 9).

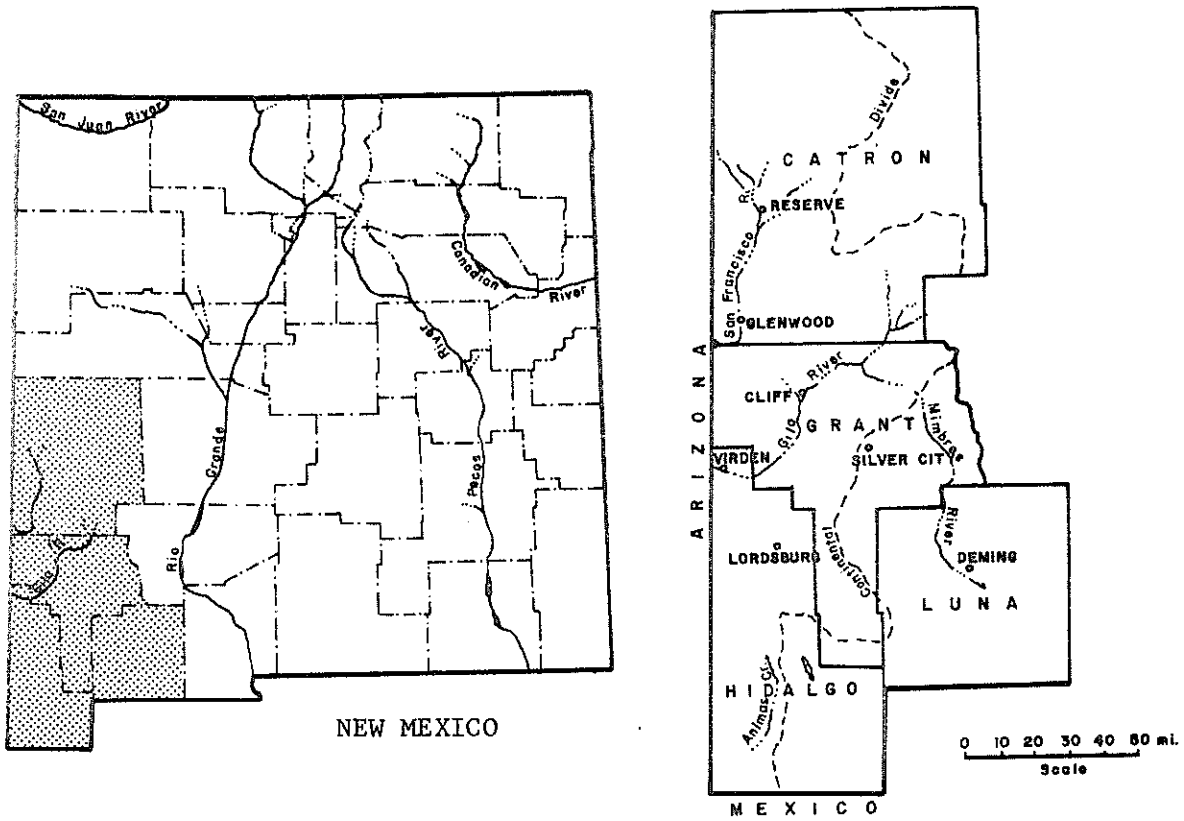


Figure 9. Maps showing counties in Southwestern New Mexico Area.

Population

Almost one-half of the 1970 population of the area was concentrated in the mining region centered around Silver City, and in Lordsburg and Deming. The southern and northern portions of the area are sparsely populated, containing only small towns and scattered farms and ranches.

Although the total population of the area has gradually increased, there was a decline in population in the Silver City area between 1950 and 1960 as a result of reduced mining activity. Most of the increase is projected for Grant and Luna counties (table 8 and figure 10).

Table 8. Total population for the Southwestern Area by county for 1950-1970, and OBERS projections for 1980, 2000, and 2020

County	Year					
	1950	1960	1970	1980	2000	2020
Catron	3,533	2,773	2,198	3,900	5,600	8,200
Grant	21,649	18,700	22,030	23,400	29,700	43,900
Hidalgo	5,095	4,961	4,734	6,500	7,400	11,000
Luna	8,753	9,839	11,706	14,300	20,400	30,200
Total	39,030	36,273	40,668	48,100	63,100	93,300

Source: 1950-1970: United States Census of Population - New Mexico, 1950, 1960, and 1970.

1980-2020: Office of Business Economics of the Commerce Department and Economic Research Service, USDA, (OBERS), compiled by State Engineer Office, 1971.

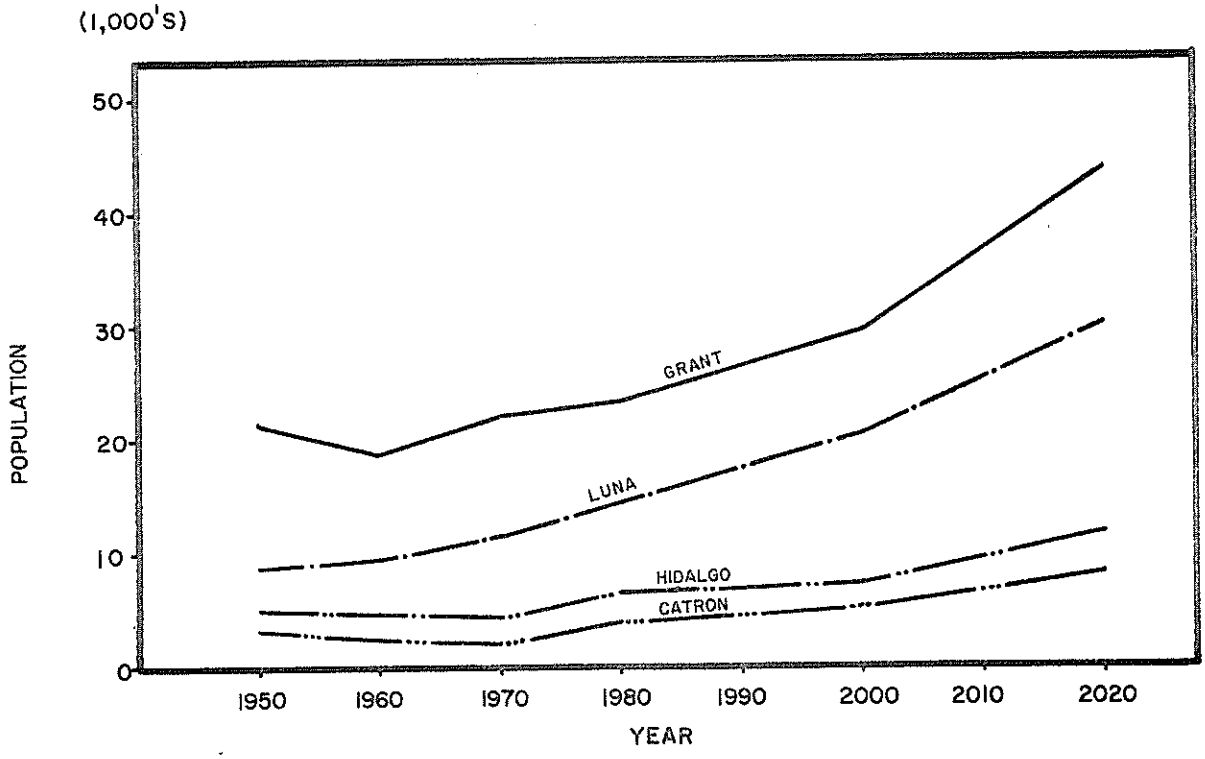


Figure 10. Southwestern Area, total population for 1950-1970, and OBERS projections for 1980, 2000, and 2020.

Agriculture

Ground water is the source for the majority of the irrigation in the area, except for limited areas along the rivers. In 1970, ground water supplied about 84 percent of the irrigated acreage and surface water about 10 percent. Combined ground and surface water supplied the remaining 6 percent of the acreage.

The acreage of irrigated cropland in the area by county for the period 1940 through 1970 with projections for 1980, 2000, and 2020 is presented in table 9 and figure 11. The projections indicate the irrigated acreage will increase by almost 30 percent over 1970, the major increase being essentially in Hidalgo and Luna counties.

Table 9. Acres of irrigated cropland, including idle, fallow, and diverted acreage, Southwestern Area by county, 1940-1970, and projections for 1980, 2000, and 2020

County	Year						
	1940	1950	1960	1970	1980	2000	2020
	- - - - - - - - - - - - - -			acres	- - - - - - - - - - - - - -		
Catron	2,600	2,200	1,900	2,440	2,440	2,440	2,440
Grant	7,500	8,000	7,000	8,010	9,880	10,380	10,880
Hidalgo	3,000	12,000	21,200	35,240	47,340	53,140	58,140
Luna	11,700	25,800	37,000	68,460	75,010	75,010	75,010
Total	24,800	48,000	67,100	114,150	134,670	140,970	146,470

Source: 1940-1970 acreage: Lansford, R. R., and E. F. Sorensen, "Planted Cropland in New Mexico in 1969 and 1970," New Mexico Agriculture--1970, Agricultural Experiment Station Research Report 195, New Mexico State University, Las Cruces, New Mexico, June, 1971, pp 6-12.

Projections for 1980, 2000, and 2020 compiled from estimates of changes in irrigated cropland by the New Mexico State Engineer Office, 1971, 11 pp.

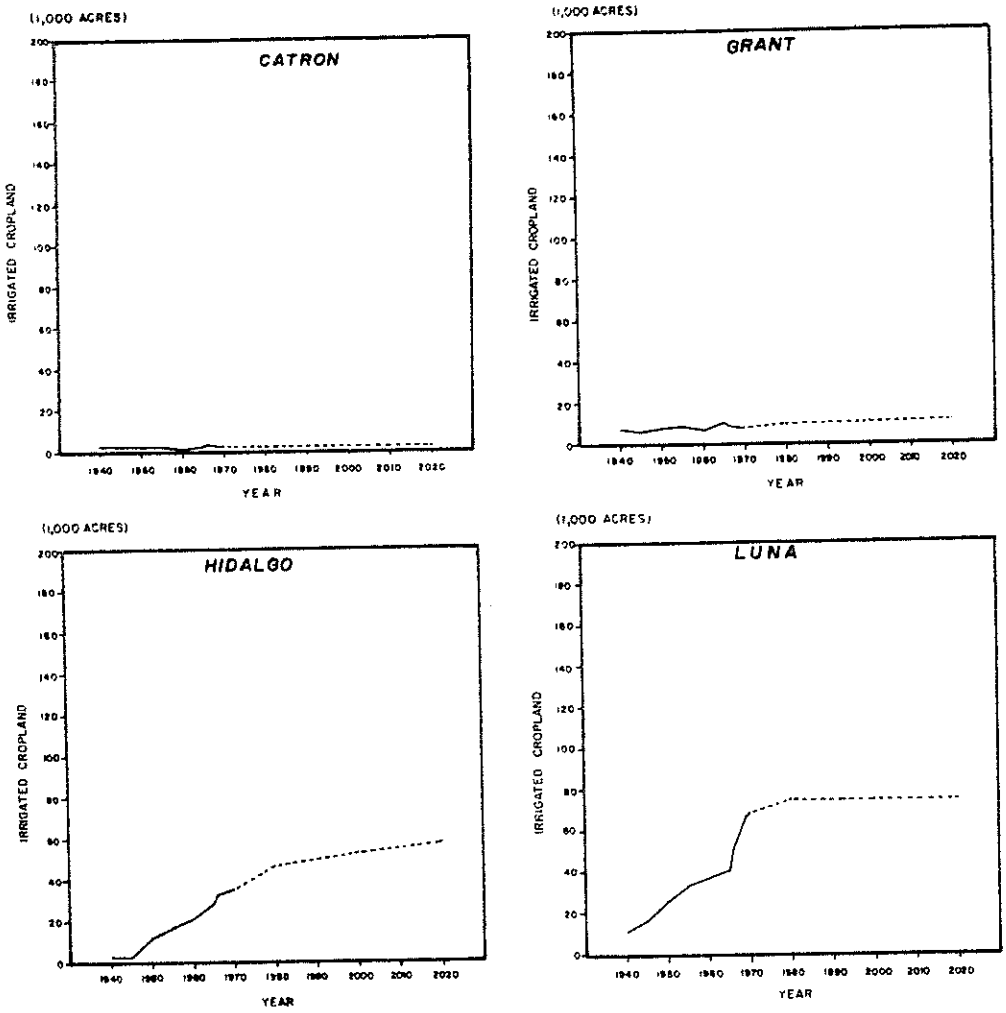


Figure 11. Acres of irrigated cropland, including idle, fallow, and diverted acreage, Southwestern Area by county, 1940-1970, and projections for 1980, 2000, and 2020.

Municipal

Ground water is the major source of municipal water in the area. The total dissolved solids of the water used in the area ranges from about 250 to over 1,300 milligrams per liter (8).

In the area the average daily per capita diversion of urban water averaged about 160 gallons per capita day in 1965 (table 10), and urban diversions are projected to reach about 210 gallons per capita day by the year 2020.

Table 10. Southwestern Area urban water requirements in 1965 and projections for 1980, 2000, and 2020 by county

County	Year			
	1965	1980	2000	2020
	all values are diversions in gallons per capita daily			
Catron	-	-	150	160
Grant	108	150	160	190
Hidalgo	184	200	210	220
Luna	247	250	250	250
Weighted average[1]	160	190	194	210

1 Based on OBERS population projections for 1980, 2000, and 2020.

Source: Memo from Earl F. Sorensen: "Projected Urban, Rural, and Self-Supplied (Manufacture and Industrial) Water Requirements in 1980, 2000, and 2020 in New Mexico," New Mexico State Engineer Office, 1971, 2 pp.

Industrial

Income in the area is derived primarily from the minerals industry, agriculture, and tourist trade. The oldest and most important industry in the area is the extraction and processing of minerals, primarily copper. The value of mineral industry output for this four-county area is several times that of agricultural output, with the major mines located in the Silver City area. The mineral industry ranks second in the number of people employed in the area, following general services and merchandising. Mineral industry requirements of water for the years 1980, 2000, and 2020 for the area are reported in

table 11. These projections indicate that the demand for new water will reach about 84,000 acre-feet in the area by 2020. This is almost twice the water requirements for the mineral industry for the entire state in 1962.

Table 11. Southwestern Area projected mineral industry requirements for water, 1980, 2000, and 2020 by county

County	1980		2000		2020	
	New water[1]	Depletion[2]	New water[1]	Depletion[2]	New water[1]	Depletion[2]
	acre-feet					
Catron	760	580	4,200	2,810	14,400	10,050
Grant	18,620	12,060	37,500	26,045	46,800	34,700
Hidalgo	1,000	465	2,300	1,360	14,400	10,085
Luna	450	315	2,250	1,560	8,400	5,860
Total	20,830	13,420	46,250	31,775	84,000	60,695

1 New water as used in these estimates signifies water used for the first time and does not represent total usage which includes recirculation.

2 Depletion includes water used in evaporation, product assimilation, etc., which is no longer available for basin use.

Source: Memo from New Mexico State Engineer: "Projected Water Requirements for New Mexico Mineral Industries for the Years 1980, 2000, and 2020," by Earl F. Sorensen and Ronald B. Stotelmeyer, New Mexico State Engineer Office and U.S. Bureau of Mines, respectively, April 1970.

Water Resource Problems of the Area

Continued growth of population and economy in the area and the recent U. S. Supreme Court decree in Arizona v. California which limits irrigated acreage and consumptive use of water in the Lower Colorado River Basin in the area are the major problems. In the Gila River and tributaries above Virden Valley the consumptive use of water, for all purposes, may not exceed 136,620 acre-feet during any period of 10 consecutive years, or a maximum of 15,895 acre-feet during any one year.

In the Virden Valley the Gila Decree (Globe Equity No. 59) and the U. S. Supreme Court decree allowed a combined irrigated acreage of 3,250.13 acres. Total depletions for irrigation in this area are estimated to be about 6,400 acre-feet annually. In the San Francisco River and tributaries the consumptive use of water may not exceed 31,870 acre-feet during any period of 10 consecutive years, or a maximum of 4,112 acre-feet during any one year. In the San Simon Creek area the Supreme Court decree also limited the consumptive use of water to 72,000 acre-feet during any 10-year period or a maximum of 8,220 acre-feet during any one year. Under the decrees, the total depletions (consumptive use) of water total to 34,627 acre-feet annually or 304,490 acre-feet during any 10-year period (2,19).

In the Deming, Animas, and Hachita area, water problems are closely related to deficient streamflow and declining ground-water levels. In a study by the U. S. Bureau of Reclamation it was reported that flows of the Mimbres River could be regulated and stored for later use by constructing a reservoir on the main stem above Faywood, which would stabilize the water supply for irrigation, prevent flood damage, and enhance recreational opportunities in the area. Cost of the project apparently exceeded the benefits to be derived from agriculture and flood control, and the project was found infeasible.

Ground water in the Deming, Animas, and Hachita area is being mined as the withdrawals from the underground reservoirs exceed the recharge. In the area south of Deming, the ground-water level dropped as much as 50 feet in certain areas over the 1913-1955 period. The rate of decline has been greater since (as much as 3 feet in the Deming area from January, 1967 to January, 1968). The problem, acute in the Deming area, exists to some extent in all irrigated areas in the area. In the Animas Valley the decline was as much as 20 feet in the 1950-1955 period, and in the Hatchet Gap area the ground-water level dropped about 18 to 20 feet during the period 1948-1957. For the period January, 1967 to January, 1968 the water level declined by as much as 4 and 5 feet in the Animas and Hachita areas, respectively (3).

Projected increases in the irrigated acreage and population in the area will result in increased pumping which will undoubtedly accelerate the water-level problem. When and at what depth it will become unprofitable to pump water for irrigation can only be surmised through consideration of future economics. At present a pumping lift of 300 feet is considered near the economic limit to lift water for general crop production. Lifts in the Deming area averaged about 105 feet in January 1968 (3).

Topic Rankings During Conference Discussions

During the meetings held in the area, a number of topics were discussed concerning the water problems and alternative solutions. At the close of the second meeting, the participants were asked to rank the most important items discussed. The resulting ranking is as follows:

I. Most Urgent Water Supply Problems

1. Inventory of future water needs in area;

2. Present shortages of water for municipal and domestic needs;

3. Need for ground-water studies in area;

4. Increasing municipal demands which may take water out of mining and agriculture;

5. Lack of continuity of programs between community officials, because of term of office, and lack of comprehension and coordination between organizations in area.

II. Water Pollution Problems

1. Soil erosion creating silting problems;

2. Septic tank pollution of domestic water supplies;

3. Lack of complete treatment of community sewage.

III. Improvements in Water-Use Efficiency in Agriculture

1. Improved irrigation efficiency through revised irrigation systems;

2. Reduction of evaporation by use of pipelines for livestock rather than open earthen tanks;

3. Use of concrete lining of ditches and underground pipe to convey irrigation water.

IV. Water Quality and Quantity Problems

1. Limits on agricultural expansion because of the U. S. Supreme Court decree;

2. Lowering of water table which may reduce economic productivity of water;

3. Possible limited development because of quality of water in Silver City and Hanover areas where mineral content is high;

4. Increased salinity because of lowering of water table.

V. Other Topics Discussed (not in ranked order)

a. Water-based recreational possibilities limited by the U. S. Supreme Court decree;

b. Hooker and Conner Dam problems of sufficient water for minimum pool, effects on ground water, possibilities of municipal uses, and evaporation;

c. Pollution of streams in early mining periods;

d. Leveling of farmland and better mechanical preparation of soil;

e. Use of sprinkler systems for irrigation to improve irrigation efficiency.

The discussion in the Silver City conferences for Catron, Grant, Hidalgo, and Luna counties brought out these important points.

1. Present shortages of water for municipal and industrial uses were emphasized by several of the Grant County communities. However, a U. S. Geological Survey study soon to be released was cited to indicate that the several communities in the Silver City area might join together and develop adequate water supplies about 15 miles south of Silver City which could be piped in for all nearby water-short communities including Silver City. This was thought to be a more suitable solution than the plan to import water from the Gila River drainage area.

2. Water pollution from septic tanks and city sewage plants was pointed out as a growing problem which must be solved before the condition becomes acute.

3. Lack of continuity of programs within agencies and between agencies was cited as a problem, because with continual changes in agency personnel many developments seem to be lost or set back until new personnel in the agencies involved is able to find the information or develop new information on certain projects.

4. Increased irrigation efficiency through improvement in transportation of irrigation water to the fields and the application of the water to the field was mentioned for all areas where irrigation is practiced.

5. Water based recreation has been limited by the issuance of the Supreme Court decree in the Arizona v. California case. It pointed out that additional water-based recreational areas are needed to meet the growing demand for all recreation, particularly near the forested areas.

SOUTHCENTRAL NEW MEXICO AREA

SIERRA, DONA ANA, AND OTERO COUNTIES

Introduction

The Citizens' Water Conferences were held in Las Cruces for the Southcentral Area, which includes Sierra, Dona Ana, and Otero counties (figure 12). The area encompasses about 12 percent of the total land area of the state and has about 12 percent of the state's population. The major population centers are Las Cruces, Alamogordo, and Truth or Consequences.

The climate of the area is predominately semiarid. The annual precipatation usually averages less than 10 inches, but may exceed 20 inches in the higher elevations.

The principal river in the area is the Rio Grande, which runs from north to south through Sierra and Dona Ana counties. The Tularosa River is the major stream in Otero County. The flow of the Rio Grande is stored for irrigation in two major reservoirs within the area: Elephant Butte Reservoir and Caballo Reservoir (figure 12).

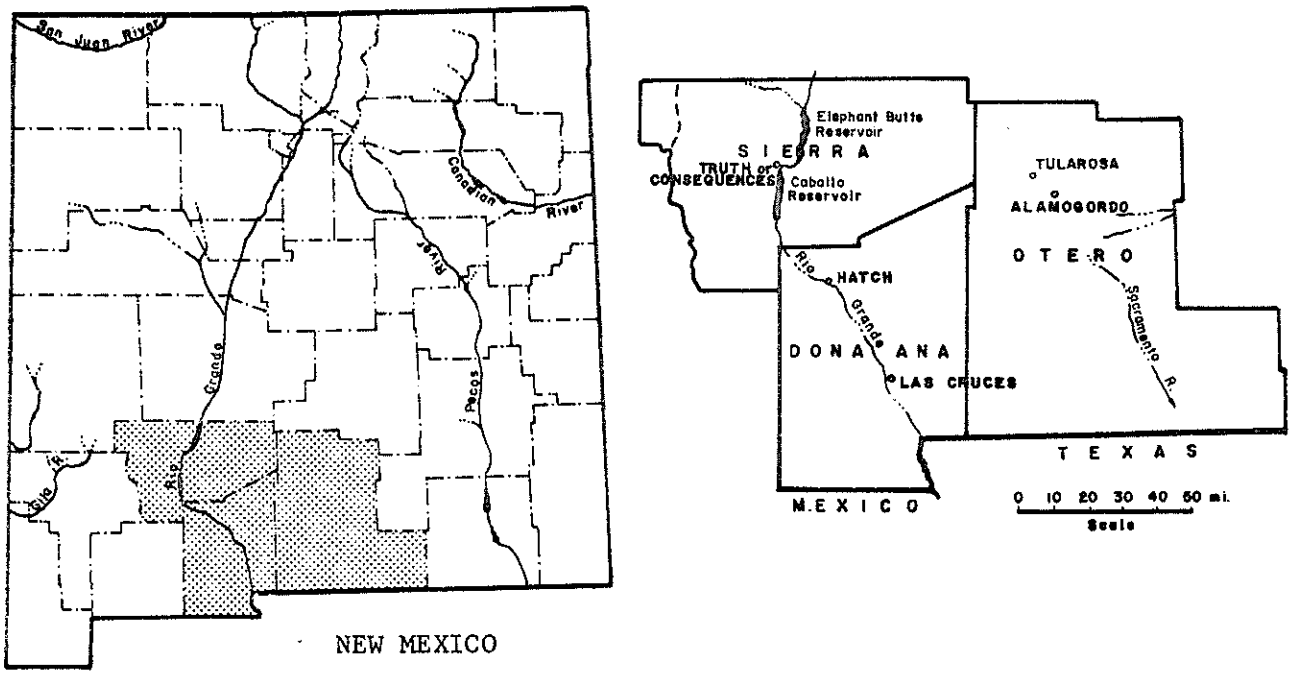


Figure 12. Maps showing counties in Southcentral New Mexico Area.

Population

Slightly over one-half of the total 1970 area population of 118,059 was concentrated in the three major cities. Most of the remaining population is located along the Rio Grande and near Alamogordo with a large portion of the area being sparsely populated, containing only small communities and scattered ranches. The total population by county for the area from 1950 to 1970 with projections to 1980, 2000, and 2020 is reported in table 12 and graphed in figure 13. The population of the area has increased quite rapidly since 1950 and the projections of population growth indicate that the area should reach over 380,000 by 2020 (table 12). Most of this increase is projected to be in Dona Ana and Otero counties (figure 13).

Table 12. Total population for the Southcentral Area by county for 1950-1970, and OBERS projections for 1980, 2000, and 2020

	Year					
County	1950	1960	1970	1980	2000	2020
Sierra	7,186	6,409	7,189	7,800	11,100	13,700
Dona Ana	39,557	59,948	69,773	109,300	148,400	252,400
Otero	14,909	36,976	41,097	48,200	68,600	115,200
Total	61,652	103,333	118,059	165,300	228,100	381,300

Source: 1950-1970: United States Census of Population - New Mexico, 1950, 1960, and 1970.

1980-2020: Office of Business Economics of the Commerce Department and Economic Research Service, USDA, (OBERS), compiled by State Engineer Office, 1971.

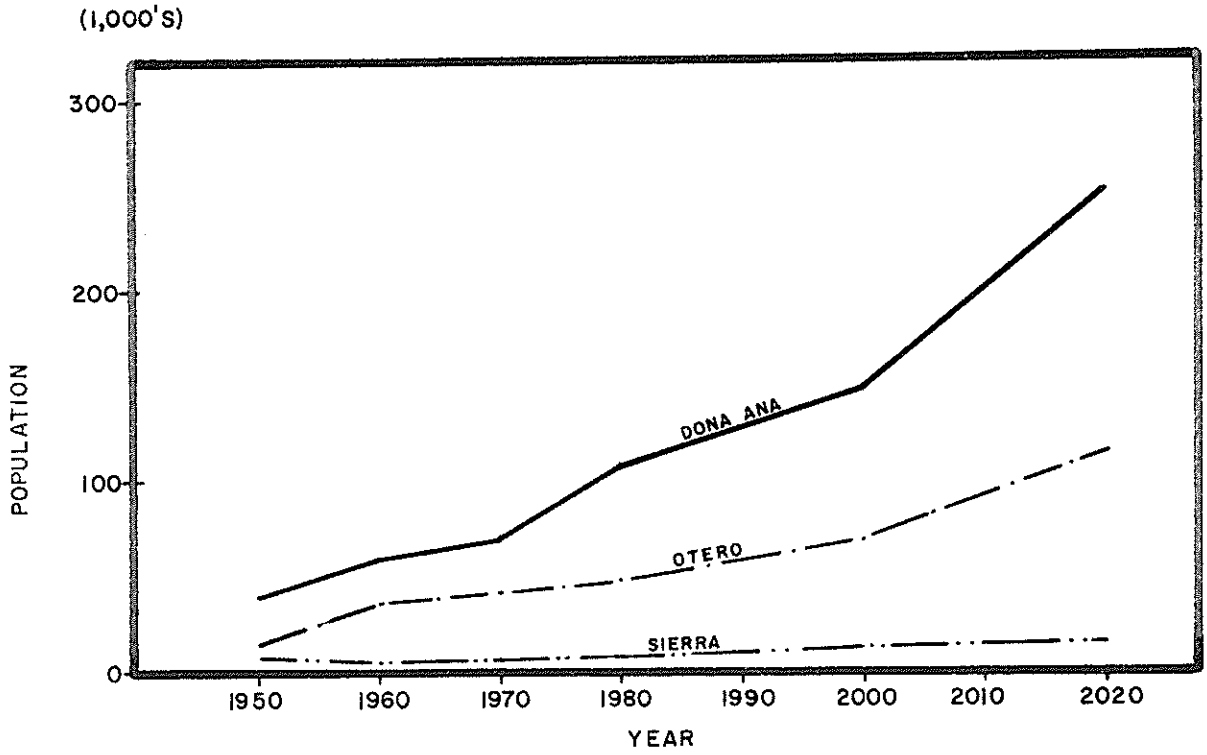


Figure 13. Southcentral Area, total population for 1950-1970, and OBERS projections for 1980, 2000, and 2020.

Agriculture

Both ground and surface water are utilized in the irrigation of the cropland. The lands irrigated in the Rio Grande Valley receive water through the waters of the Elephant Butte Irrigation District and from ground water which is used primarily to supplement the surface source. The lands are primarily in the valley flood plains between Caballo Dam and the Texas-New Mexico state line. Irrigation of lands with ground water only is practiced in the Rio Grande Valley both within and outside the district boundaries in Sierra and Dona Ana counties. In Otero County irrigation farming is carried on to a lesser extent in the Tularosa and Alamogordo area and at Crow Flats in the extreme southeastern portion of the county. In the Tularosa area about 3,070 acres of land are irrigated with surface water, 4,800 acres with ground water, and 1,000 acres with a combination of the two (22). More than 80 percent of the surface irrigated lands receive water from the Rio Tularosa. Many small tracts of land irrigated from streams originating

in the Sacramento Mountains have been purchased by the City of Alamogordo and the water rights transferred from agricultural to municipal uses. In the Crow Flats area ground water is used for irrigation.

The acreage of irrigated cropland in the area by county for the period 1940-1970 and projections for 1980, 2000, and 2020 are presented in table 13 and in figure 14. The projections for 1980, 2000, and 2020 indicate that the development of irrigated cropland in the area has essentially leveled off in Dona Ana and Sierra Counties and may increase about 9,000 acres from 1970 to 2020 in Otero County (table 13 and figure 14), unless the water for present or potentially irrigated acres is diverted to municipal, industrial, and recreational uses.

Table 13. Acres of irrigated cropland, including idle, fallow, and diverted acreage, Southcentral Area by county, 1940-1970, and projections for 1980, 2000, and 2020

County	Year						
	1940	1950	1960	1970	1980	2000	2020
	acres						
Sierra	4,800	5,200	7,000	8,840	9,470	9,470	9,470
Dona Ana	76,500	86,000	90,800	98,310	98,890	98,890	98,890
Otero	4,600	11,700	14,300	13,130	16,900	19,900	22,900
Total	85,900	102,900	112,100	120,280	125,260	128,260	131,260

Source: 1940-1970 acreage: Lansford, R. R., and E. F. Sorensen, "Planted Cropland in New Mexico in 1969 and 1970," New Mexico Agriculture--1970, Agricultural Experiment Station Research Report 195, New Mexico State University, Las Cruces, New Mexico, June, 1971, pp 6-12.

Projections for 1980, 2000, and 2020 compiled from estimates of changes in irrigated cropland by the New Mexico State Engineer Office, 1971, 11 pp.

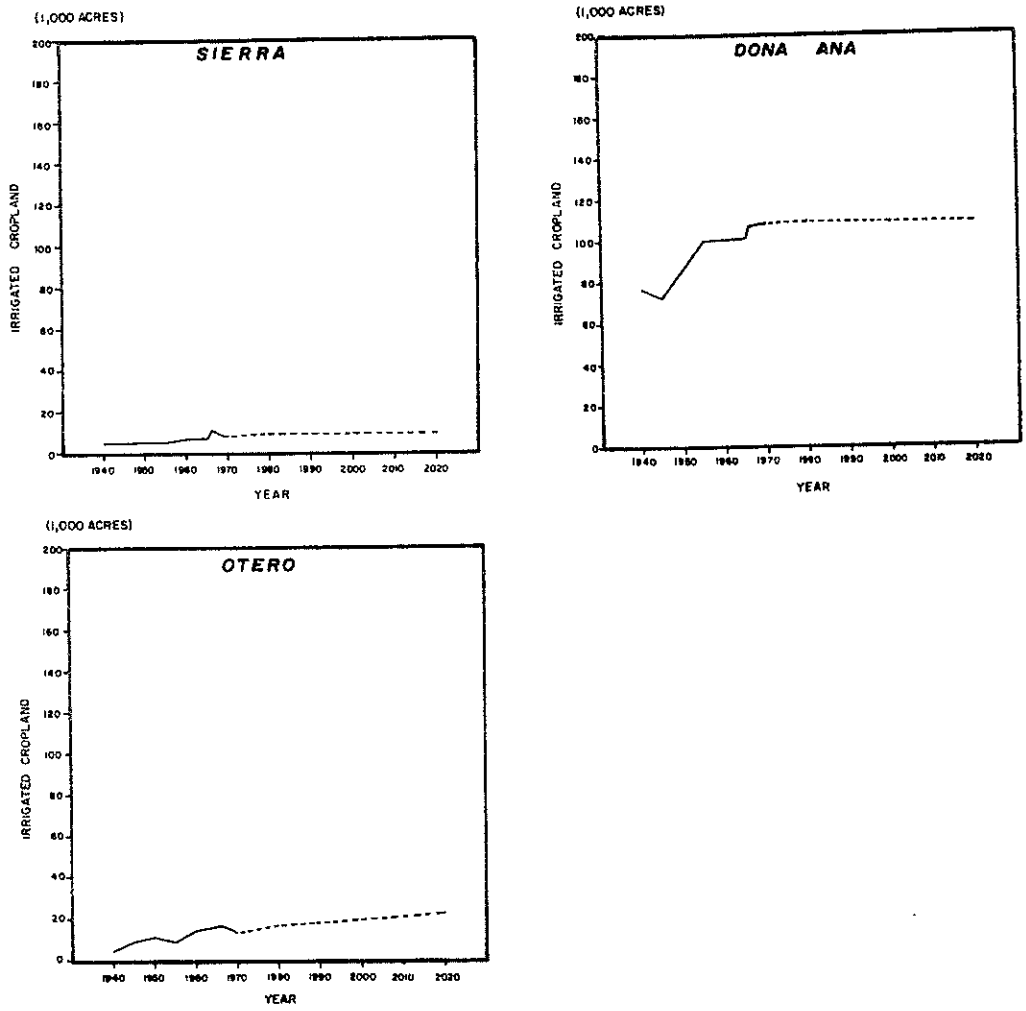


Figure 14. Acres of irrigated cropland, including idle, fallow, and diverted acreage, Southcentral Area by county, 1940-1970, and projections for 1980, 2000, and 2020.

Municipal

Ground water is used primarily for municipal supplies in the area. The city of Alamogordo uses a combination of spring water, lake water, and ground water in its municipal supply. The community of Tularosa gets most of its water from Rio Tularosa, but also pumps some water. The total dissolved solids of the water used in the area ranges from 300 to over 2,800 milligrams per liter (5,8). In some communities, such as Alamogordo, the quality of the municipal supplies are declining with increased use.

In the area the average annual per capita diversion for urban uses ranges from about 172 gallons per day in Otero County to about 195 gallons per day in Dona Ana County (table 14). Urban diversions are projected to reach a weighted average of 237 gallons per capita day by the year 2020 (table 14).

Table 14. Southcentral Area urban water requirements in 1965 and projections for 1980, 2000, and 2020 by county

County	Year			
	1965	1980	2000	2020
	all values are diversions in gallons per capita daily			
Sierra	183	190	200	210
Dona Ana	195	200	220	250
Otero	172	190	200	210
Weighted average	186	197	213	237

1 Based on OBERS population projections for 1980, 2000, and 2020.

Source: Memo from Earl F. Sorensen: "Projected Urban, Rural, and Self-Supplied (Manufacture and Industrial) Water Requirement in 1980, 2000, and 2020 in New Mexico," New Mexico State Engineer Office, 1971, 2 pp.

Industrial

Income in the area is derived primarily from government, agriculture, and tourist trade. The most important in terms of employment is the government sector and related support. Manufacturing is not carried on to a large extent, but there are a few manufacturing enterprises of appreciable size in the area with more in the planning stage. The mineral industry in the area is relatively small.

Water Resource Problems of the Area

The continued growth of the population and economy in the area are the major problems. In the Rio Grande area, development of the water resources must be considered under the various interstate compacts. In Sierra and Dona Ana counties the surface and ground water are intimately connected in the Rio Grande Basin and the pumping of ground water depletes surface supplies at certain locations. Increased pumping is expected to infringe upon the valid rights of the surface water users.

In Otero County the supplies of surface water are limited. There are, however, large reserves of marginal and impotable water which may become exploitable for urban uses with improvements in the desalting processes. The ground-water supplies in the area are barely sufficient to serve the present population. Alamogordo and Holloman Air Force Base have an allocation of 1.27 million gallons daily each from the approximately 80-mile long, 20 inch pipeline from Bonita Lake. Alamogordo held a right for 2.54 million gallons daily from Bonita Lake. However, by a joint use agreement the Air Force rebuilt 74.41 miles of the line and agreed to pay $24,000 per year for pipeline maintenance and received a right for one-half of the pipeline deliveries. The Bonita Lake supply is not consistently reliable since the recharge of the lake depends on rainfall and winter snows in the high mountain area. Some additional but limited supplies of usable water may be obtained from the Grapevine Canyon area approximately 20 miles south of Alamogordo. There are large quantities of medium to high salinity water in most of the basin which may be converted to usable quality by desalting. The armed forces have recently installed a 100,000 gallon per day desalting plant at the Stallion Range Site in the northwestern section of the basin.

Topic Rankings During Conference Discussions

During the meetings held in the area, a number of topics were discussed concerning the water problems and alternative solutions. At the close of the second meeting, the participants were asked to rank the most important items discussed. The resulting ranking is as follows:

I. Most Urgent Water Supply Problems

1. Determining of needs and supplies (It is important to know how many people can be taken care of before communities attempt to attract new people and industry. There is a need for complete studies of ground water in areas.);
2. Defining water quality problems;
3. Allocation--both now and in future;
4. Decision on whether agriculture should give way to municipal uses and other nonagricultural uses;
5. Low quality water in Alamogordo area.

II. Water Pollution Problems

1. Lower water quality resulting from increased use;
2. Increase in salt build-up in irrigated cropland;
3. Population increasing faster than water and sewer development;

4. Need for central sanitary land fill to control some pollution problems.

III. Improvements in Water-Use Efficiency in Agriculture

1. Improved irrigation systems;

2. Improved irrigation practices;

3. Elimination of nonbeneficial evaporation and deep percolation;

4. Erosion control and silt movement control.

IV. Water Quality and Quantity Problems

1. Demand for higher quality water in city system;

2. Water quality standards not compatible between New Mexico and Texas;

3. Quantity problems between recreational demands and agricultural development.

V. Other Topics Discussed (not in ranked order)

a. Importations of water for agricultural uses and use of existing supplies for municipal, industrial, and other uses;

b. Pollution of river by sewage plants because of capital limitations;

c. Nitrate pollution possibly caused by agriculture;

d. Use of meters and gauges for improved irrigation efficiency.

The discussion in the Las Cruces conferences for Sierra, Dona Ana, and Otero counties brought out the following important points.

1. Surface and ground-water studies were emphasized particularly for both Dona Ana and Otero counties. The population has grown rapidly in both counties due to military and industrial developments and further increases are in the discussion stages.

   The Alamogordo-Holloman-White Sands Monument area needs a comprehensive study for all three communities with the cooperation of the U. S. Geological Survey and the State Engineer

Office. A desalting plant may be the most feasible long-run solution to the water problem, but this cannot be determined without some exploration drilling and pumping tests to determine the potentials for developing the Grapevine Canyon area as compared with a desalting plant in the vicinity of Alamogordo.

A comprehensive water-balance study is needed of both the surface and ground water in the Mesilla-Rincon area. This would then be followed by an exploration drilling and pumping test program to determine the potentials of a more complete development of the combined surface and ground-water resources of the area. This may be conducted in advance of or in conjunction with a study of the total resources and development potentials of the area from Fort Quitman, Texas, to San Marcial, New Mexico, along the Rio Grande.

2. Quality of ground water, particularly in connection with pumping for irrigation was discussed at great length. Specific water quality studies are needed to determine the effect of pumping and of irrigation on the water quality. The quality of water as it may be affected by septic tanks and small home wells was considered for all these counties. The projected 9,000 acre increase in irrigated land in Otero County should be very carefully considered in connection with the over-all demand for potable water in the Tularosa Basin for industrial and municipal uses and availability of sufficient additional supplies of quality land and water for irrigation.

3. Problems of water allocations, now and in the future, were considered in connection with the continuing subdivision of irrigated tracts for residential and commercial uses. Also considered was the means by which water may be transferred between uses, and still protect the rights of both types of users involved in these transfers. Since water knows no property boundaries, it is not a simple matter to determine the effect of one type of withdrawal and use on the other types of withdrawals and uses.

4. Pollution of rivers and ground waters by septic tanks and city sewage disposal. These problems are developing along the streams and drainages, particularly in the Sacramento Mountains. The pollution is coming from trailer camps and small subdivisions which are developing rapidly in many areas of New Mexico. The ineffectiveness of even the larger sewage systems, particularly in Las Cruces, was noted. Properly trained and paid management personnel for these plants was pointed out as a must if this problem is to be solved.

SOUTHEAST CENTRAL NEW MEXICO AREA

LINCOLN, CHAVES, AND EDDY COUNTIES

Introduction

The Southeast Central Area Citizens' Water Conferences were convened in Artesia. The counties of Lincoln, Chaves, and Eddy (figure 15) are included in this area, which encompasses about 12 percent of the total area of the state and slightly over 9 percent of the total population. The major population centers are Artesia, Carlsbad, Roswell, and Carrizozo.

The annual precipitation averages about 10 inches but may exceed 20 inches in the higher elevations.

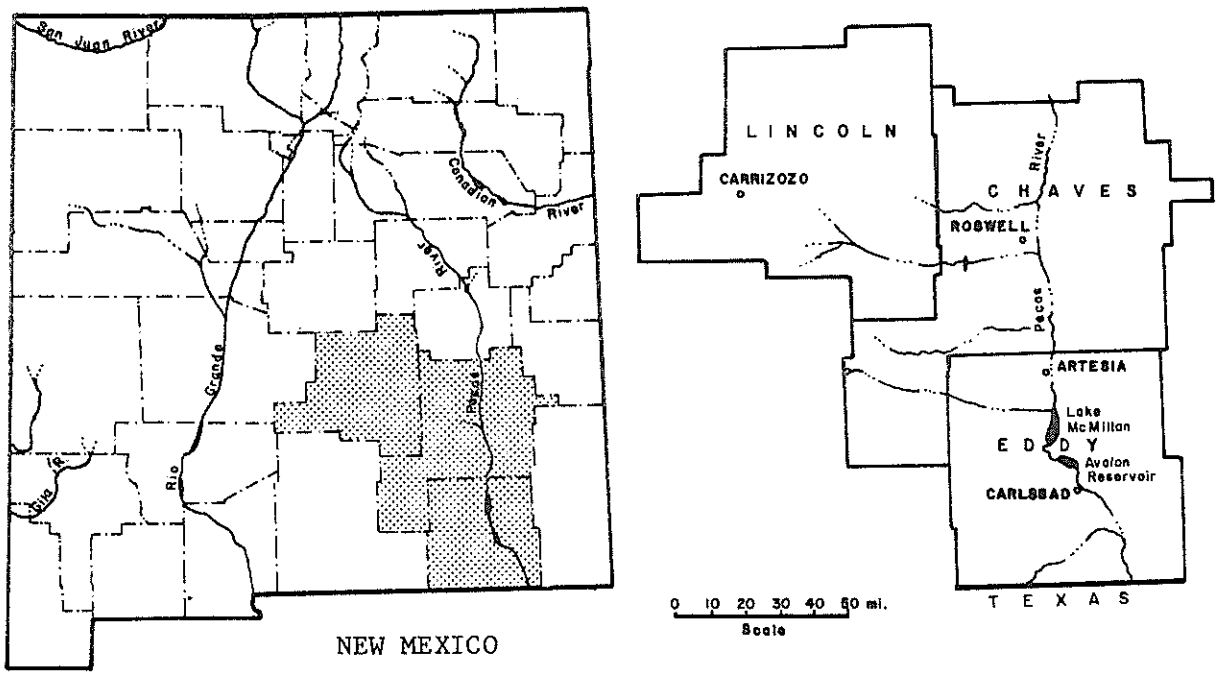


Figure 15. Maps showing counties in Southeast Central New Mexico Area.

Most of the area lies within the Pecos River drainage basin, except about one-third of western Lincoln County which is within the Central closed basin. The principal river in the area is the Pecos River, which originiates in the Sangre de Cristo Mountains in northwestern San Miguel County. The principal tributaries of the Pecos River in the area are the Rio Hondo, Rio Felix, Rio Penasco, and Black River, which drain the area west of the river. The flow of the Pecos River is partially regulated by Alamogordo and McMillian Reservoirs, and the Rio Hondo by Two Rivers Reservoir (figure 15).

Population

In 1970, over 90 percent of the area population resided in Chaves and Eddy counties, over two-thirds of which was concentrated in the three largest cities of Roswell, Artesia, and Carlsbad.

Most of the remaining population of Chaves and Eddy counties is located along the Pecos River in small communities and on farms. A large portion of the three county area is sparsely populated, containing small communities and scattered farms and ranches. The total population by county for the area from 1950 to 1970 with projections for 1980, 2000, and 2020 is reported in table 15 and graphed in figure 16. The population of Chaves and Eddy counties declined from 1960 to 1970 because of reductions in military installations and mining activity. The population of this area is projected to increase about three times, from 92,000 in 1970 to over 270,000 by 2020 (table 15). Most of the increase in population is projected for Chaves and Eddy counties, with Lincoln County's population remaining relatively stable (figure 16).

Table 15. Total population for the Southeast Central Area by county for 1950-1970, and OBERS projections for 1980, 2000, and 2020

	Year					
County	1950	1960	1970	1980	2000	2020
Lincoln	7,409	7,744	7,560	11,700	16,700	19,200
Chaves	40,605	57,649	43,335	74,200	100,100	150,900
Eddy	40,640	50,783	41,119	53,400	68,700	101,500
Total	88,654	116,176	92,014	139,300	185,500	271,600

Source: 1950-1970: United States Census of Population - New Mexico, 1950, 1960, and 1970.

1980-2020: Office of Business Economics of the Commerce Department and Economic Research Service, USDA, (OBERS), compiled by State Engineer Office, 1971.

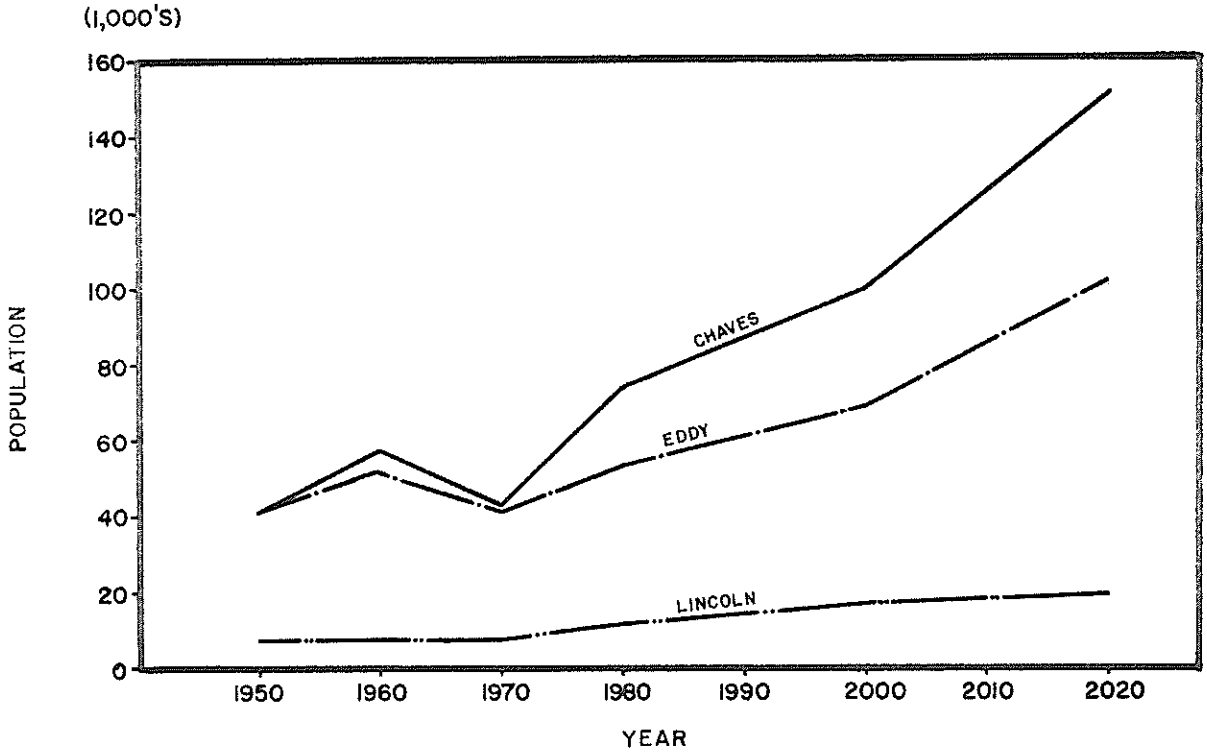


Figure 16. Southeast Central Area, total population for 1950-1970, and OBERS projections for 1980, 2000, and 2020.

Agriculture

Surface and ground water both are used for irrigation in the area. The principal irrigated lands are in the Roswell-Artesia and Carlsbad area. Irrigation to a lesser extent is carried on along the Rio Hondo, Rio Felix, Rio Penasco, and Black River. Most of the irrigated lands in the area utilize ground water as the primary source of irrigation water (table 16).

Irrigation with surface water started about 1880 near Roswell and in the middle 1800s on the tributaries. By 1920, the use of surface water had increased to the extent that users became concerned about the availability of supplies. The "Hope Decree," issued in 1933, defined the rights of water use in most areas above Lake McMillian and established priorities, diversion rates, and storage quantities for the Carlsbad Irrigation District.

Table 16. Acreage irrigated by source of water for the Southeast Central Area, by county

Area	Surface Water	Ground Water	Surface and Ground Combined
	- - - - - - - - acres - - - - - - - -		
Roswell-Artesia[1]	9,470	115,270	14,030
Rio Hondo	1,000	350	2,650
Rio Penasco	1,200	200	1,400
Carlsbad Irrigation District	7,300	--	13,100
Carlsbad (non-project)	2,990	4,900	--
Black River	400	--	940
Rattlesnake Springs	--	720	--
Delaware River	--	--	700
Pecos River near state line	--	400	--
Total	22,360	121,840	32,820

1 Includes Rio Felix area.

Source: Sorensen, E. F., and Robert L. Borton, "Settlement, Development, and Water Use - Pecos River Basin," Water Resources of New Mexico - Occurrence, Development, and Use, State Planning Office, Santa Fe, New Mexico, 1967, p 88.

Ground water used for irrigation in the Roswell-Artesia area comes from two primary sources--the artesian aquifer and the alluvium. The flowing artesian ground water was first discovered in 1891. After 1900, this source of water began to be used for irrigation and extensive development occurred until 1931 when the Roswell-Artesian Underground Basin was established. The shallow water (alluvium) was not extensively developed during the period of artesian development, but by 1937 had become a major source of supply. This source was closed to further development for irrigation in 1937.

In 1956, the State Engineer and the Pecos Valley Artesian Conservancy, through court action, started the adjudication to determine water rights, both artesian and shallow aquifers, in the Roswell-Artesian Basin. A companion suit filed to include the Hagerman Canal rights was consolidated with the original suit. The District Court of Chaves County filed a partial final judgment and decree in January 1966. The duty of water for irrigation was established at three acre-feet per acre per annum, to be exceeded in any one year provided that the total amount diverted during any period of five consecutive years shall not exceed five times the annual duty of water. The court order also called

for water meters to be placed on all irrigation wells by January 1, 1967. The court retained jurisdiction in the case, which was reopened in 1969, wherein one-half acre-foot per acre was allowed for delivery losses until the actual conveyance losses could be determined.

The acreage of irrigated cropland in the area by county for the period 1940-1970 and projections for 1980, 2000, and 2020 are presented in table 17 and in figure 17. The projections indicate that the development of irrigated cropland in the area will essentially level off at the 1970 level in all three counties.

Table 17. Acres of irrigated cropland including idle, fallow, and diverted acreage, Southeast Central Area by county, 1940-1970, and projections for 1980, 2000, and 2020

County	Year						
	1940	1950	1960	1970	1980	2000	2020
	acres						
Lincoln	4,800	5,900	4,600	4,600	4,100	4,100	4,100
Chaves	72,600	89,200	97,600	105,730	105,730	105,730	105,730
Eddy	57,700	70,100	73,800	78,000	78,000	78,000	78,000
Total	135,100	165,200	176,000	188,330	187,830	187,830	187,830

Source: 1940-1970 acreage: Lansford, R. R., and E. F. Sorensen, "Planted Cropland in New Mexico in 1969 and 1970," New Mexico Agriculture--1970, Agricultural Experiment Station Research Report 195, New Mexico State University, Las Cruces, New Mexico, June, 1971, pp 6-12.

Projections for 1980, 2000, and 2020 compiled from estimates of changes in irrigated cropland by the New Mexico State Engineer Office, 1971, 11 pp.

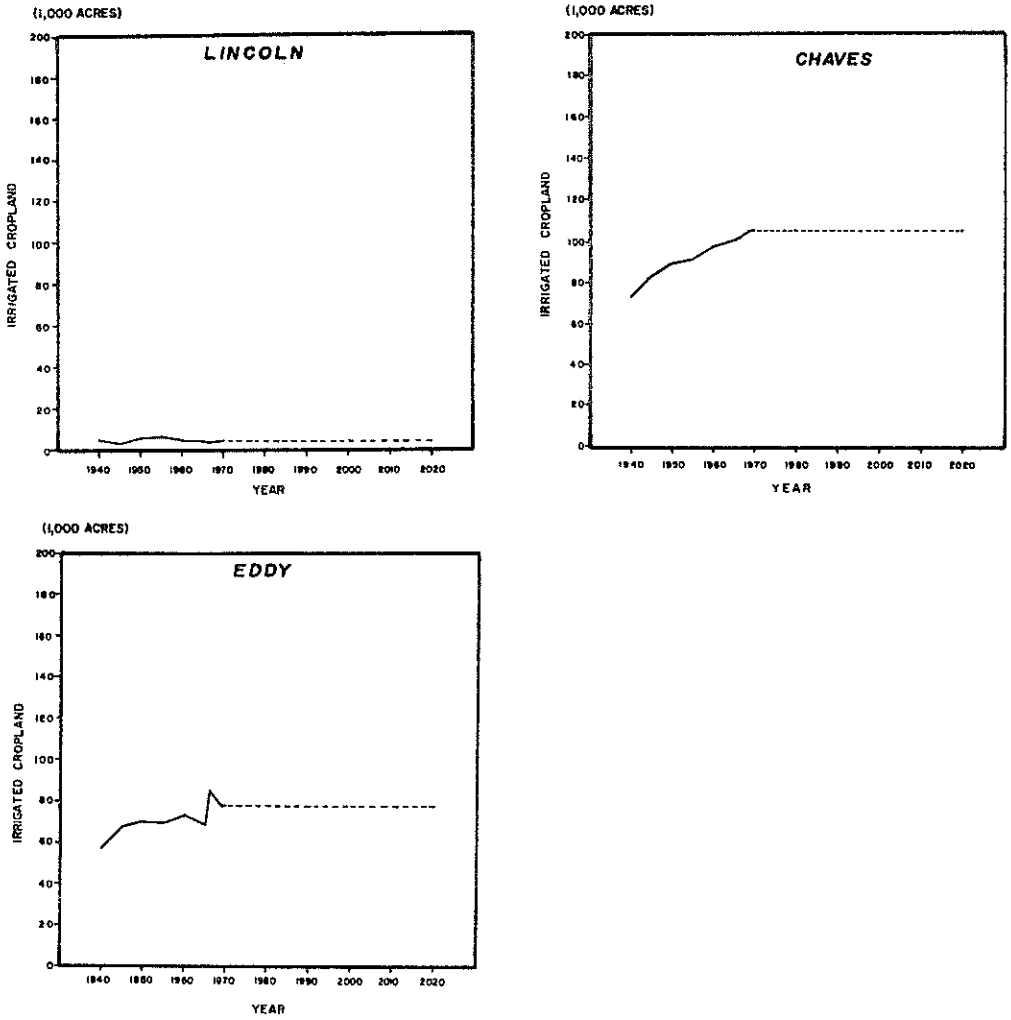


Figure 17. Acres of irrigated cropland, including idle, fallow, and diverted acreage, Southeast Central Area by county, 1940-1970, and projections for 1980, 2000, and 2020.

Municipal

Ground water is used primarily for urban supplies in the area, but small communities in Lincoln County use surface water from Bonito Lake, streams and springs. The quality of the water used in the area ranges from about 100 to over 2,300 milligrams per liter (6).

The average annual per capita diversions of urban water ranges from about 99 gallons per day in Lincoln County to about 270 gallons per day in Chaves County (table 18). Weighted average urban diversions of water for the area were about 248 gallons per capita day in 1965 and are projected to be about 246 gallons per capita day by the year 2020 (table 18).

Table 18. Southeast Central Area urban water requirements in 1965 and projections for 1980, 2000, and 2020 by county

County	Year			
	1965	1980	2000	2020
	all values are diversions in gallons per capita daily			
Lincoln	99	150	160	190
Chaves	270	250	250	250
Eddy	249	250	250	250
Weighted average[1]	248	242	242	246

1 Based on OBERS population projections for 1980, 2000, and 2020.

Source: Memo from Earl F. Sorensen: "Projected Urban, Rural, and Self-Supplied (Manufacture and Industrial) Water Requirements in 1980, 2000, and 2020 in New Mexico," New Mexico State Engineer Office, 1971, 2 pp.

Industrial

The economy of the area is based primarily on the recovery and processing of oil and gas, agriculture, ranching, tourism, and the mining and processing of potash. Recreation is also becoming increasingly important in the area. The oil fields and the industries connected with them are confined primarily to eastern Chaves and Eddy counties. The mining of potash salts near Carlsbad was a major factor

in the economic development of the area. The mining of precious and base metals, once a major industry in Lincoln County, is practically nonexistent today. The lumber industry in the area is located primarily in Lincoln County, which has 260,500 acres of commercial forest land.

Total depletions of water by industry is small compared to agriculture. Mineral industry depletions account for the largest portion, and projections of these depletions for 1980, 2000, and 2020 are 10,105, 22,305, and 40,330 acre-feet, respectively.

Water Resource Problems of the Area

There is an abundance of good land in the area with the limit of development being the availability of water of satisfactory quality. Both the quantity and quality of the water supplies are limiting factors in the area. Salinity of the ground water has become acute in the Roswell area. The quality of the surface water is marginal in some places, due to the inflow of springs high in dissolved-solids content, irrigation return flow, leakage of oil-field brines from the unused surface-evaporation disposal pits, and the consumptive use of phreatophytes.

Large-scale withdrawal of ground water in the Roswell-Artesia area has resulted in a long-term net loss of ground-water storage. Water level declines in the area have been as great as 85 feet in the period 1944-1960. Pumpage from shallow and artesian aquifers in the Roswell area, plus the natural discharge to the Pecos River, exceeded the recharge to the aquifers, both natural and artificial, by more than 120,000 acre-feet annually (23). A reduction in the amount of irrigation depletions since 1967 has slowed the salt encroachment of saline water in the fresh artesian aquifer to some extent and has tended to stabilize the declining artesian pressures.

Topic Rankings During Conference Discussions

During the meetings held in the area, a number of topics were discussed concerning the water related problems of the area. The mining of the ground water and the salt encroachment in the Roswell area were considered major problems. At the close of the second meeting, the participants were asked to rank the most important water problems discussed. This ranking is as follows:

I. Most Urgent Water Supply Problems

1. Re-evaluation of Pecos River Compact to permit control of flooding and silting through larger dams and impoundments on rangeland;

2. Mining of ground water in Roswell-Artesian Basin;

3. Watershed management on rangeland;

4. Transportation and storage of existing supplies of present water resource to obtain maximum use;

5. Improving management of irrigation water.

II. Water Pollution Problems

1. Salt water encroachment in both ground and surface sources;

2. Over-utilization of existing supplies, which is lowering the quality of water;

3. Sediment;

4. Lower water quality from sewage effluent going into Pecos River.

III. Improvements in Water-Use Efficiency in Agriculture

Rangeland:

1. Improved grazing systems to keep moisture from running off and eroding the land;

2. Pipe lines and troughs to more fully utilize rangelands;

3. Better distribution of water on rangelands through the use of spreader dams;

4. Revision of tank construction design to reduce seepage and evaporation of water from stock tanks.

Irrigation:

1. Installation of concrete-lined ditches;

2. Pipe lines to transport water and stop leaching below root zones;

3. Educational program on methods of more efficient irrigation;

4. Land levelling.

IV. Other Topics Discussed (not in ranked order)

a. Limited surface water irrigation because of limited supply of water;

b. Limited water for recreation development;

c. Storage to hold and prevent run-off of irrigation water;

d. Increasing salinity of ground water;

e. Flood run-off control on rangeland;

f. Dumping of tailings by several potash mines without regard to where they go;

g. Possibility of feedlot water run-off getting in streams or poorly constructed wells;

h. Contamination of water by septic tanks;

i. Contamination of water by pesticides;

j. Noxious brush control;

k. Constructing of 10 acre-feet ponds wherever possible on rangeland to alleviate flooding;

l. Prevention of deep leaching;

m. Evaporation control - from plants and soil;

n. Crop use efficiency education program, e.g., the selection of crops that use less water but provide same level of income.

The discussion in the Artesia conferences for Lincoln, Chaves, and Eddy counties brought out these important points.

1. Mining of ground water in the Pecos Basin was emphasized as a major concern now as it has been since the early 1930s when the New Mexico ground-water law was put into effect in the Roswell-Artesian Basin. The withdrawals appear to be exceeding recharge by about 30 percent in the Roswell-Artesian Basin. There was a near universal decline in the water tables in 1970. The water table has been lowered to the extent that some wells are no longer usable; there is an increase in operating costs due to increased pumping depths, and a decreased pumping efficiency. Well metering was started in 1967. The average water usage in 1970 was 2.98 acre-feet per acre.

2. Salt encroachment is associated with the draw down of the water table. The reduced hydrologic pressures permit salt water to move in, particularly to the north and east of Roswell. As the general water table continues to be lowered,

it is expected that salt encroachment will increase. The water table was lowered by as much as 16 feet in the Dexter-Hagerman area in 1970.

3. An inventory of future water needs was recommended to determine how much water may be needed for industrial, municipal, recreational, and agricultural uses, and to determine what adjustments may be required to meet the needs of the expected increase in population by the year 2000 and 2020 and beyond. It appears certain that there must be a decrease in the total irrigated land in these counties due to the present declines in the water table and the expected population increases. Municipal, industrial, and mining uses would have to increase to provide future employment requirements.

4. Improved irrigation efficiency was pointed to as a means of reducing the required pumping and thus extending the life of the ground-water reserves. Since agriculture is using about 93 percent of the total water used in these counties, a 10 to 15 percent increase in water use efficiency could make a major contribution to the reduced water demands by agriculture. The Pecos Valley Artesian Conservancy District is purchasing the water rights from various tracts of land in order to assist in reducing the water demands by agriculture.

5. Pollution by sewage effluent. Lack of complete sewage treatment by some municipalities and in septic tanks and in some cases little or no treatment in smaller communities and trailer parks were noted as problems needing consideration and correction.

SOUTHEASTERN NEW MEXICO AREA

CURRY, ROOSEVELT, AND LEA COUNTIES

Introduction

The Citizens' Water Conferences for the Southeastern Area were held at Portales. The area includes Curry, Roosevelt, and Lea counties (figure 18), and has a total land area of 5,280,640 acres, about 7 percent of the total land area of the state. The 1970 population was 105,550, about 10 percent of the state population.

The area generally encompasses the southern high plains region in New Mexico. There are no permanent streams in the area and only a few intermittent streams that flow following thunderstorms. The area slopes gently to the east and southeast, and with few exceptions, is remarkably smooth. The nearly featureless grassy surface is characteristically dotted with many broad shallow depressions called "buffalo wallows," and together the draws constitute the only semblance of surface drainage in the area.

The annual precipitation for the area averages about 16 inches and the mean annual temperature about 59.5 degrees F.

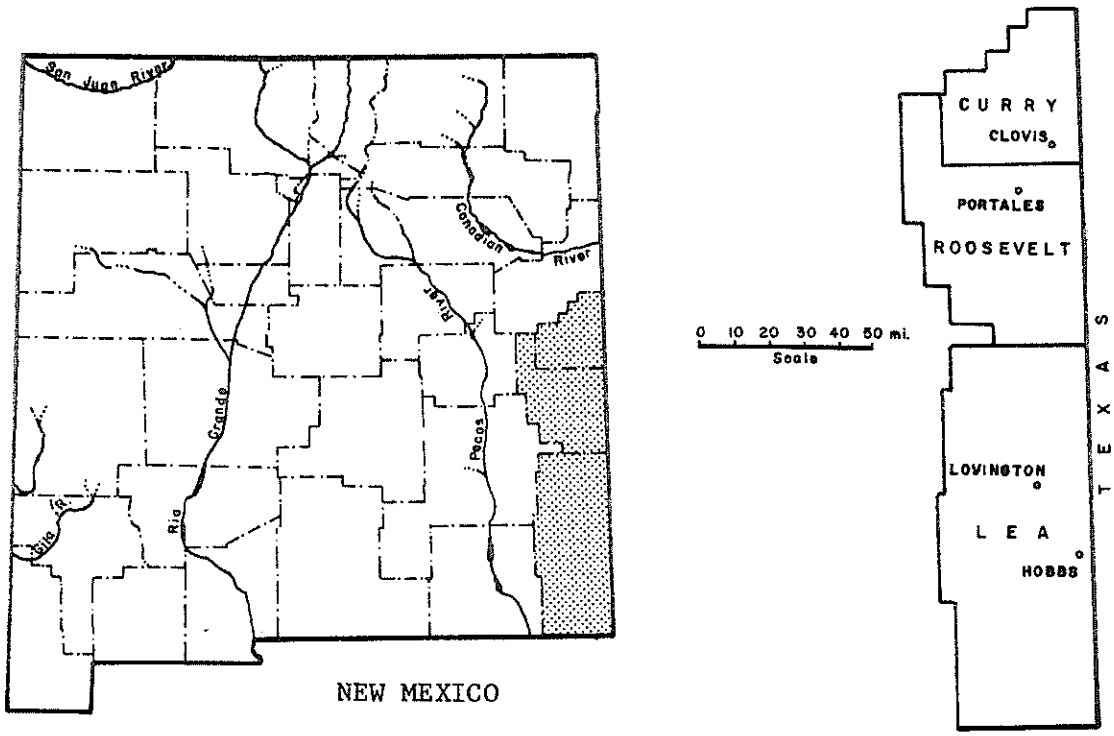


Figure 18. Maps showing counties in Southeastern New Mexico Area.

Population

About 70 percent of the 1970 population of the area was concentrated in the major cities of Clovis, Portales, Lovington, and Hobbs. The remaining 30 percent is located in small communities throughout the area and on scattered farms and ranches. The total population of the area by county for 1950-1970 and projections for 1980, 2000, and 2020 are reported in table 19 and figure 19.

The area has generally gained in population over the period, with Lea County experiencing a decline from 1960 to 1970. The largest increases projected for the area are for Lea and Curry counties. The total population of the three county area is projected to reach 321,000 by the year 2020 (table 19).

Table 19. Total population for the Southeastern Area by county for 1950-1970, and OBERS projections for 1980, 2000, and 2020

County	Year					
	1950	1960	1970	1980	2000	2020
Curry	23,351	32,691	39,517	54,600	81,600	129,000
Roosevelt	16,409	16,198	16,479	20,800	26,000	46,600
Lea	30,717	53,429	49,554	67,700	92,700	145,400
Total	70,477	102,318	105,550	143,100	200,300	321,000

Source: 1950-1970: United States Census of Population - New Mexico, 1950, 1960, and 1970.

1980-2020: Office of Business Economics of the Commerce Department and Economic Research Service, USDA, (OBERS), compiled by State Engineer Office, 1971.

Agriculture

Practically all water diverted in the area for all uses is pumped from wells. Some surface water in the form of run-off from precipitation is stored for livestock-watering purposes in ponds through the area. There were about 1,182,410 acres of cropland in the area in 1970, of which about 34 percent was irrigated and 66 percent was dry farmed.

Irrigation of most of the 407,200 acres in the area is centered around Clovis, Lovington, Hobbs, and Portales. In the Clovis and Portales areas about 10 percent of the land is irrigated with sprinkler systems. The crops produced in 1970 were primarily sorghum, wheat, and cotton. Smaller acreages were planted in hay, pasture, peanuts, barley, and other small grains, and a small acreage of vegetable crops.

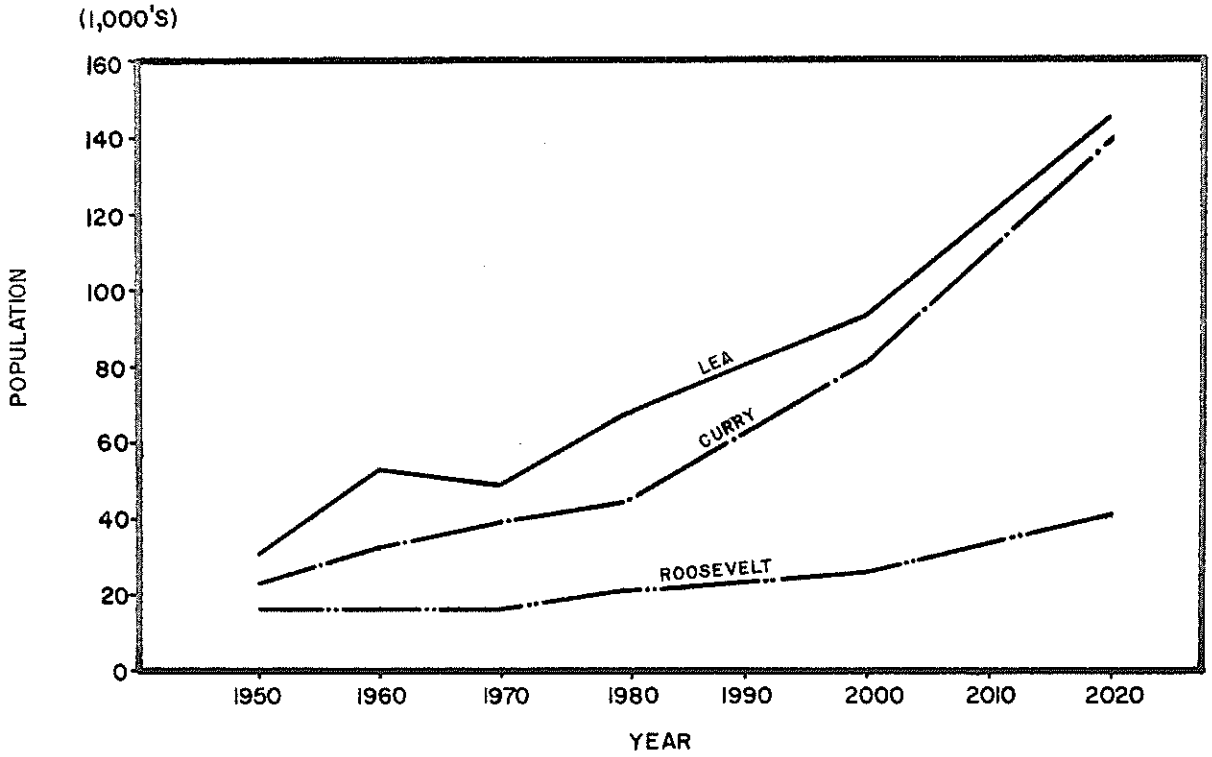


Figure 19. Southeastern Area, total population for 1950-1970, and OBERS projections for 1980, 2000, and 2020.

The acreage of irrigated cropland in the area for the period 1940-1970 with projections for 1980, 2000, and 2020 is presented in table 20 and figure 20. Projections of irrigated cropland acreage indicate that the rapid expansion which took place since 1940 will reverse and acreage will be reduced to less than the 1960 level by 2020. This is primarily because of the limited ground-water supplies in the area. Large-scale pumpage has resulted in large scale water-level declines throughout the area. The problem has been greatest in the area southeast of Lovington where the declines were about 13 feet over the five-year period 1961-1965.

Municipal

Ground water is used for essentially all municipal supplies in the area. The greater portion of the urban use is for domestic purposes in the four larger cities. The total dissolved solids of the water used in the area ranges from about 300 to almost 3,300 milligrams per liter (5). Lowering of the water levels in the area has resulted in a general deterioration of the water. The weighted average urban diversion for the area in 1965 was about 201 gallons per capita daily ranging from 165 in Roosevelt County to 219 in Curry Counry (table 21).

Table 20. Acres of irrigated cropland, including idle, fallow, and diverted acreage, Southeastern Area by county, 1940-1970, and projections for 1980, 2000, and 2020

County	Year						
	1940	1950	1960	1970	1980	2000	2020
	acres						
Curry	0	3,000	87,000	190,000	199,190	89,190	49,190
Roosevelt	11,300	30,000	62,000	103,700	109,580	84,580	34,580
Lea	3,200	73,000	97,500	113,500	170,750	195,450	153,750
Total	14,500	106,000	246,500	407,200	479,520	369,220	237,520

Source: 1940-1970 acreage: Lansford, R. R., and E. F. Sorensen, "Planted Cropland in New Mexico in 1969 and 1970," New Mexico Agriculture--1970, Agricultural Experiment Station Research Report 195, New Mexico State University, Las Cruces, New Mexico, June, 1971, pp 6-12.

Projections for 1980, 2000, and 2020 compiled from estimates of changes in irrigated cropland by the New Mexico State Engineer Office, 1971, 11 pp.

Table 21. Southeastern Area urban water requirements in 1965 and projections for 1980, 2000, and 2020 by county

County	Year			
	1965	1980	2000	2020
	all values are diversions in gallons per capita daily			
Curry	219	220	230	250
Roosevelt	165	190	200	210
Lea	201	200	210	220
Weighted average[1]	201	206	217	231

1 Based on OBERS population projections for 1980, 2000, and 2020.

Source: Memo from Earl F. Sorensen: "Projected Urban, Rural, and Self-Supplied (Manufacture and Industrial) Water Requirements in 1980, 2000, and 2020 in New Mexico," New Mexico State Engineer Office, 1971, 2 pp.

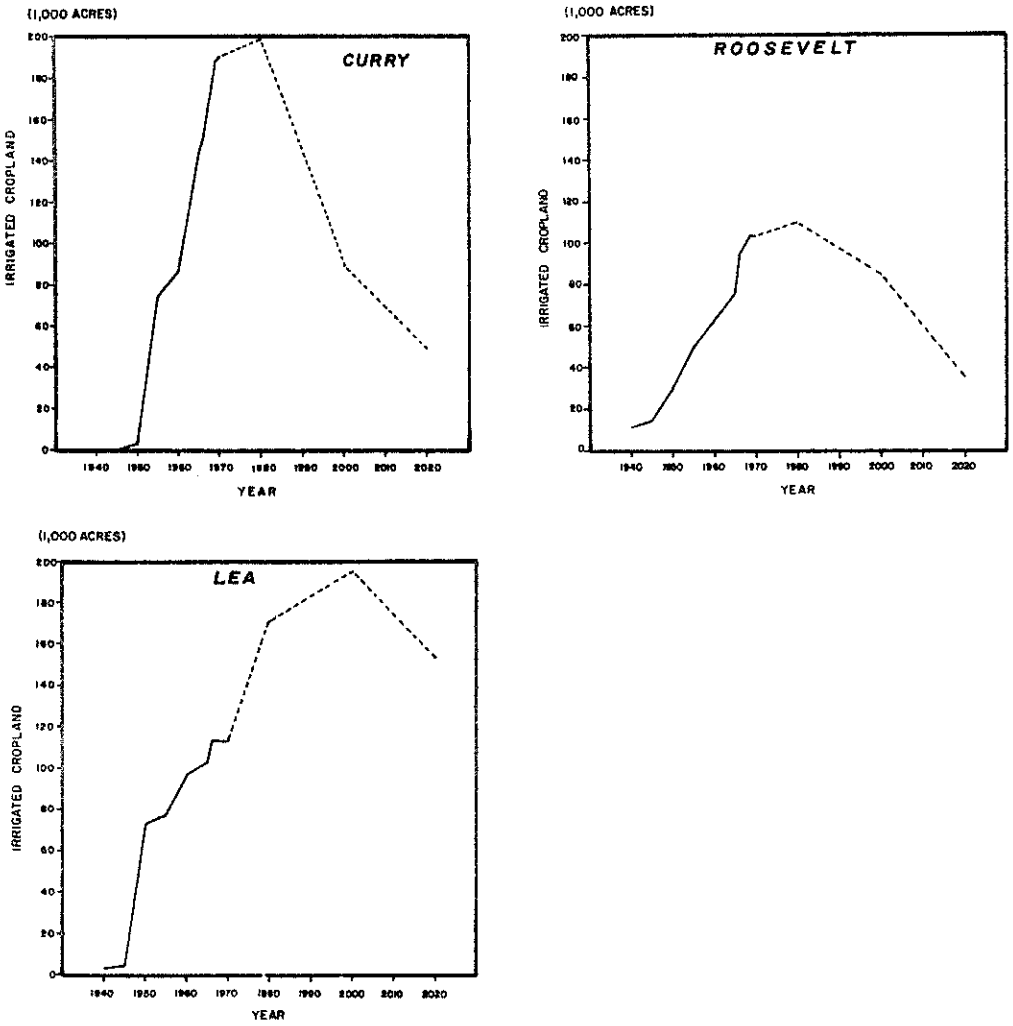


Figure 20. Acres of irrigated cropland, including idle, fallow, and diverted acreage, Southeastern Area by county, 1940-1970, and projections for 1980, 2000, and 2020.

The weighted average diversion for the area is projected to increase to 231 gallons per capita daily by 2020 (table 21).

The seven communities of Clovis, Elida, Hobbs, Lovington, Melrose, Portales, and Tatum are representatives of the Eastern New Mexico Inter-Community Water Supply Association. The purpose of the association is to determine the feasibility and desirability of diverting water from Ute Reservoir, on the Canadian River near Logan, for municipal purposes.

Industrial

The economy of the area is dependent largely on petroleum, farming, ranching, and the allied industries. Production and refining of petroleum and gas is confined mainly to Lea and southern Roosevelt counties. Projections of mineral industry water requirements for 1980, 2000, and 2020 indicate that in the three county area requirements for new water will be 16,520, 25,130, and 56,940 acre-feet, respectively (table 22). The largest portion of the water requirements will be in Lea County for the drilling and processing of oil and gas, and for oil-well flooding to assist in oil recovery.

Table 22. Southeastern Area projected mineral industry requirements for water, 1980, 2000, and 2020 by county

County	1980		2000		2020	
	New water[1]	Depletion[2]	New water[1]	Depletion[2]	New water[1]	Depletion[2]
	acre-feet					
Curry	850	525	2,200	1,425	3,900	2,225
Roosevelt	3,870	1,650	6,020	3,145	7,900	3,800
Lea	11,800	2,575	16,910	5,720	45,140	24,770
Total	16,520	4,750	25,130	10,290	56,940	30,795

1 New water as used in these estimates signifies water used for the first time and does not represent total usage which includes recirculation.

2 Depletion includes water used in evaporation, product assimilation, etc., which is no longer available for basin use.

Source: Memo from New Mexico State Engineer: "Projected Water Requirements for New Mexico Mineral Industries for the Years 1980, 2000, and 2020," by Earl F. Sorensen and Ronald B. Stotelmeyer, New Mexico State Engineer Office and U.S. Bureau of Mines, respectively, April 1970.

Water Resource Problems of the Area

Essentially all water problems of the area are concerned with ground-water supplies. Large-scale pumping of ground water for irrigation of the rapidly increasing acreage, industrial, municipal, domestic and stock, power production, and recreational uses has resulted in a rapid lowering of the water table. Ground-water level declines were as much as 30 feet over the period 1961-1965 and were as much as 9 feet in the Clovis area from 1967 to 1968. The main source of the underground water is the Ogallala formation. There is relatively little recharge of ground water in any of the area. In the Portales area, water-level declines resulting from pumping were as high as 10 feet over the five-year period from 1961-1965 and 4 feet from 1967 to 1968 (3). Ground-water development in the Portales area has been under control of the State Engineer since 1950 when the area was declared an underground-water basin. (See figure 3 which shows all declared basins in state.) Irrigation water is primarily from ground-water storage in the valley fill. In the Causey-Lingo area, in east-central Roosevelt County, water-level declines during the five-year period 1961-1965 averaged about 7 feet and were as high as 6 feet from 1967-1968 (3).

The Lea County underground-water basin was declared in 1931 and extended in 1952. The largest water-level declines in the area occurred southeast of Lovington, where the decline was about 13 feet, over the five-year period 1961-1965; the decline for the 1967-1968 period was about 3 feet. The water-bearing formation is the Ogallala. This area is one of New Mexico's major petroleum-producing areas, and in recent years demand for use in oil-field waterflooding operatings has been increasing, and projections indicate that the demands will continue to increase. Contamination of the ground water by surface disposal of oil-field brines and from leaky oil-well casing has been partially corrected in recent years by subsurface disposal of brine and periodic testing of oil-well casing. There is still concern, indicated by the topics discussed during the meetings, about further contamination of the ground water by the oil-field brines. The declining water table, however, was considered the most important of all items discussed.

Topic Rankings During Conference Discussions

The ranking of the items and topics discussed during the meetings is as follows. This ranking was made by the participants to the Citizens' Water Conferences at the close of the second meeting under three primary categories.

I. Most Urgent Water Supply Problems

1. Declining water table (lack of recharge);

2. Septic tank pollution of ground water around Portales;

3. Lack of water;

4. Uncertainty of future of water supply as it affects industrial and community development;

5. Municipal, industrial, and recreational water needed.

II. Water Pollution Problems

1. Bacterial and chemical pollution of ground water;

2. Chemical, petroleum, salt water encroachment - Hobbs and Lovington oil well fields;

3. Salt water encroachment from abandoned livestock and irrigation wells.

III. Improvements in Water-Use Efficiency in Agriculture

1. Sprinkler irrigation development;

2. More efficient irrigation water applications varied by soil information, water basin condition, and stage of plant growth;

3. Retaining of water on farm and on fields and controlling of tail water;

4. Limiting of irrigation to the amount plants use (holding down deep pentration and field run-off);

5. Selection of crops which use less water.

IV. Other Topics Discussed (not in ranked order)

a. Invasion of salt water in some areas;

b. Changes needed in water laws of New Mexico in relation to ground water;

c. Salt pollution from oil wells;

d. Tail water pits, tail water systems;

e. Land engineering;

f. Concrete-lined ditches;

g. Need for water spreading (range);

h. Water harvesting (dry land);

i. Check dams and stock tanks;

j. Brush control (range);

k. Development of livestock water pipelines (range);

l. Need to reduce breakout of rangeland;

m. Recreation areas development and planning;

n. Community recognition of problems and planning;

o. Emphasizing of different crops; lower water using crops;

p. Possibility of developing ground-water compact between Texas and New Mexico.

The discussion in the Portales conferences for Curry, Roosevelt, and Lea counties brought out these important points.

1. Declining water tables in all of these counties was considered to be the major water problem. The municipalities of Clovis, Lovington, Hobbs, and Jal, along with other communities in the southeastern section of New Mexico, have been considering construction of a pipeline from Ute reservoir near Tucumcari to supply municipal waters. Water, Inc., organized by citizens in the High Plains of Texas and these three counties of New Mexico, are considering the possibilities of importing water from the Mississippi to supply water for irrigation, municipal, and industrial uses. The U. S. Bureau of Reclamation in cooperation with the Texas Water Board and the New Mexico State Engineer Office is studying both of these possibilities. The projected declines in irrigated crop acres, particularly in Curry and Roosevelt counties (figure 20), are expected to occur unless some water importation program is put into operation in the near future.

2. Pollution of ground water from septic tanks and sewage plants, particularly in the Portales area, was noted with considerable concern. Since practically all of the water for all uses in these three counties comes from ground water, or from rainfall directly on the land, there is no way for the polluted waters to move out of the immediate area. Some wells in the Portales area apparently are being polluted from septic tanks or from animal wastes originating near these wells. A study is under way to determine, if possible, the extent and source of the fecal coliform found in a number of wells in this area. Pollution from oil-well brines was also mentioned as a problem in localized areas.

3. A detailed inventory of water supplies and a study of the alternate ways in which these supplies might be used was recommended. At present there is a great uncertainty about the water supply as it will affect industrial and community development.

4. Salt water encroachment in wells as pumping continues was considered important in some areas and this situation was expected to increase as the ground water is depleted. Water from some wells in the Portales area was reported to be too brackish to produce satisfactory lawns.

5. Increased irrigation efficiency was pointed as as a major means of extending the life of the ground water in these counties. Since over 90 percent of the water depleted in this area is used by agriculture, this subject deserves intensive consideration by all farm operators and all local, state, and federal agencies having activities in this area.

NORTHEASTERN NEW MEXICO AREA

COLFAX, UNION, MORA, HARDING, SAN MIGUEL,
QUAY, GUADALUPE, AND DE BACA COUNTIES

Introduction

Citizens' Water Conferences were held in Las Vegas for the Northeastern Area, which includes the counties of Colfax, Union, Mora, Harding, Quay, San Miguel, Guadalupe, and De Baca (figure 21). The area has a total land area of 15,774,000 acres, about 20 percent of the total land area of the state, and a 1970 population of 63,282, about 6 percent of the state's total population. The population centers (over 2,500) in the area are Raton, Clayton, Las Vegas, and Tucumcari.

The area encompasses the Arkansas River Basin in New Mexico and the northern one-half of the Pecos River Basin. The Canadian River and its tributaries drain most of the five northeastern counties in New Mexico. The Canadian River flows southward from its headwaters near the Colorado line west of Raton, into southern San Miguel County, thence eastward into Texas to its confluence with the Arkansas.

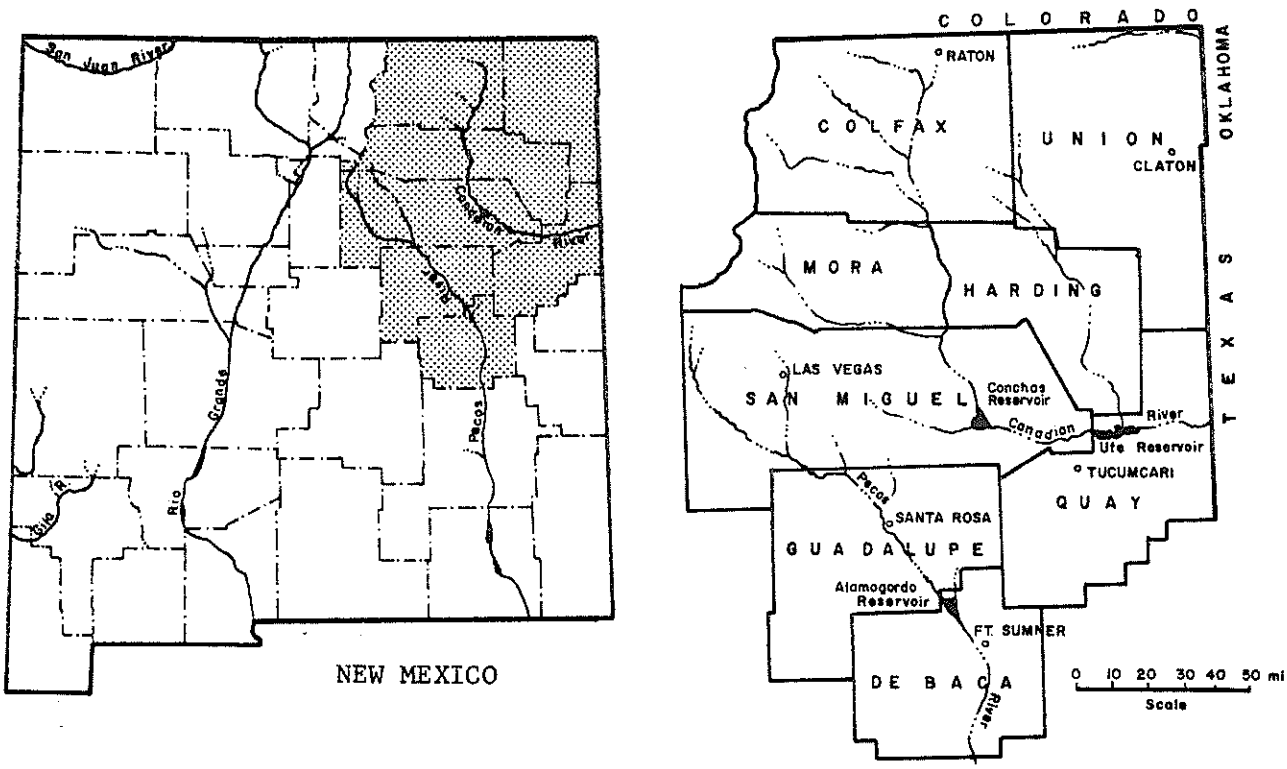


Figure 21. Maps showing counties in Northeastern New Mexico Area.

The Pecos River Basin drainage covers western San Miguel and most of Guadalupe, De Baca, and Quay counties, with headwaters in the Sangre de Cristo Mountains of eastern San Miguel County. The Pecos River has a number of tributaries in the area, the largest ones being the Gallinas River and Tecolote Creek. The southeastern part of the area is relatively low (altitudes range to about 4,000 feet). To the north and west there is a gradual increase in altitude to more than 10,000 feet.

The average annual precipitation for the area averages about 15 inches and the mean annual temperature about 54.3 degrees F.

Population

The total population of the area has declined in recent years. Most of the decline has taken place in the rural areas. Cities with more than 2,500 census population in 1970 were Clayton, Raton, Las Vegas, and Tucumcari. These four cities account for almost 50 percent of the total population of the area (30,917). The remaining one-half are located in a number of small communities throughout the area and on scattered farms and ranches. The total population of the area by county for 1950-1970 and projections for 1980, 2000, and 2020 are reported in table 23 and figure 22.

Table 23. Total population for the Northeastern Area by county for 1950-1970, and OBERS projections for 1980, 2000, and 2020

County	Year					
	1950	1960	1970	1980	2000	2020
Colfax	16,761	13,806	12,170	14,300	18,600	22,000
Union	7,372	6,068	4,925	5,200	7,400	8,200
Mora	8,720	6,028	4,673	3,900	7,400	8,200
Harding	3,013	1,874	1,348	2,600	5,600	5,500
San Miguel	26,512	23,468	21,951	23,400	33,400	41,200
Quay	13,971	12,279	10,903	13,000	18,500	22,000
Guadalupe	6,772	5,610	4,765	6,500	11,100	13,700
De Baca	3,464	2,991	2,547	3,900	7,400	8,200
Total	86,585	72,124	63,282	72,800	109,400	129,000

Source: 1950-1970: United States Census of Population - New Mexico 1950, 1960, and 1970.

1980-2020: Office of Business Economics of the Commerce Department and Economic Research Service, USDA, (OBERS), compiled by State Engineer Office, 1971.

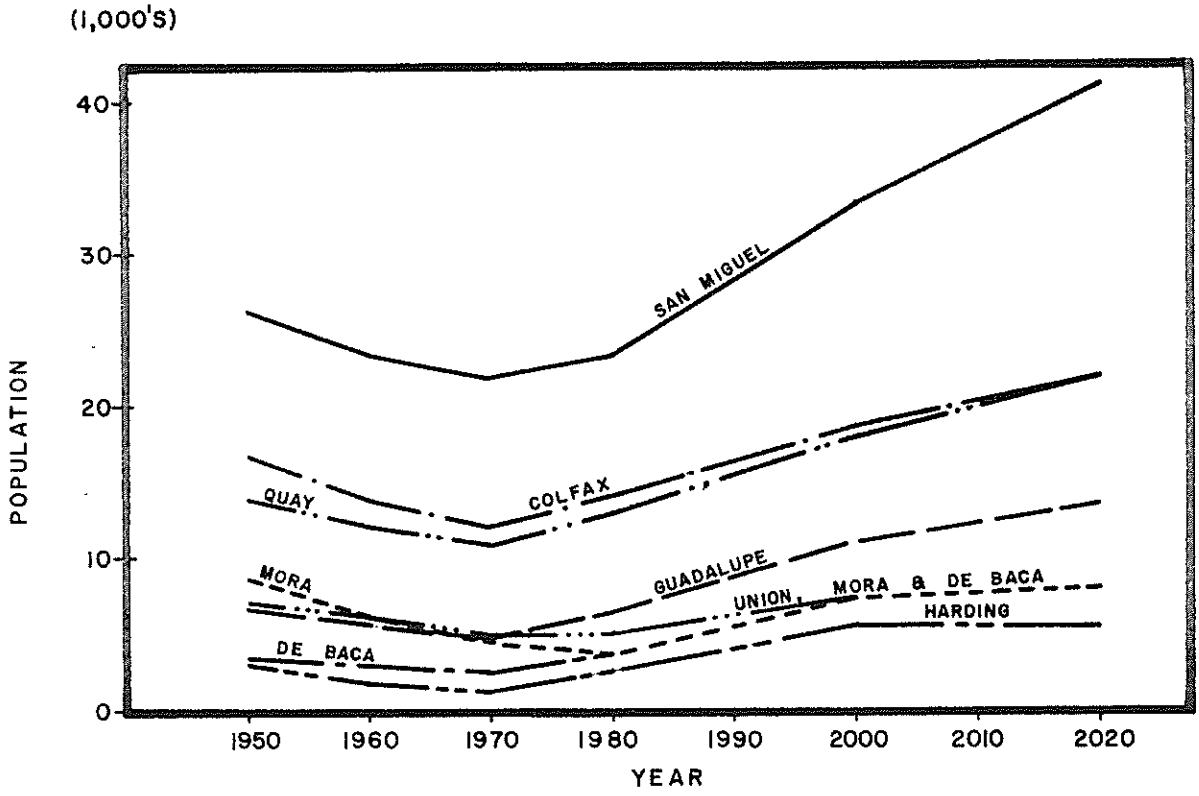


Figure 22. Northeastern Area, total population for 1950-1970, and OBERS projections for 1980, 2000, and 2020.

The area generally has lost population since 1950, but projections for 1980-2020 show that some increases are expected in all counties. The total population of the area is expected to reach 129,000 by 2020 (table 23).

Agriculture

Surface water supplies most of the water used in the area for irrigation. Within the area in 1970 there were approximately 170,670 acres if irrigated cropland. About 69 percent was irrigated from surface-water sources and 31 percent from ground-water sources.

The areas irrigated with surface water are generally located along the Pecos and Canadian rivers and their tributaries and in the Tucumcari irrigation project. The ground-water development is primarily in eastern Union and Quay counties. The acreage irrigated in 1970 by source of water for the area is reported in table 24.

Table 24. Acreage irrigated by source of water for the Northeastern Area, by county, 1970

County	Surface	Ground	Combined	Total
		acres		
Colfax	33,780	1,000	-	34,780
Union	4,830	29,870	300	35,000
Mora	18,000	0	0	18,000
Harding	0	6,270	0	6,270
San Miguel	12,230	150	0	12,380
Quay	38,890	11,730	0	50,620
Guadalupe	3,400	430	0	3,830
De Baca	6,070	3,720	0	9,790
Total	117,200	53,170	300	170,670
Percent	68.7	31.2	0.1	100.0

Source: Lansford, R. R., and Earl F. Sorensen, "Planted Cropland Acreage in New Mexico in 1969 and 1970," New Mexico Agriculture --1970, Agricultural Experiment Station, New Mexico State University, Research Report 195, pp 6-12, 1971.

The principal crops produced in the area in 1970 were hays, small grains, and sorghum.

The acreage of irrigated cropland in the area for the period 1940-1970 with projections for 1980, 2000, and 2020 is presented in table 25 and in figure 23. Major increases in acreage are projected for Union and Quay counties (figure 23), with most of the other counties in the area remaining relatively stable. Total acreage of irrigated cropland in the area is projected to reach 247,800 by the year 2020 (table 25).

Table 25. Acres of irrigated cropland, including idle, fallow, and diverted acreage, Northeastern Area by county, 1940-1970, and projections for 1980, 2000, and 2020

County	Year						
	1940	1950	1960	1970	1980	2000	2020
	acres						
Colfax	31,300	32,500	31,000	34,780	34,780	34,780	34,780
Union	5,800	6,700	9,200	35,000	60,370	71,870	87,370
Mora	21,300	19,900	12,000	18,000	18,000	18,000	18,000
Harding	0	100	2,100	6,270	10,220	14,020	14,020
San Miguel	15,000	18,000	11,400	12,380	12,900	12,900	12,900
Quay	200	32,600	32,700	50,620	53,700	60,500	64,800
Guadalupe	3,200	3,100	3,300	3,830	3,830	3,830	3,830
De Baca	3,300	4,300	5,600	9,790	12,120	12,120	12,120
Total	80,100	117,200	107,300	170,670	205,920	228,020	247,820

Source: 1940-1970 acreage: Lansford, R. R., and E. F. Sorensen, "Planted Cropland in New Mexico in 1969 and 1970," <u>New Mexico Agriculture--1970</u>, Agricultural Experiment Station Research Report 195, New Mexico State University, Las Cruces, New Mexico, June, 1971, pp 6-12.

Projections for 1980, 2000, and 2020 compiled from estimates of changes in irrigated cropland by the New Mexico State Engineer Office, 1971, 11 pp.

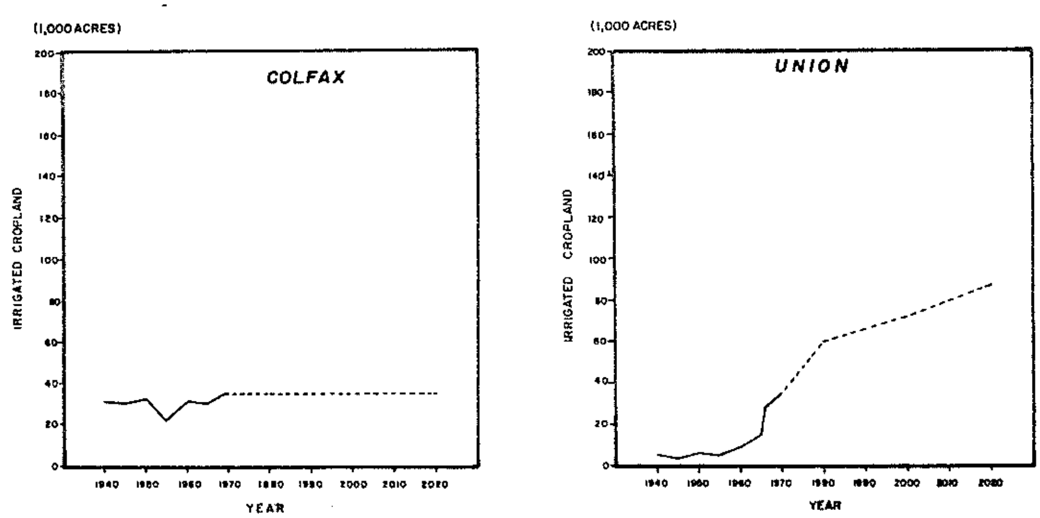
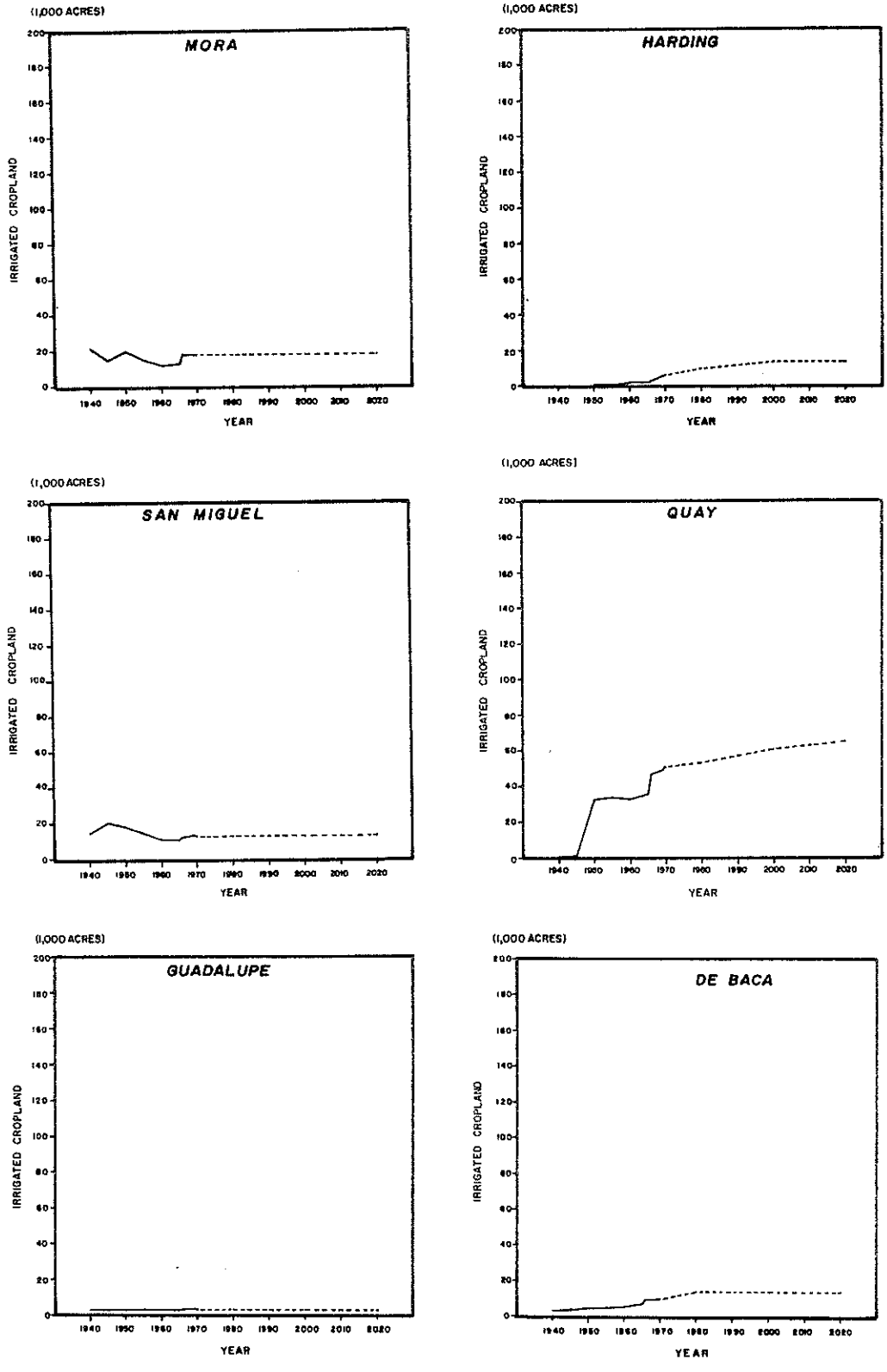


Figure 23. Acres of irrigated cropland, including idle, fallow, and diverted acreage, Northeastern Area by county, 1940-1970, and projections for 1980, 2000, and 2020.

Figure 23. continued,



Municipal

Both ground and surface water are utilized by the municipalities for domestic supplies. The total dissolved solids of the municipal water range from about 200 to over 1,500 milligrams per liter (5,6). Saline ground water is generally thought to occur throughout the area, ranging from 1,000 to 3,000 ppm, but reaching as high as 10,000 ppm in some areas (26, p. 293).

The daily per capita diversions for various counties are reported in table 26. The weighted average urban diversion in 1965 was about 133 gallons per capita daily, ranging from 87 in San Miguel County to 175 in Colfax County. The weighted average diversions are projected to reach 195 gallons per capita daily in the year 2020 (table 26).

Table 26. Northeastern Area urban water requirements in 1965 and projections for 1980, 2000, and 2020 by county

County	Year			
	1965	1980	2000	2020
	all values are diversions in gallons per capita daily			
Colfax	175	190	200	210
Union	165	190	200	210
Mora	-	-	150	160
Harding	-	-	150	160
San Miguel	87	150	160	190
Quay	160	190	200	210
Guadalupe	-	150	160	190
De Baca	-	150	160	190
Weighted average[1]	133	170	175	195

1 Based on OBERS population projections for 1980, 2000, and 2020

Source: Memo from Earl F. Sorensen: "Projected Urban, Rural, and Self-Supplied (Manufacture and Industrial) Water Requirements in 1980, 2000, and 2020 in New Mexico," New Mexico State Engineer Office, 1971, 2 pp.

Industrial

The economy of the area is primarily based on agriculture and is dependent on livestock for most of its income. There is very little manufacturing or heavy industry in the area. Coal mining has made a principal contribution to the area's economy in the past but has been depressed in recent years. Recreation and tourism are becoming important in certain sections, particularly in the higher elevations.

Water Resource Problems of the Area

Most of the water problems are associated with agricultural uses in the area. Urban, industrial, and recreational uses deplete only about three percent of that used by agriculture. Practically all low flows of the Canadian River above Conchas Dam are diverted into reservoirs or onto irrigated lands. Under the terms of the Canadian River Compact, New Mexico is entitled to free and unrestricted use of all waters originating in the drainage basin of the Canadian River in New Mexico below Conchas Dam, provided the amount of conservation storage in New Mexico available for impounding these waters which originate below Conchas Dam shall be limited to a total of 200,000 acre-feet. The conservation storage of Ute Reservoir in 1965 was about 60,000 acre-feet (18).

In general, many areas suffer chronic seasonal water shortages, resulting from several factors, such as uneven precipitation, temporary and inadequate diversion works, wasteful irrigation practices, lack of storage facilities, and nonbeneficial uses such as excessive channel losses.

In the Pecos River Basin portion of the area, there usually is a shortage of surface water during the irrigation season. The surface flow of the river is erratic, being influenced by flood flows resulting from heavy rains.

Several cities, towns, and villages in the area are dependent upon surface water for domestic supplies; many have experienced water shortages. Increased demands for water by both municipalities and irrigation in the area has resulted in increased competition.

Ground-water supplies in the area are generally meager or do not exist at all, and considerable expenditures are required to develop ground water as a supplemental source for municipal use in certain areas.

Topic Rankings During Conference Discussions

The need for conservation practices and lack of storage facilities are the major problems according to the ranking of problems by the area

Citizens' Water Conferences. It has been noted that in many communities there has been little improvement in irrigation systems since they were constructed, some as long as 100 years ago. Explanations of the generally unsatisfactory conditions of the area have been factors such as farming practices, farm size, cropping patterns, farm markets, and water supply. Possibly the largest factor is that farm sizes in individual ownership are generally too small to provide income required for family living expenses, and additional incomes are required for adequate operation, maintenance, and needed capital improvements. Many of the community ditch systems are small and inefficient.

Major water problems of the area were ranked by the participants in the Citizens' Water Conferences and are as follows:

I. Most Urgent Water Supply Problems

1. Conservation practices to retain all the water possible in New Mexico;

2. Lack of storage facilities (dams) in valleys to store spring run-off for use in summer where stream flows are low during the summer months;

3. Poor irrigation ditch construction which results in excessive seepage from irrigation ditches in Mora, San Miguel, and Guadalupe counties and in the silting and breaking of irrigation ditches by arroyos;

4. Great Plains Program (small operators do not qualify or cannot match dollars for improvements);

5. Need to consolidate small irrigation ditches and diversion dams;

6. Irrigation wells have not been developed in Mora, San Miguel, and Guadalupe counties.

II. Water Pollution Problems

1. Sewerage systems flowing into rivers and streams;

2. Recreational housing developments polluting ground water;

3. Feedlot yard run-off flowing into rivers and streams.

III. Improvements in Water-Use Efficiency in Agriculture

1. Controlling of tail water (irrigation);

2. Lining of irrigation ditches to control seepage;

3. Land leveling to use irrigation water more efficiently;

4. Improved irrigation methods - sprinkler, subsurface;

5. Range water distribution systems (underground pipelines);

6. Dikes and earth tanks to control water erosion (range).

IV. Water Quality and Water Quantity Problems

1. Value of protecting water rights not generally recognized;

2. Lower quality of water and reduced development because of sewer plants dumping into rivers;

3. Dependency of development on more water;

4. Probably reduction in water quality if area has more development and more people.

V. Other Topics Discussed (not in ranked order)

a. Need for drainage ditches in water-logged areas;

b. Depth to, availability, and low volume of irrigation wells in Union and Colfax counties;

c. Recourse for people when a diversion dam is washed out;

d. Placing of meters on main ditches, instead of at the farm-gate. (In the Puerto de Luna subdistrict 60 percent of the water diverted from the river is lost before it gets to the field. There is also the problem of water rights on the river. Refer to Puerto de Luna statement below.);

e. Drought;

f. Difficulty in securing a dated water right on new land since many rights were established prior to 1900, and more land has been added since that time.

g. Construction of storage facilities for spring run-off for later use;

h. Use of moisture measuring devices to guide irrigation water management.

The discussion in the Las Vegas conferences for Colfax, Union, Mora, Harding, San Miguel, Quay, Guadalupe, and De Baca counties brought out these important points.

1. Increased irrigation efficiency was pointed to as the major need in this area. There are many small farms and many small ditches and laterals leading to these small tracts. Consolidation of many of these small ditches into a new and possibly an underground pipe or a concrete-lined ditch was recommended. This would eliminate the excessive seepage and evaporation which is so common at present. More efficient methods for applying the water to the fields, such as land leveling or furrow irrigation, were suggested, along with closer attention to the time the water is allowed to run at each set.

   The Puerto de Luna water users presented a problem in the Las Vegas conference which was also discussed at the state conference regarding the handling of the water meters required in the Puerto de Luna subdistrict under the Pecos River adjudication. At present there are meters at the turnouts from the river but not at the end where the unused water returns to the river. This results in the subdistrict being billed for much more water than is actually diverted to the fields. The State Engineer Office recommended that meters be installed at the end of the ditches, so the net use will be recorded and charges can be made on this net diversion to the fields. It was pointed out that this net diversion can be charged for, only if there are metered records on the flows returning to the river. This situation applies not only to Puerto de Luna but to several other ditches on adjudicated streams in New Mexico.

2. Sewage effluent flowing into streams from municipalities, subdivisions, trailer parks, and resort areas was pointed to as a growing menace to the water quality of the area. Instituting of control procedures was recommended.

3. Protection of water rights, particularly on small tracts, was recommended. Some persons who may have valid water rights may lose them by nonuse unless they take action to keep these rights valid.

4. A shortage of water for irrigating the small farms and tracts was pointed to as a general problem in the area. This shortage is made more severe by the heavy conveyance losses in the small ditches and laterals.

5. Dams and storage facilities in the counties on the headwaters of the Pecos and the Canadian rivers were indicated as needed to permit use of the limited water supply over more of the growing season. The river compacts limit the construction of such dams and storage facilities.

CENTRAL NEW MEXICO AREA

SANDOVAL, BERNALILLO, VALENCIA, TORRANCE, AND SOCORRO COUNTIES

Introduction

Participants in the Central Area Citizens' Water Conferences met in Albuquerque. The area includes the counties of Sandoval, Bernalillo, Valencia, Torrance, and Socorro (figure 24). It encompasses about 17 percent of the total land area of the state and has about 38 percent of the total 1970 state population.

The climate of the area ranges from semi-arid to humid and the annual precipitation normally averages from 8 to 10 inches but may be as high as 20 inches in the higher elevations.

The principal drainage of the area is by the Rio Grande River and tributaries. The main streams are the Jemez, Rio Puerco, Rio Grande, and Rio San Jose (tributary of Rio Puerco) (figure 24). The tributaries are perennial only in the upper reaches.

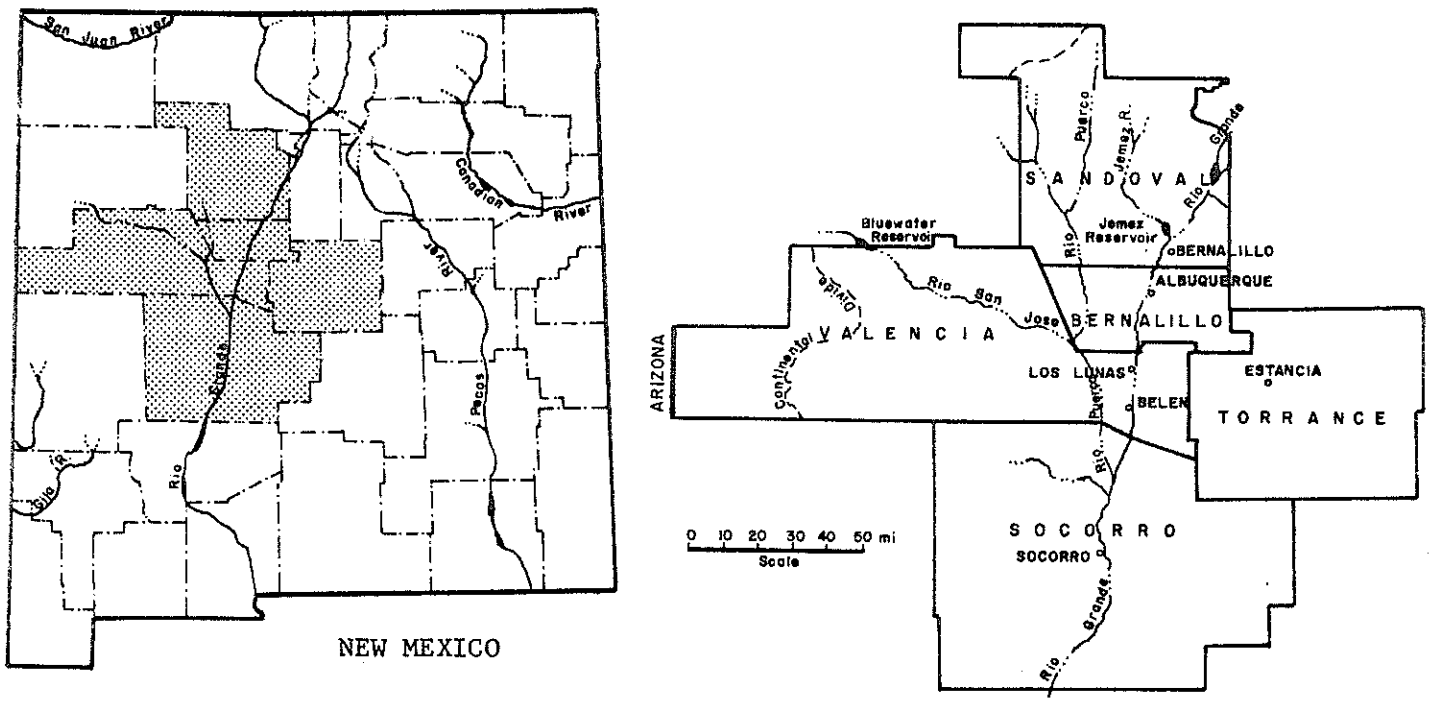


Figure 24. Maps showing counties in Central New Mexico Area.

Population

The major population centers are Albuquerque, Belen, Grants, and Socorro. Over three-fourths of the population of the area is concentrated in Bernalillo County and mostly in the city of Albuquerque. The remaining population is located in smaller communities throughout the area and on scattered farms and ranches. The total population of the area has almost doubled since 1950 (table 27), with only Torrance and Socorro counties experiencing losses in population. The most rapid growth in the past and projected in the future is in Bernalillo County (table 27 and figure 25).

Table 27. Total population for the Central Area by county for 1950-1970, and OBERS projections for 1980, 2000, and 2020

	Year					
County	1950	1960	1970	1980	2000	2020
Sandoval	12,438	14,201	17,492	14,300	18,500	30,200
Bernalillo	145,673	262,199	315,774	424,300	632,300	919,200
Valencia	22,481	39,085	40,539	45,600	57,500	87,800
Torrance	8,012	6,497	5,290	5,200	7,400	8,200
Socorro	9,670	10,168	9,763	10,400	14,800	16,500
Total	198,274	332,150	388,858	499,800	730,500	1,061,900

Source: 1950-1970: United States Census of Population - New Mexico, 1950, 1960, and 1970.

1980-2020: Office of Business Economics of the Commerce Department and Economic Research Service, USDA, (OBERS), compiled by State Engineer Office, 1971.

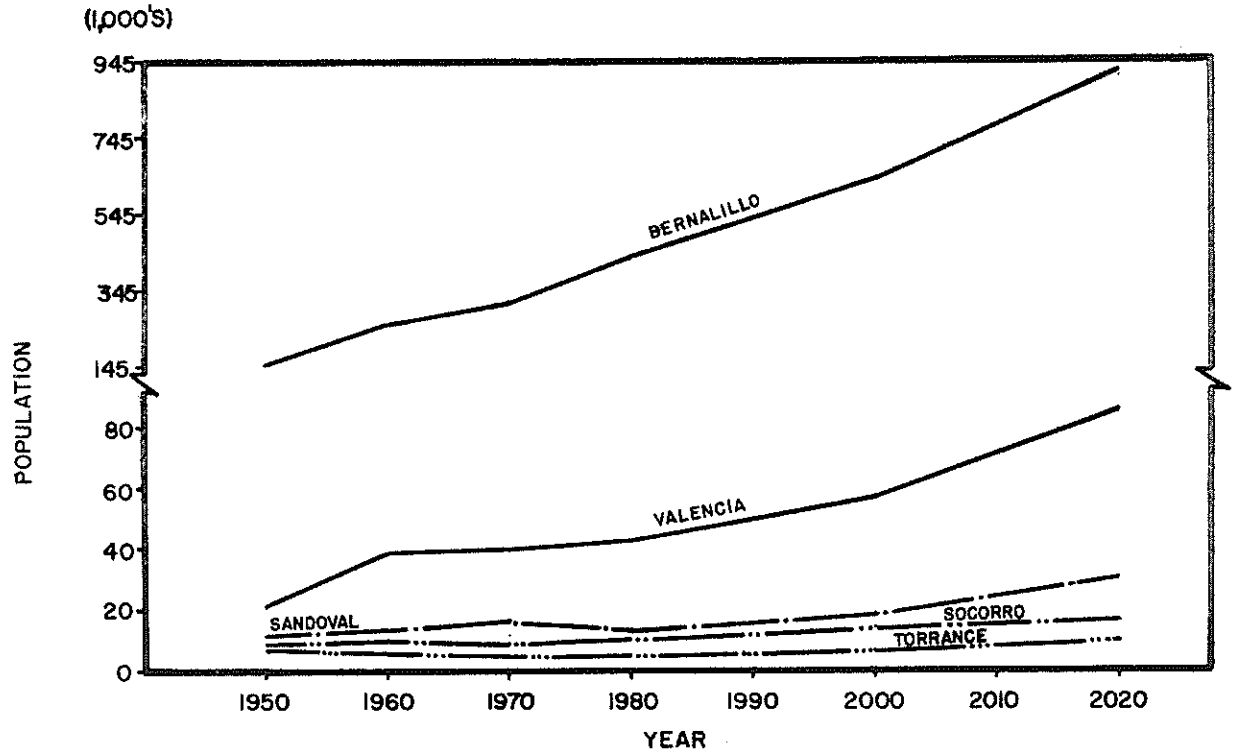


Figure 25. Central Area, total population for 1950-1970, and OBERS projections for 1980, 2000, and 2020.

Agriculture

Surface water is the primary source for the majority of the irrigated cropland in the area. Of the total acreage irrigated in the area in 1970, approximately 46 percent was supplied with surface water, 27 percent with ground water and 27 percent with a combination of surface and ground water.

The acreage of irrigated cropland in the area for the period 1940 through 1970 with projections for 1980, 2000, and 2020 is presented in table 28 and in figure 26, by county.

Table 28. Acres of irrigated cropland, including idle, fallow, and diverted acreage, Central Area by county, 1940-1970, and projections for 1980, 2000, and 2020

County	Year						
	1940	1950	1960	1970	1980	2000	2020
	acres						
Sandoval	18,600	19,400	15,000	15,200	17,050	17,050	17,050
Bernalillo	20,600	34,600	10,900	13,240	13,240	13,240	13,240
Valencia	37,000	25,700	34,300	43,300	44,680	44,680	44,680
Torrance	1,400	7,100	15,000	33,330	53,630	70,660	68,710
Socorro	13,300	17,200	12,300	16,500	16,200	16,200	16,200
Total	90,900	104,000	87,500	121,570	144,800	161,830	159,880

Source: 1940-1970 acreage: Lansford, R. R., and E. F. Sorensen, "Planted Cropland in New Mexico in 1969 and 1970," New Mexico Agriculture--1970, Agricultural Experiment Station Research Report 195, New Mexico State University, Las Cruces, New Mexico, June, 1971, pp 6-12.

Projections for 1980, 2000, and 2020 compiled from estimates of changes in irrigated cropland by the New Mexico State Engineer Office, 1971, 11 pp.

Municipal

Ground water is the major source of municipal water in the area. The total dissolved solids of the water used ranges from less than 200 to greater than 2,500 milligrams per liter (5,7,8).

The county average daily per capita diversion of urban water ranged from about 98 gallons to 195 gallons and weighted average was about 174 gallons per capita daily in 1965. The weighted average diversion is projected to reach over 240 gallons per capita daily by the year 2020 (table 29).

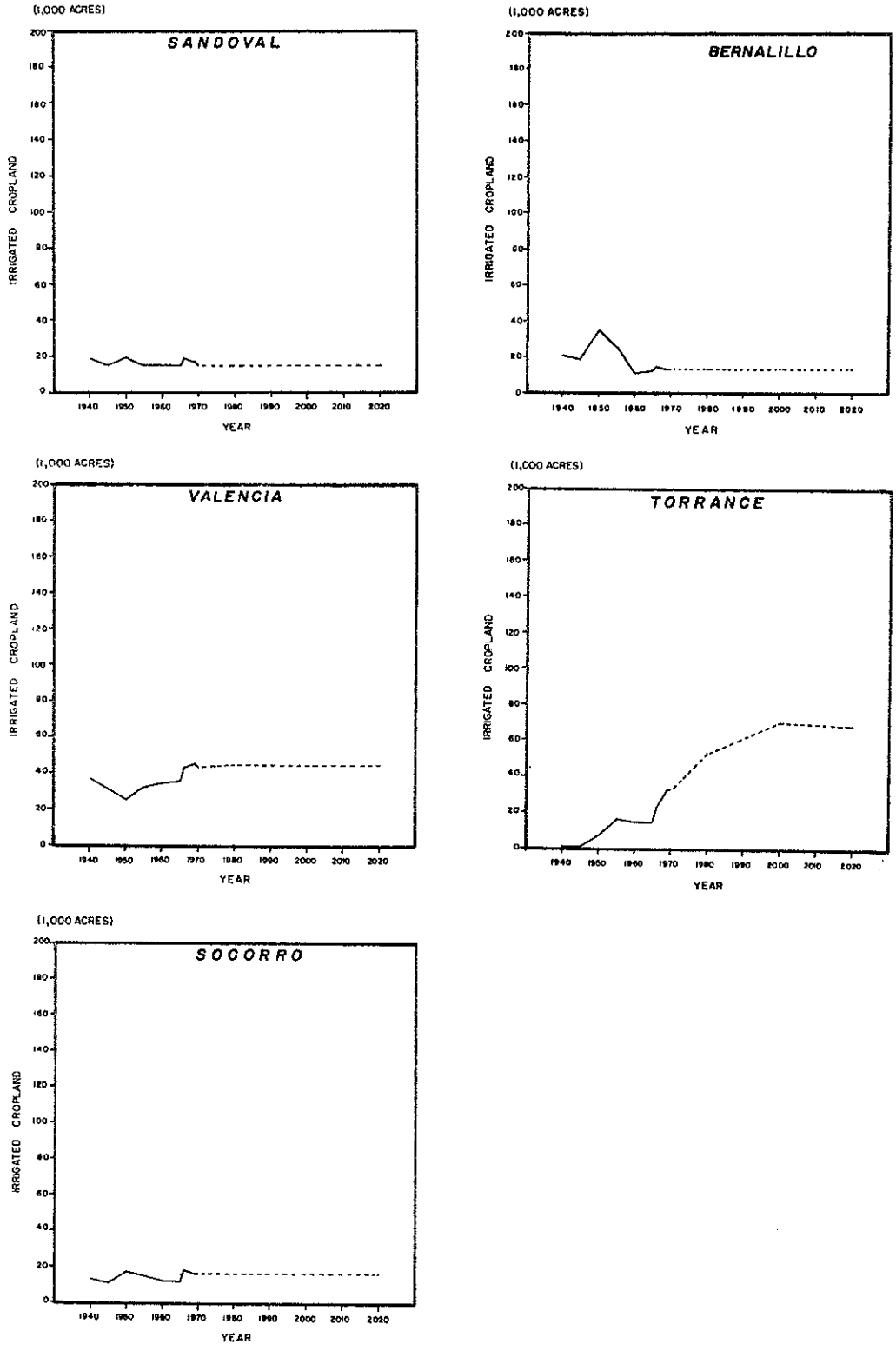


Figure 26. Acres of irrigated cropland, including idle, fallow, and diverted acreage, Central Area by county, 1940-1970, and projections for 1980, 2000, and 2020.

Table 29. Central Area urban water requirements in 1965 and projections for 1980, 2000, and 2020 by county

County	Year			
	1965	1980	2000	2020
	all values are diversions in gallons per capita daily			
Sandoval	98	150	160	190
Bernalillo	187	200	220	250
Valencia	107	150	160	190
Torrance	-	-	150	160
Socorro	195	200	200	210
Weighted average[1]	174	194	213	242

1 Based on OBERS population projections for 1980, 2000, and 2020.

Source: Memo from Earl F. Sorensen: "Projected Urban, Rural, and Self-Supplied (Manufacture and Industrial) Water Requirements in 1980, 2000, and 2020 in New Mexico," New Mexico State Engineer Office, 1971, 2 pp.

Industrial

Most of the manufacturing and industrial activity of the state is in the area. The number of people employed and income generated by government functions and merchandising are the most important in the area. Manufacturing employed almost four times more people in the area than did agriculture in 1965. However, mining is important in Valencia County and employs more people than agriculture and manufacturing combined. Projections of mineral industry requirements of water for Valencia County are expected to reach almost 20,000 acre-feet by the year 2020 primarily for use in uranium mining.

Water Resource Problems of the Area

The continued growth of the population, primarily in the Albuquerque area, will result in the major water related problems. Annual pumpage for urban uses in the Albuquerque area increased from about 10,000 acre-feet in 1940 to about 63,000 acre-feet in 1960, primarily as a result of the growth of the city and development of nearby areas (15). It is estimated that pumpage in the area will exceed 250,000 acre-feet annually by the year 2000. Reductions in the flow of the Rio Grande in the area are related to the increased pumpage, and large increases in the future may result in surface water shortages.

In the Estancia Valley water level declines were as great as 19 feet for the five-year period 1961-1966 and as much as 5 feet in some areas from 1967 to 1968 indicating a water mining condition (3). In the Grants area, large acreages of irrigated cropland have been retired from production and the water rights transferred to production of minerals, mostly uranium.

Topic Rankings During Conference Discussions

Many water supply and pollution problems were discussed during the Citizens' Water Conferences held in the area. Those ranked as the most important by the participants in the meetings are as follows:

I. Most Urgent Water Supply Problems

1. Continuous and orderly supply of irrigation water;
2. Control of flood waters;
3. Shortages of irrigation water through the growing season;
4. Orderly methods for transfer of water rights and protection of water rights;
5. Protection of water rights on agricultural lands;
6. Checking of developers' motivation to ensure proper water development for housing developments.

II. Water Pollution Problems

1. Proximity of domestic wells to other wells and to septic tanks; domestic well pollution with sewer water;
2. Pollution in city water supplies (especially in Estancia where source is unidentified);
3. Water from industry getting into storm sewers, then into rivers;
4. Increase in pollution problem because of increased population;
5. Lack of planning and few restrictions on developers;
6. Sewage and detergent wastes draining from city into the rivers;
7. Salt water intrusions into wells.

III. Improvements in Water-Use Efficiency in Agriculture

1. Better regulation of water distribution;
2. Lining of ditches and installation of proper turn-out gates;
3. Controlling of amount of irrigation water deliveries;
4. Improved efficiency of irrigation systems;
5. Control over irrigation, preventing tail water from leaving the farm.

IV. Effects of Water Quality and Quantity on People

1. Public awareness (it takes many years [25-75] to bring most major water developments into existence);
2. Dependency of quantity and quality of water on snowfall;
3. Improved planning through zoning;
4. Education of the population on water demands and availability;
5. Inadvisability of new agricultural developments.

V. Other Topics Discussed (not in ranked order)

a. Careful handling of planned over-supply of Albuquerque water stored in Jemez Lake to safeguard farmers' rights;
b. Lowering of water table and decreasing water quality because of over-pumping in Estancia Valley;
c. Uneconomical use and misuse of water through private wells as compared to community water system;
d. Poor ditch systems to supply irrigation water;
e. Purchase of water rights by uranium mills from farmers;
f. Increasing use of water by uranium mills;
g. High iron content in water in drains near Los Lunas;
h. Wastes from plating plants dumped into sewer;
i. Sandoval County is 30 miles of open sewer down the Jemez River;

j. Lack of restrictions on land developers;

k. Dumping of raw sewage in San Jose River;

l. Dumping in sewer of chemicals used by chrome plating plants, which then make their way to the rivers;

m. Apparent sufficiency of quality and quantity of water for domestic and industrial uses;

n. Abandonment of irrigated land as a result of a lack of water.

The discussion in the Albuquerque conferences for Sandoval, Bernalillo, Valencia, Torrance, and Socorro counties brought out these important points.

1. Improved irrigation efficiency and enforced rules for the "beneficial use" of water were pointed to as needs in this area. The tendencies for water to be used only on an 8 to 5 basis or to set it and let it run unattended were considered as ways in which water tends to be wasted. Lined ditches and underground pipes for conveying water to the farms and fields are being installed on some farms. These practices were recommended to cut down losses from seepage and evaporation from the many poorly constructed and maintained ditches.

2. Pollution of surface and ground water resulting from the inefficient operation of sewage treatment facilities and from septic tanks in subdivisions, trailer parks, and along streams in the higher areas were pointed to as a growing problem of major proportions. There tend to be too many septic tanks and private wells concentrated on small tracts and subdivisions in the Rio Grande Valley.

3. Transfer of water rights and protection of these water rights were indicated as subjects needing consideration by the communities and by the owners of present valid water rights.

4. Shortage of irrigated water through the entire growing season is an important problem particularly to those who are not receiving water under the Middle Rio Grande Project operation.

5. Public awareness of the water problems seems to be lacking among the majority of the citizens of the area. It was recommended that an educational program be developed to inform the general public regarding the water situation of the area and the possible alternatives which may be available in the management and use of the local and state water resources.

NORTHCENTRAL NEW MEXICO AREA

RIO ARRIBA, TAOS, LOS ALAMOS, AND SANTA FE COUNTIES

Introduction

The Citizens' Water Conferences for the Northcentral Area were held in Espanola. The area includes the counties of Rio Arriba, Taos, Los Alamos, and Santa Fe.

The major drainage of the area is by the Rio Grande and the Rio Chama, a major tributary of the Rio Grande (figure 27). There is an average annual precipitation of 16 to 24 inches over much of the area.

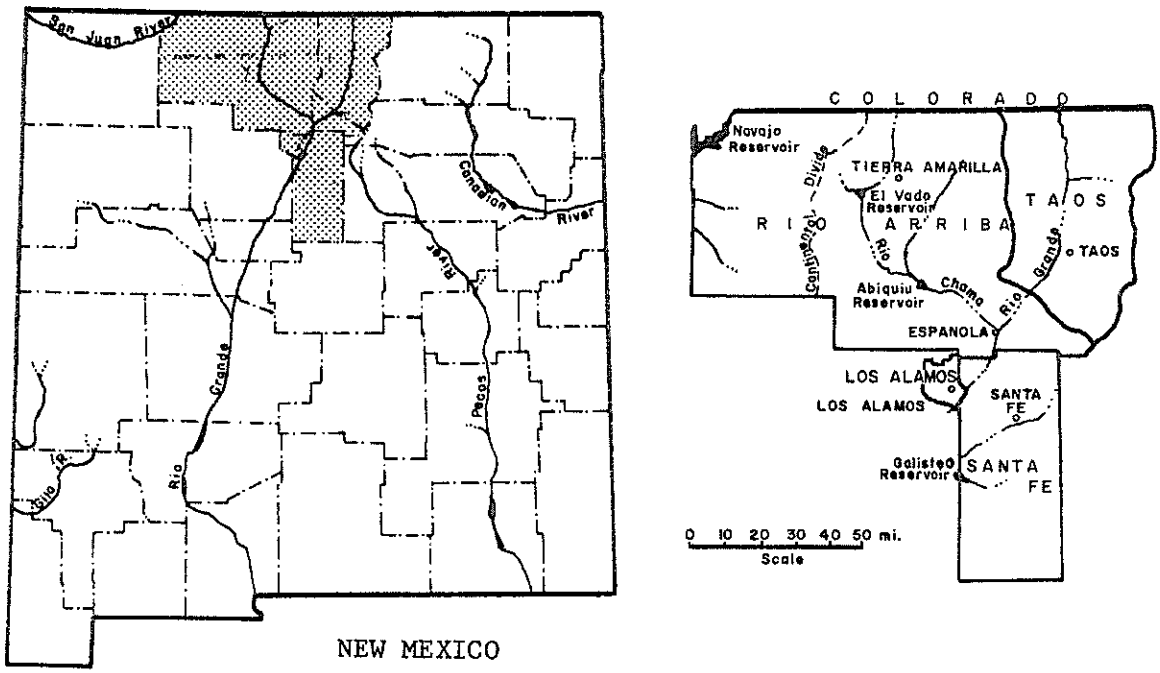


Figure 27. Maps showing counties in Northcentral New Mexico Area.

Population

The total population of the area in 1970 was 111,640 (table 30), over half of which was concentrated in the larger cities (over 2,500) of Espanola, Los Alamos, Santa Fe, and Taos. The remainder of the population is in scattered small communities throughout the area.

Table 30. Total population for the Northcentral Area by county for 1950-1970, and OBERS projections for 1980, 2000, and 2020

County	Year					
	1950	1960	1970	1980	2000	2020
Rio Arriba	24,997	24,193	25,170	20,800	29,700	41,200
Taos	17,146	15,934	17,516	19,500	26,000	30,200
Los Alamos	10,476	13,037	15,198	27,300	37,100	54,900
Santa Fe	38,153	44,970	53,756	65,100	118,700	170,100
Total	90,772	98,134	111,640	132,700	211,500	296,400

Source: 1950-1970: United States Census of Population - New Mexico, 1950, 1960, and 1970.

1980-2020: Office of Business Economics of the Commerce Department and Economic Research Service, USDA, (OBERS), compiled by State Engineer Office, 1971.

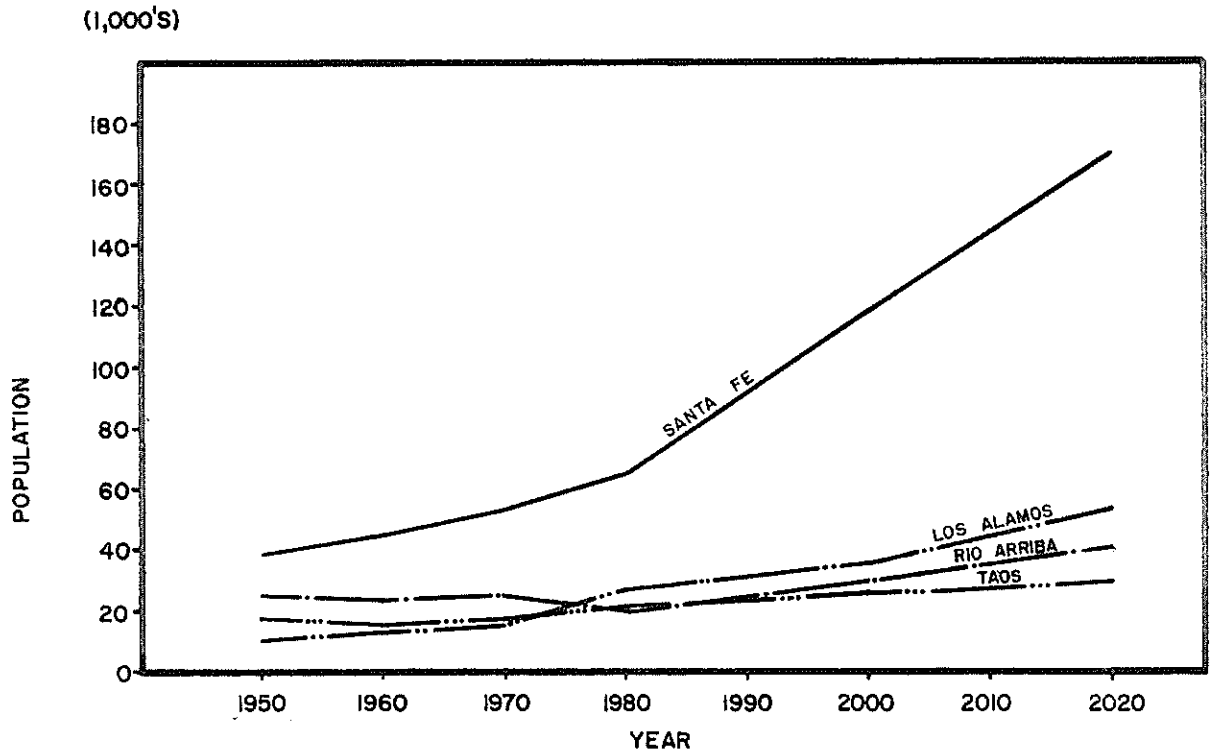


Figure 28. Northcentral Area, total population for 1950-1970, and OBERS projections for 1980, 2000, and 2020.

The total population of the area has increased since 1950 at the rate of about 736 people per year from 1950 to 1960 and at the rate of 1,351 people per year from 1960 to 1970. The 1950, 1960, and 1970 population of the area and projections for 1980, 2000, and 2020, by county are presented in table 30 and in figure 28.

Agriculture

Surface water is the primary source for about 84 percent of the irrigated cropland in the area. Ground water accounts for about 15 percent of the total.

Most of the lands irrigated with surface water are located along the Rio Grande, the major tributaries, and along smaller streams.

The acreages of irrigated cropland in the area since 1940 and projections for 1980, 2000, and 2020 are presented in table 31 and figure 29.

Table 31. Acres of irrigated cropland, including idle, fallow, and diverted acreage, Northcentral Area by county, 1940-1970, and projections for 1980, 2000, and 2020

County	Year						
	1940	1950	1960	1970	1980	2000	2020
	acres						
Rio Arriba	35,600	36,800	38,900	38,860	41,030	41,030	41,030
Taos	37,100	36,000	36,800	40,860	47,890	47,890	47,890
Los Alamos	--	--	--	--	--	--	--
Santa Fe	10,400	6,100	9,900	15,840	19,720	18,570	16,490
Total	83,100	78,900	85,600	95,560	108,640	107,490	105,410

Source: 1940-1970 acreage: Lansford, R. R., and E. F. Sorensen, "Planted Cropland in New Mexico in 1969 and 1970," New Mexico Agriculture--1970, Agricultural Experiment Station Research Report 195, New Mexico State University, Las Cruces, New Mexico, June, 1971, pp 6-12.

Projections for 1980, 2000, and 2020 compiled from estimates of changes in irrigated cropland by the New Mexico State Engineer Office, 1971, 11 pp.

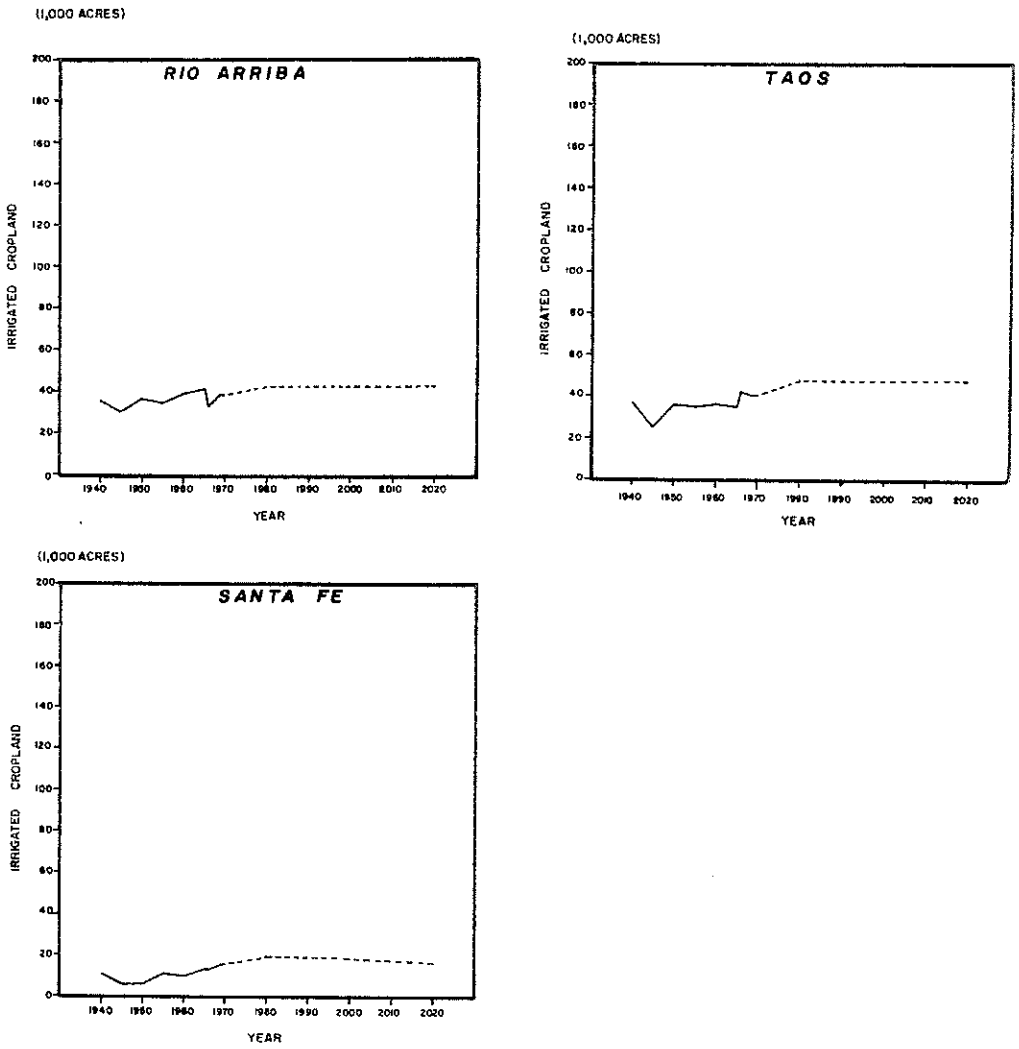


Figure 29. Acres of irrigated cropland, including idle, fallow, and diverted acreage, Northcentral Area by county, 1940-1970, and projections for 1980, 2000, and 2020.

Municipal

Both surface and ground water are used for domestic supplies in the area. The larger cities of Santa Fe and Los Alamos use surface water, as do many small communities and villages in the area. In many small villages and other rural areas, people utilize water from acequia systems to furnish all household supplies.

The total dissolved solids of the water used for urban purposes in the area ranges from less than 100 to about 1,000 milligrams per liter (7). The average daily per capita diversion of urban water ranges from

about 90 gallons to about 215 gallons in the area (table 32). The weighted average urban diversion for the area was about 126 gallons per capita daily in 1965 and is projected to reach about 207 by the year 2020 (table 32).

Table 32. Northcentral Area urban water requirements in 1965 and projections for 1980, 2000, and 2020 by county

County	Year			
	1965	1980	2000	2020
	all values are diversions in gallons per capita daily			
Rio Arriba	90	150	160	190
Taos	119	150	160	190
Los Alamos	215	220	220	220
Santa Fe	120	190	200	210
Weighted average[1]	126	184	193	207

1 Based on OBERS population projections for 1980, 2000, and 2020.

Source: Memo from Earl F. Sorensen: "Projected Urban, Rural, and Self-Supplied (Manufacture and Industrial) Water Requirements in 1980, 2000, and 2020 in New Mexico," New Mexico State Engineer Office, 1971, 2 pp.

Industrial

Income is derived primarily from agriculture throughout most of the area. There is a major contribution to the economy by state and federal governmental activities primarily in Santa Fe and Los Alamos counties. Recreational activities are also becoming more important in the area, while manufacturing is relatively small. Mining operations are located primarily in Taos and Santa Fe counties. Projections of water requirements for the mineral industry indicate that there will be substantial increases in the use of water in the four county area. The projections estimate that the demand for new water will reach about 48,000 acre-feet by the year 2020 (table 33). Much of this could be contributed to indications of increased development of molybdenum reserves near Questa.

Table 33. Northcentral Area projected mineral industry requirements for water, 1980, 2000, and 2020, by county

County	1980		2000		2020	
	New water[1]	Depletion[2]	New water[1]	Depletion[2]	New water[1]	Depletion[2]
	acre-feet					
Rio Arriba	2,160	820	5,440	3,070	19,765	12,630
Taos	10,000	5,000	16,000	8,815	20,000	12,040
Los Alamos	0	0	0	0	2,500	1,875
Santa Fe	450	315	1,800	1,225	5,815	3,955
Total	12,610	6,135	23,240	13,110	48,080	30,500

1 New water as used in these estimates signifies water used for the first time and does not represent total usage which includes recirculation.

2 Depletion includes water used in evaporation, product assimilation, etc., which is no longer available for basin use.

Source: Memo from New Mexico State Engineer: "Projected Water Requirements for New Mexico Mineral Industries for the Years 1980, 2000, and 2020," by Earl F. Sorensen and Ronald B. Stotelmeyer, New Mexico State Engineer Office and U.S. Bureau of Mines, respectively, April 1970.

Water Resource Problems of the Area

Most of the water problems of the area are related to surface water, and its use in agriculture. Agriculture depletes 90 to 95 percent while urban, industry, mining, and recreation deplete 5 to 10 percent of the water used in the area. The first water is being delivered under the San Juan-Chama Diversion Project being completed by the Bureau of Reclamation. It will supply additional water in the area and allow supplemental agricultural development.

The San Juan-Chama Project will make possible an average annual diversion of 110,000 acre-feet of water from the upper tributaries of the San Juan River in the Upper Colorado River Basin. The water, collected from tributary streams in Colorado, is carried through tunnels penetrating the Continental Divide to a reservoir on Willow Creek, a tributary of the Rio Chama in New Mexico. The imported waters will be used to serve the city of Albuquerque with municipal water (48,200 acre-feet), to provide supplemental water for irrigation of lands in the Middle Rio Grande Conservancy District (21,000 acre-feet), to establish

a minimum pool for Cochiti Reservoir (5,000 acre-feet) for recreation, fish, and wildlife purposes, and to replace depletions in the Rio Grande Basin caused by projects for irrigation and other purposes on tributary units (27,700 acre-feet). The remainder would be consumed by evaporation and transportation losses.

The four tributary units authorized are the Cerro Unit, the Taos Unit, the Llano Unit, and the Pojoaque Unit. Proposed storage facility sites for two of the units were found to be geologically infeasible and evaluations for potential redesign and use of ground water in a portion of the Taos Unit are being considered at present.

Farms are generally small and limit the economic productivity of the area, and thus the improvements which can be made to the irrigation systems.

Topic Rankings During Conference Discussions

These problems, as well as many others, were among those ranked by the participants to the Citizens' Water Conferences in the area. The ranking of the major problems by the group during the meetings is included in this report. The first and most important water problem in the area, according to the ranking, is the long-range availability of water. The other water-supply problems, water pollution problems, water use, and quality problems ranked are as follows:

I. Most Urgent Water Supply Problems

1. Long-range availability of water;
2. Fair and equitable adjudication of all water rights;
3. Lack of an adequate transportation system for water from main stream to ditch system;
4. Drain on ground-water supply by Santa Fe racetrack which may drop water level in existing wells;
5. Storing of spring run-off for irrigation, recreation, and other uses.

II. Water Pollution Problems

1. Lack of community sanitary land fills;
2. Inadequate sewage treatment plants and poor location of sewage plants;
3. Raw sewage dumped into irrigation ditches and rivers;

4. Subdivisions and trailer parks with inadequate acreage per house or trailer to handle septic tanks and cesspools;

5. Chemical pollutants from city run-off and city sewage.

III. Improvements in Water-Use Efficiency in Agriculture

1. Land leveling;

2. Tighter control of water use by more careful measurement of amount diverted;

3. Ditch lining, underground pipe;

4. Limited phreatophyte control;

5. Education in irrigation water-use management.

IV. Effects of Water Quality and Quantity on People

1. Health, financial cost, property values;

2. Legal battle over how much water there is available (subdivisions);

3. Migration from the farm because of lack of water;

4. Fewer people moving into the state because of lack of water.

V. Other

1. Need for educational program on water rights and adjudication by State Engineer;

2. Landscaping of cities in native southwest design to reduce water requirements;

3. Licensing of sewage treatment plant operators and protection of their position or job by a personnel act.

VI. Other Topics Discussed (not in ranked order)

a. Adjudication of Indian water rights;

b. Flood water control;

c. Shortage of summer supply of water for municipal uses, especially in Santa Fe;

d. Inundation by mobile homes which need water; resulting wells take water from irrigation;

e. Question on portion of the Rio Grande Compact which deals with the limitations on impounding water;

f. Dumping of used oil in waterways;

g. Contamination of ground water by minerals;

h. Possible contamination of ditch water by power boats on Santa Cruz Lake;

i. More and better erosion control;

j. Mine waste disposal in river;

k. Handling of racetrace sanitation;

l. Better use of rain water;

m. Consolidation of community ditch system;

n. Range reseeding;

o. Attempts to eliminate evaporation;

p. Recycling of city water;

q. Necessity of having official body (county-state-federal) make needed improvements and collect from irrigators before water is delivered because people will not assist in cleaning and maintaining ditches;

r. Need to use overnight storage tank and do not irrigate at night;

s. Opportune installation of underground and subsurface irrigation systems as frozen orchards are replaced;

t. Strained relations caused by low quality water;

u. Legal battles over ownership of water rights;

v. Sewage recycling for evaporative cooling;

w. Smoke from sawmills;

x. Need to plan for open space (Scenic drives with plants along waterways attract tourists, enhance human enjoyment, relieve urban pressures.)

The discussion in the Espanola conferences for Rio Arriba, Taos, Los Alamos, and Santa Fe counties brought out these important points.

1. Adjudication of water rights on an equitable basis was recommended. This is especially important in this area because of the water which is presently being diverted through the San Juan-Chama diversion. This water will be allocated for various uses under a program which is currently being developed and put into operation.

2. A general shortage of water for irrigation of the present water-right land and for municipal and industrial uses was emphasized as a major problem in the area. The people in the Espanola area have just recently organized a water conservancy district which will permit the multiple use and allocation of the new water which is to be available to the area under the San Juan-Chama Project.

3. Pollution of surface and ground water from treatment plants and subdivisions was emphasized as an important and rapidly growing problem. Small tracts and subdivisions having both septic tanks and private wells in too limited an area appear to be possible health hazards.

4. Increased irrigation efficiency, particularly in reorganizing many small ditches into larger lined ditches or underground pipe lines, to reduce seepage and evaporation losses was recommended. Improving the application of water on the fields was recommended, through land leveling, furrow irrigation, more attention to the time the water is diverted to each specific tract.

5. An educational program, on water rights, adjudication procedures, water application improvement methods and the possible alternative uses of the short water supply of the area, was recommended. It was suggested that a periodic news letter originating possibly with the Cooperative Extension Service, Water Resources Research Institute, or State Engineer Office, or a coordinated effort by these and possibly other agencies would help inform people of the many developing problems and programs. There are something over 100 ditch companies in this area which hold annual meetings. Such a letter would be helpful in keeping these groups informed.

NORTHWESTERN NEW MEXICO AREA

SAN JUAN AND McKINLEY COUNTIES

Introduction

The Citizens' Water Conferences for the two county area were convened in Farmington. The area includes San Juan and McKinley counties (figure 30). The climate is generally mild with annual precipitation averaging about 8 to 10 inches. Some of the higher elevations in southern McKinley County receive as much as 16 inches of precipitation annually. The area encompasses about 9 percent of the total land area of the state and has about 9 percent of the 1970 state population.

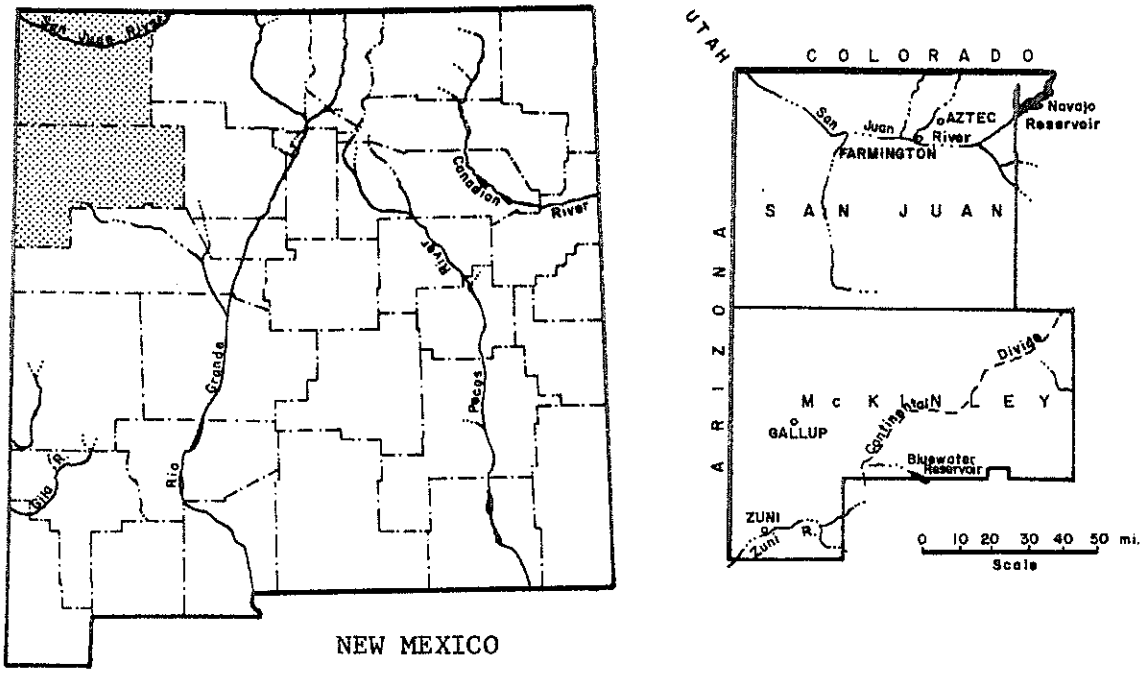


Figure 30. Maps showing counties in Northwestern New Mexico Area.

The principal streams in the area are the San Juan River and the Zuni River. The San Juan River flows into New Mexico in the northeastern corner of San Juan County from its headwaters in Colorado and flows out of San Juan County back into Colorado near the Four Corners and then into Utah. The Zuni River flows west across the southern tip of McKinley County into Arizona.

Population

The major population centers in the area are Aztec, Farmington, Gallup, and Zuni. About 45 percent of the population of the area is concentrated in these four cities. The remaining population is in small towns and villages, and on scattered ranches. Total population of the area for the period 1950-1970 and projections for 1980, 2000, and 2020 are reported in table 34 and figure 31.

Table 34. Total population for the Northwestern Area by county for 1950-1970, and OBERS projections for 1980, 2000, and 2020

County	Year					
	1950	1960	1970	1980	2000	2020
San Juan	18,292	53,306	52,517	53,400	66,700	104,300
McKinley	27,451	37,209	42,391	46,900	59,300	85,100
Total	45,743	90,515	94,908	100,300	126,000	189,400

Source: 1950-1970: United States Census of Population - New Mexico, 1950, 1960, and 1970.

1980-2020: Office of Business Economics of the Commerce Department and Economic Research Service, USDA, (OBERS), compiled by State Engineer Office, 1971.

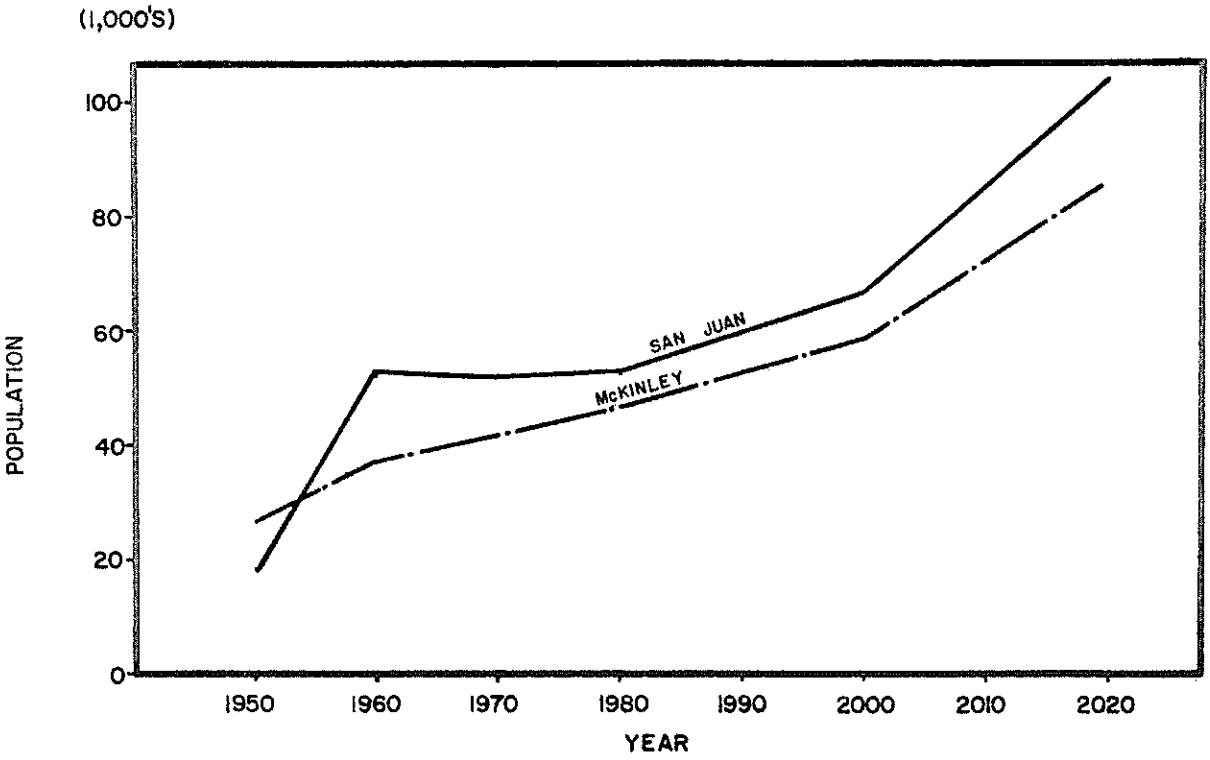


Figure 31. Northwestern Area, total population for 1950-1970, and OBERS projections for 1980, 2000, and 2020.

Agriculture

Irrigation in the area is almost completely with surface water. There are 200 acres irrigated with ground water in McKinley County. Lands along the San Juan River in the vicinity of Farmington, Kirtland, and Fruitland are irrigated. Storage facilities are meager on the Navajo Reservation, consisting of small reservoirs mostly in the Black Canyon area, Black Rock Dam on the Zuni River, and small dams on Rio Nutria.

The Hammond and Navajo Indian Irrigation Projects in the San Juan area, completed as planned, will irrigate 3,900 and 110,000 acres, respectively. The Navajo Reservoir constructed by the Bureau of Reclamation will store water for irrigating the Navajo Project lands in an area generally south of Farmington.

The acreage of irrigated cropland in the area for 1940 to 1970, with projections for 1980, 2000, and 2020 is reported in table 35 and in figure 32.

Table 35. Acres of irrigated cropland, including idle, fallow, and diverted acreage, Northwestern Area by county, 1940-1970, and projections for 1980, 2000, and 2020

County	Year						
	1940	1950	1960	1970	1980	2000	2020
	- - - - - - - - - - - - - - - - acres - - - - - - - - - - - - - - - -						
San Juan	34,800	42,300	47,600	53,000	106,700	180,800	180,800
McKinley	4,000	3,500	3,300	5,290	9,500	9,500	9,500
Total	38,800	45,800	50,900	58,290	116,200	190,300	190,300

Source: 1940-1970 acreage: Lansford, R. R., and E. F. Sorensen, "Planted Cropland in New Mexico in 1969 and 1970," New Mexico Agriculture--1970, Agricultural Experiment Station Research Report 195, New Mexico State University, Las Cruces, New Mexico, June, 1971, pp 6-12.

Projections for 1980, 2000, and 2020 compiled from estimates of changes in irrigated cropland by the New Mexico State Engineer Office, 1971, 11 pp.

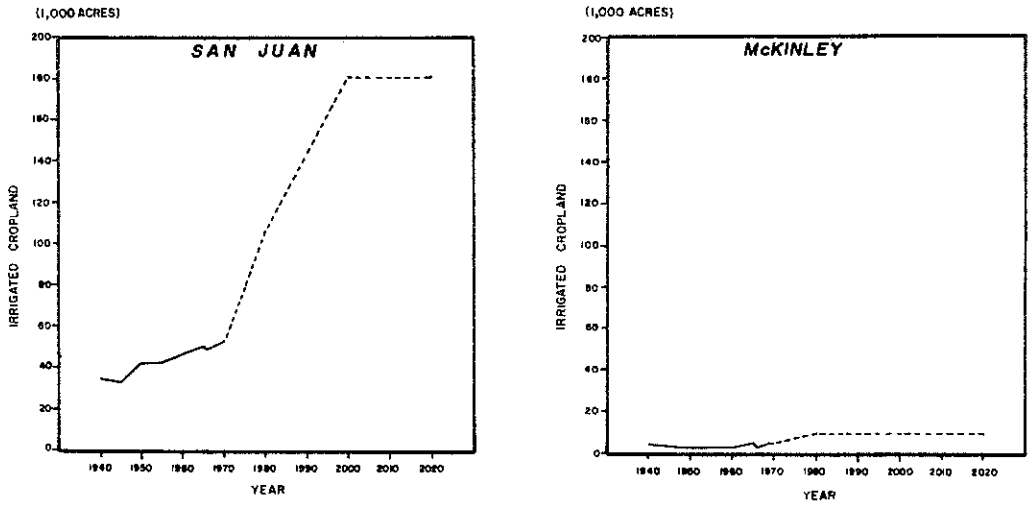


Figure 32. Acres of irrigated cropland, including idle, fallow, and diverted acreage, Northwestern Area by county, 1940-1970, and projections for 1980, 2000, and 2020.

Municipal

Water for urban use in the area is obtained primarily from surface sources. Water for rural domestic use is obtained from both surface and underground sources, with ground water supplying about 55 percent of the total. The total dissolved solids of the water used for domestic supplies ranges from about 300 to about 1,500 milligrams per liter (7). Weighted average urban water requirements for the two county area were 151 gallons per capita daily in 1965 and are projected to reach 207 by the year 2020 (table 36).

Table 36. Northwestern area urban water requirements in 1965 and projections for 1980, 2000, and 2020 by county

County	Year			
	1965	1980	2000	2020
	all values are diversions in gallons per capita daily			
San Juan	199	200	210	220
McKinley	88	150	160	190
Weighted average[1]	151	177	186	207

1 Based on OBERS population projections for 1980, 2000, and 2020.

Source: Memo from Earl F. Sorensen: "Projected Urban, Rural, and Self-Supplied (Manufacture and Industrial) Water Requirements in 1980, 2000, and 2020 in New Mexico," New Mexico State Engineer Office, 1971, 2 pp.

Industrial

The economy of the area is based on agriculture, a growing minerals industry, and tourism. Manufacturing is not carried on to a large extent in the area. The mineral industry development in the area has been relatively recent. Extensive deposits of coal are being mined to supply the thermal-electric generating plant near Kirtland in San Juan County. Oil and gas has been developed extensively in the area. In 1964 there were 1,919 oil wells and 6,210 gas wells in the area and numerous wells have been drilled since then (20). Uranium mining in southern McKinley County is also becoming important. Projected water requirements for the mineral industry (including petroleum) in the area for the years 1980, 2000, and 2020 are presented in table 37.

Table 37. Northwestern Area projected mineral industry requirements for water, 1980, 2000, and 2020 by county

County	1980		2000		2020	
	New water[1]	Depletion[2]	New water[1]	Depletion[2]	New water[1]	Depletion[2]
	acre-feet					
San Juan	17,805	11,465	23,540	16,640	37,160	29,040
McKinley	7,255	4,815	11,030	8,175	24,775	20,350
Total	25,060	16,280	34,570	24,815	61,935	49,390

1 New water as used in these estimates signifies water used for the first time and does not represent total usage which includes recirculation.

2 Depletion includes water used in evaporation, product assimilation, etc., which is no longer available for basin use.

Source: Memo from New Mexico State Engineer: "Projected Water Requirements for New Mexico Mineral Industries for the Years 1980, 2000, and 2020," by Earl F. Sorensen and Ronald B. Stotelmeyer, New Mexico State Engineer Office and U.S. Bureau of Mines, respectively, April 1970.

Water Resource Problems of the Area

Problems connected with surface-water supplies in the area are the major concerns. The surface-water supplies of the San Juan River have not been fully developed; however, they are committed for development of the Navajo Project and to further coal and power development. Future municipal, industrial, irrigation, and other uses will add to the present water problems in the area. In the past irrigation in some areas has experienced water shortages, generally resulting from deficient water supplies or lack of regulatory systems. In most areas, however, water in excess of requirements is available, and water-use inefficiencies existed. The projects, proposed and recently completed, will furnish a dependable water supply to the project lands.

Topic Rankings During Conference Discussions

During the Citizens' Water Conferences the problems of low irrigation efficiencies was ranked as the major water-supply concern in the area. Problems, as they were ranked by the group, are as follows:

I. Most Urgent Water Supply Problems

1. Low irrigation efficiency;

2. Seepage from over-irrigation which is damaging good bottom lands (salt build-up);

3. La Plata shortage of water; need for Animas-La Plata Project;

4. Shortage of water in Gallup for industrial and municipal uses;

5. Dams for flood control.

II. Water Pollution Problems

1. Cloudbursts on arroyos which create silt problems;

2. Silting on Animas and La Plata Rivers;

3. Proper land planning for agriculture to reduce silting;

4. Raw sewage running through a public water supply well field;

5. Septic tanks and sewers creating problems for ground water in subdivisions outside of city limits.

III. Improvement of Water-Use Efficiency in Agriculture

1. Installation of cement-lined ditches or pipes with proper outlets;

2. Sprinkler systems;

3. Improved water control methods under present irrigation systems;

4. Need for specific allocation of water for irrigation;

5. Zoning of irrigated, municipal, and industrial areas.

IV. Other Topics Discussed (not in ranked order)

a. Sprinkling system design, costs, uses;

b. Urban wells - 1,200 to 2,000 to 3,000 feet deep (the water in the first 500 feet is often not usable);

c. Possibility of transporting Navajo water to Gallup;

d. Probability that Ya Ta Hay Project will ease water shortage for only a brief time;

e. Reports that Navajo Tribe farm at Shiprock not working too well;

f. Breaking up of farms and irrigation systems by small tracts;

g. Reduced silting because of Navajo Dam;

h. Possible problems created by Farmington area septic tanks and sewers;

i. Poor quality of shallow water in Gallup area;

j. Raw sewage being dumped in Navajo Lake from boats and other users along shore line;

k. Clean-up of silt in streams to permit more fishing;

l. Limited development in Gallup because of water quality and quantity;

m. Generally poor quality of water from Farmington wells.

n. Affect of silt on recreational use of good quality water in lakes and streams.

The discussion in the Farmington conferences for San Juan and McKinley counties brought out the following important points.

1. Improved irrigation efficiency, both as it applies to improved irrigation systems and in the management of water application on the fields. There are many poorly constructed small ditches throughout the area. These should be improved possibly by use of underground water lines or concrete-lined surface ditches. Several of these ditches could be combined into a more efficient system. Many water users are diverting too much irrigation water which results in the leaching and erosion of the fields and in the damage of lower lying fields and farms from a build-up of harmful salts. Definite application of controls in light of the "beneficial use" of water under New Mexico water law, would assist in correcting these problems.

2. Pollution of surface and ground water by raw sewage from municipalities, subdivisions, trailer parks and small tracts is a serious and a growing problem. A program to reduce the pollution is greatly needed. Pollution of the Navajo Lake by uncontrolled dumping from boats and from houses and camp sites along the shores was pointed to with some alarm.

3. Control of silting to improve the irrigation and recreational use of the San Juan, Animas, and La Plata rivers was recommended. The silt tends to fill up the small irrigation ditches. The heavy silt in the rivers appears to reduce the population and growth of the fish.

4. Continued development of Navajo Project and the proposed Animas-La Plata Project. The 110,000 acre Navajo Indian Irrigation Project is under construction, with the first 10,000 acres expected to receive water by 1975 or 1976. Most of this land will be sprinkle irrigated. The Animas-La Plata Project has been authorized by Congress but no construction funds have been appropriated. This project would supply supplemental water to presently irrigated land and to some additional land particularly on the benches on either side of the river. It was pointed out that only the highest quality land should be developed for irrigation on either project.

5. The City of Gallup is short of water for possible future municipal and industrial development. Much of their present water supply has a high mineral content. Wells from 1,200 to 3,000 feet deep must be distilled to get supplies of water suitable for municipal uses. Some of the water being used for irrigation of lawns tends to kill out the grass within two or three years after planting. Two possibilities for increasing the quantity and quality of water for the City of Gallup are being considered. These proposals are: (1) to bring water from the San Juan River by pipe line from the Navajo Project and (2) to desalt the brackish water presently available in the area.

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APPENDIX A

RESULTS OF QUESTIONNAIRE

Introduction

The citizens who participated in the area Citizens' Conferences on water were asked to complete a detailed questionnaire. This six-page questionnaire, including 34 questions, was designed to determine the participants' interest in water resources, the manner in which they receive information on water resources, and their personal feelings of the vital water problems in their specific areas.

The response to the questionnaire was fairly uniformly distributed over the state. About one-half of the respondents were involved in agriculture, but a cross-section of occupations was represented. Respondents included housewives, as well as industrial, public service, and professional people. There were 211 questionnaires returned.

The answers to some of the more important questions are summarized, on a state-wide basis, in the following section.

Summary of Questionnaires

The questionnaire results indicated that interest in water resources is high. Almost 70 percent indicated their interest as high and about 25 percent as moderate. Over 80 percent of the respondents indicated they were concerned about the water resources of the state. They wanted to see things improved but were not sure what to do. A number stated they needed more information. Many also felt that most individuals in their area have a desire to find out more about what could be done to improve the total water situation in their area and state.

The need for additional water resources information was indicated by the results of the following question:

> Would you say there is a need for additional water resources information to meet the needs of local citizens?
>
> Yes - 89.6% No - 3.3% Not sure - 6.6%

Over 70 percent of the respondents indicated they had asked agencies for information on water-related problems. The five agencies from which most respondents received information were ranked as follows:

1. Soil Conservation Service

2. State Engineer Office

3. New Mexico Cooperative Extension Service

4. Bureau of Reclamation

5. Water Resources Research Institute

Most information was received through personal contacts, meetings, and bulletins.

The respondents' feelings toward opportunities for participation in decisions, and in educational programs in phases of water resources were obtained by the following four questions:

1. Have you had opportunities to take part in the decisions being made on water resources by your community?

   Yes - 56.4% No - 38.9%

2. Are there adequate opportunities for public participation in water resources planning and management?

   Yes - 31.8% No - 50.2%

3. Do you feel there is an adequate public educational program on most phases of water resources in your area?

   Yes - 10.9% No - 81.0%

4. Statement: "Individual citizens presently pay a major role in influencing water resource programs in the area." (Check the answer which best describes your feelings about this statement.)

Strongly agree -	10.0%	Tend to disagree -	21.8%
Agree -	17.1%	Disagree -	17.1%
Tend to agree -	21.3%	Strongly disagree -	6.2%

Opinions of respondents concerning the development of the water resources of the area in which they live, and the direction of this development, were indicated by the following responses.

Most of the respondents felt that water resources would be the limiting factor in the future development and growth of their respective counties. On a statewide basis, feelings about future agricultural development were as follows:

Increase	1980 - 21.3%	2000 - 14.2%	2020 - 11.4%
Decrease	1980 - 39.3%	2000 - 27.0%	2020 - 25.1%
Remain about the same	1980 - 31.3%	2000 - 11.8%	2020 - 12.8%

Many did not respond to this question, especially on the later dates.

About 80 percent felt that municipal demands for water in their respective counties would increase by 1980, and about one-half felt that they would increase by 2000 and 2020. Over one-half of the respondents felt that if municipal demands for water should increase in their county, agricultural development would decrease. About one-half also felt that it would be feasible to import water into their counties by the year 2020.

From a list of water resources problems, the respondents indicated those which were especially applicable in their area. The five items checked most frequently were:

1. Need for water resources planning;
2. Flood control;
3. Ground-water inventories;
4. Limited community water supply;
5. Stream pollution from run-off and erosion.

The five additional water-related problems ranked by the respondents were:

1. Improved surface irrigation practices;
2. Watershed management;
3. Flood control;
4. Importation of water from other areas;
5. Water resources research.

The New Mexico Water Resources Research Institute, established in 1965 for the purpose of conducting research and supply information on important water-related subjects, was interested in determining the extent of public awareness of the Institute and its program and the need for information and/or research. Six specific questions were used. Results indicated that about one-fourth of the respondents had no previous contact with the Institute. Over one-half did not know of any research sponsored by the Institute, and only about one-fourth had used research information from the Institute.

The areas in which additional information would be helpful in meeting community needs were: (1) water conservation--more efficient utilization, (2) improved methods of agricultural water use, (3) groundwater inventories, (4) planning for total water utilization in the area, and (5) surface water sources and supply. Over 80 percent felt that the general public needs additional information on water resources. About 50 percent felt that public officials need additional information and about 35 percent felt that the business community needs additional information.

APPENDIX B

LIST OF THOSE ATTENDING CITIZENS' CONFERENCES ON WATER

STATE CONFERENCE

Name	Address	Representing
Ernest L. Alary	Corrales	Central Area
L. E. Archer	La Mesa	Farmer - Dona Ana County
Herman C. Baca	Santa Rosa	County Extension Service
O. F. Baca	Las Cruces	Extension Supervisor
Mrs. (Mabel) Dee Bibb	Las Vegas	Northeastern Area
Robert D. Bishop	Las Cruces	Soil Conservation Service
Duce B. Bivins	Carlsbad	Southeast Central Area
J. W. Clark	Las Cruces	Civil Engr Dept, NMSU
Bob Creel	Las Cruces	Agri Econ Dept, NMSU
Wilson Conover	Santa Fe	Municipal League
Rowland W. Fife	Albuquerque	Bureau of Reclamation
Marion Foster	Lovington	Southeastern Area
H. E. Gary	Rincon	Southcentral Area
N. N. Gunaji	Las Cruces	Assoc Dir Engr Expr Sta, NMSU
John R. Hakanson	Deming	Southwestern Area
Eldon G. Hanson	Las Cruces	Agri Engr Dept, NMSU
John Hinrichs	Silver City	County Extension Service
Wm. D. Horton, Jr. Lt.Col.	Albuquerque	Corps of Engineers
Carroll D. Hunton	Albuquerque	Farmers Home Administration
Arthur Jernigan	Amistad	Northeastern Area
James E. Kirby	Las Cruces	Extension Service

Name	Address	Representing
Robert R. Lansford	Las Cruces	Agri Econ Dept, NMSU
J. V. Lunsford	Las Cruces	Civil Engr Dept, NMSU
Darrell McCauley	Deming	Southwestern Area
Chas C. McGee	Aztec	Northwestern Area
J. T. McMillen	Silver City	Southwestern Area
Cooper Malone	Lake Arthur	Southeast Central Area
Richard G. Marek	Carlsbad	County Extension Service
Salomon Martinez	Los Lunas	Central Area
F. F. Montoya	La Plata	Northwestern Area
George W. Murrey	Tularosa	Southcentral Area
John M. Oglesby	Shiprock	Extension Service
J. E. Provine	Las Cruces	Bureau of Land Management
Herbert Quintana	Taos	Northcentral Area
S. E. Reynolds	Santa Fe	State Engineer
Mrs. Fred Ribi	Los Alamos	Northcentral Area
Morris Robertson	Alamogordo	Southcentral Area
Anthony Romo	Los Lunas	County Extension Service
Carl Slingerland	Santa Fe	N M Interstate Stream Comm
W. P. Stephens	Las Cruces	Asst Dir Agri Expr Sta, NMSU
H. R. Stucky	Las Cruces	Dir, WRRI, NMSU
Fred A. Thompson	Santa Fe	N M Dept of Game & Fish
F. B. Titus	Socorro	N M Inst of Mining & Technology
K. A. Valentine	Las Cruces	Animal Science Dept, NMSU

AREA CONFERENCES

SOUTHWESTERN AREA

Bob Abercrombie
Silver City

W. W. Baltosser
Silver City

A. M. Bosworth
Silver City

Horace L. Bounds
Santa Rita

Mrs. Horace L. Bounds
Santa Rita

John W. Fleming
Hanover

Mitzi Fortenbury
Quemado

Lew Foster
Silver City

Alvin Franks
Silver City

J. A. Gardner
Deming

John R. Hakanson
Deming

John Higbie
Silver City

John Hinrichs
Silver City

Darrel McCauley
Deming

J. T. McMillen
Silver City

Ben Ormand
Silver City

Lewis Putman
Deming

Jimmy Shelley
Mesilla Park

Virginia Slover
Animas

Charles J. Smith
Bayard

William A. Swift
Rodeo

Clair Tozer
Silver City

Fred Tranger
Albuquerque

L. C. Wells
Deming

SOUTHCENTRAL AREA

Jack Cain
Truth or Consequences

Don H. Chappel
Las Cruces

Darrell Danner
Las Cruces

Charles Dickerson
Las Cruces

Art Evans
Caballo

Henry U. Gaines
Las Cruces

H. E. Gary
Rincon

G. F. Henry
Las Cruces

J. C. Johnson
Tularosa

James E. Kirby
Las Cruces

Chester La Paz
Mescalero

Don McKee
Truth or Consequences

George W. Murray
Tularosa

Frederick G. Peso
Mescalero

Morris Robertson
Alamogordo

George Vaughn
Las Cruces

Danny Ware
Mesilla Park

SOUTHEAST CENTRAL AREA

Bill Atkinson
Roswell

Duce D. Bivins
Carlsbad

Dean Campbell
Las Cruces

William W. Campbell
Roswell

John J. Chappell
Roswell

Bill Hall
Las Cruces

Bob Herrin
Roswell

John R. Lucas
Roswell

Cooper Malone
Lake Arthur

Thomas T. Mann
Roswell

Richard G. Marek
Carlsbad

Jim Ogden
Loving

Don Patterson
Carlsbad

W. E. Utterback
Hagerman

Charles F. Ward
Roswell

George C. White
Ruidoso

SOUTHEASTERN AREA

David Bigbie
Portales

Dudley Cash
Portales

Philip E. Crystal
Clovis

Gerald Dorough
Clovis

Hank Elmendorf
Las Cruces

Emory Ferguson
Portales

Edwin Ford
Clovis

Ted Ford
Portales

Marion Foster
Lovington

Dale Fuehrig
Clovis

Stan Fury
Grady

Vernon Gibson
Portales

Jim Gilstrap
Lovington

Eddie Harrington
Texico

Merle Kindel
Lovington

Hayden Martin
Portales

Ernest Murrell
Clovis

Bibby C. Smith
Portales

Bob Taylor
Portales

NORTHEASTERN AREA

Jose I. Angel
Santa Rosa

Herman C. Baca
Santa Rosa

K. S. Basappa

Mrs. Dee Bibb
Las Vegas

Richard C. Chavez
Puerto de Luna

Richard L. Chavez
Puerto de Luna

Manuel Cordova
Puerto de Luna

Arturo F. Duran
Rainsville

Honorato Flores
Puerto de Luna

Paul R. Gamertsfelder
Las Vegas

Jose M. Garcia
Santa Rosa

J. Heimann
Bueyeros

Joe E. Herrera
Las Vegas

Macario Herrera
Las Vegas

Arthur Jernigan
Amistad

Mrs. Arthur Jernigan
Amistad

Charles Kruse
Wagon Mound

Jacob H. Langley
La Loma

Carlos Lovato
Watrous

Cip Lujan
Sabinoso

Frank Lujan
Sabinoso

George Marquez
Santa Fe

Anthony Martinez
Rociada

J. D. Montoya
Ocate

Carlos E. Padilla
Puerto de Luna

Cap Parkinson
Las Vegas

Secundino Rivera, Sr.
Santa Rosa

Manuel Roybal
Santa Fe

Arsenio C. Sanchez
Puerto de Luna

Lonnie L. Schulze
Clayton

Anselmo Sedilla
Las Vegas

Jose Simon Vigil
Pecos

Liberato A. Vigil
Pecos

A. W. Woodburn
Raton

CENTRAL AREA

Ernest L. Alary
Corrales

Fred Alber
Albuquerque

Efren Apodaca
Los Lunas

Rudy Benavidez
Belen

Jim G. Brown
Albuquerque

David Candelaria
Grants

Ralph Daugherty
Estancia

Eric L. Freelove
La Jara

Conrad Gonzales
Albuquerque

Mrs. Grace Hyde
Albuquerque

Mrs. E. L. Johnson
Albuquerque

Harbour Jones
Los Lunas

Noble T. Jones
Albuquerque

Max B. McBride
Grants

F. S. Marquez
Bernalillo

Solomon Martinez
Los Lunas

Anthony Romo
Los Lunas

James R. Sais
Albuquerque

Edith Schulmeister
Albuquerque

Edward H. Wallace
Albuquerque

L. G. Zartman
Albuquerque

NORTHCENTRAL AREA

Roberto Apodaca
Santa Fe

Mrs. Jack (Jeanne) Arby
Los Alamos

Nancy Bartlet
Los Alamos

Melinda Bell
Espanola

Robert Blanton
Los Alamos

Joe H. Casados
Espanola

J. R. Chavez
Espanola

Richard C. Crook
Los Alamos

Lud Emelity
Los Alamos

Hayden Gaylor
Tierra Amarilla

Mrs. Peter (Helen) Gram
Los Alamos

Jim Lee
Santa Fe

Roberto Lopez
Ascencion
Paraguay, S. A.

Richard L. Lucero
Espanola

Abad Martinez
Taos

Palemon A. Martinez
Taos

Robert D. Martinez
Espanola

Manuel A. Montoya
Santa Fe

Robert Nieman
Taos

Margaret G. Prince
Los Alamos

W. D. Purtymun
Los Alamos

Marie Louise Quarles
Tierra Amarilla

Herbert Quintana
Taos

Mrs. Fred Ribe (Molly)
Los Alamos

T. W. Roehl
Los Alamos

Fred Romero
Fairview

Reynaldo Romero
Santa Fe

Richard F. Romero
Santa Fe

Pablo Roybal
Santa Fe

Fred Sack
Los Alamos

Larkin Salazar
Santa Fe

Myrtle L. Stedman
Tesuque

Mrs. A. M. Swarthout
Santa Fe

Alfonso Tejado
Taos

Carlos A. Trujillo
San Cristobal

Paul Trujillo
Espanola

Phil Trujillo
Alcalde

Belen Vigil
Espanola

NORTHWESTERN AREA

Ralph Armstrong
Farmington

Norris O. Enders
Farmington

Myles R. Jones
Fruitland

Charles Keller
Farmington

Claude W. Lester
Gallup

Bert Levine
Farmington

Chas C. McGee
Aztec

John M. Oglesby
Shiprock

Orion J. Utton
Aztec

F. F. Montoya
La Plata

Walter E. Rein
Farmington

C. M. Woodbury
Farmington

Edward Munoz
Gallup

Leroy Scherer
Aztec

Guido E. Zecca
Gallup