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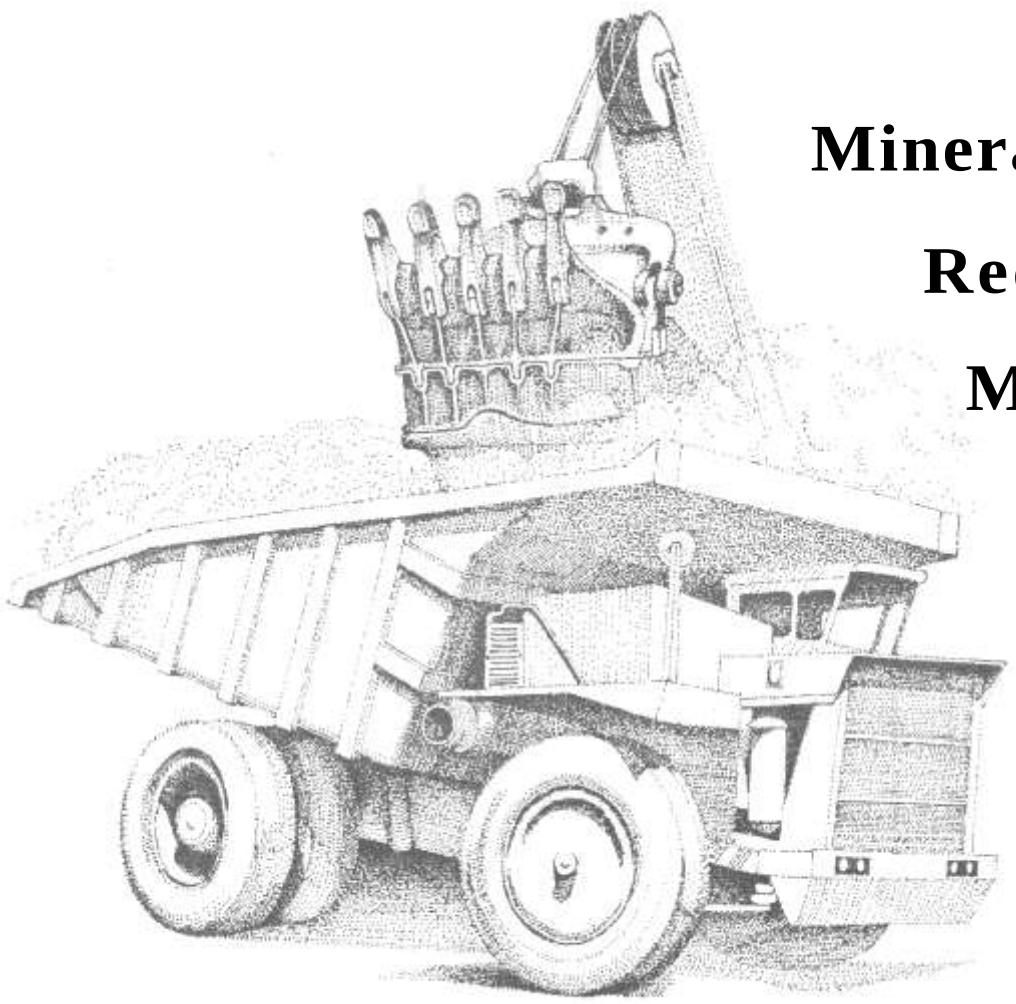

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NEW MEXICO BUREAU OF MINES AND MINERAL RESOURCES
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by

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Mineral Resources and Water Requirements for New Mexico Minerals Industries

This paper outlines and summarizes 1) present and estimated future production of mineral resources in New Mexico, 2) location and utilization of these resources, and 3) the estimated water requirements for mineral industries for the years 1962, 1970, 1980, 2000, and 2020. This information supersedes similar data in an April 1970 memorandum by Sorensen and Stotelmeyer "Projected Water Requirements for New Mexico Mineral Industries for the years 1980, 2000, and 2020" prepared for the State Water Plan. Changes are discussed in footnotes and attachments to tables.

The tables are organized in mineral commodity groups as follows: potash and other soluble salt minerals; uranium; copper; molybdenum; lead; zinc, and other metallic and nonmetallic minerals; industrial stone and minerals (sand, gravel, building stone, clay, and cement); petroleum and natural gas (oil and gas well drilling, petroleum secondary recovery); processing of fossil fuels (coal mining, gasification, beneficiation; petroleum refining, petrochemical; natural gas processing and transmission).

Items for which water requirements were estimated include: mining, milling, and smelting operations of metallic and/or nonmetallic minerals; oil and gas well drilling; petroleum secondary recovery; natural gas transmission; and the processing of fossil fuels. The estimates do not include power requirements from fossil or uranium fuels.

The figure and 9 tables accompanying this report are included at the rear. Figure 1, prepared by the New Mexico State Bureau of Mines and Mineral Resources shows major river basins and general location of mineral resources in New Mexico.

Table 1 summarizes water requirements for New Mexico mineral industries for 1962, 1980, 2000, and 2020. Projected requirements for water shown in table 1 are the original estimates prepared by the U. S. Bureau of Mines in 1968 for the State Water Plan.

Table 2 summarizes the changes made in estimates of table 1, along with uses of water by the minerals industries in New Mexico in 1970. Table 3 shows projected water requirements of mineral commodities for 1980, 2000, and 2020 and how the projected requirements were allocated to counties. The attachment to table 2 explains changes made to estimated requirements shown in table 1 and explains why the changes were made. Tables 4 and 5 show projected water requirements for New Mexico counties and river basins; table 6 shows sources of water for mineral use in 1980, 2000, and 2020.

Tables 7, 8, and 9 show mineral water requirements in New Mexico in 1970. These tables identify the use of water for that year by mineral commodities, location of use by county and river basin, and the sources of water used.

The intent of the attached estimates is that sufficient water requirements for any future production mix in New Mexico are adequate. Consequently, the first approach in determining water requirements was to identify and locate mineral reserves and resources in each county of the state. A tabulation was made of past and present production, known mineral reserves, and the probability of future production in each of the counties. These data were then used as an indication of what requirements for water might be.

The estimated water requirements were weighted to reflect two conditions: 1) mining and processing of minerals similar to existing conditions found in Lea County (oil), Grant County (copper), and Valencia County (uranium); 2) an increase of economic activity that envisions processing of minerals in ways that do not presently exist. Examples might be petrochemical plants in San Juan and McKinley counties or a steel mill near Albuquerque.

New water as used in these estimates signifies water used for the first time and does not represent total usage (which includes recirculation). Depletion includes water used in evaporation and product assimilation, no longer available for basin use. The percentages shown in table 2 are estimates of new water that is depleted. Because the amount of water being used increases with time, one might assume that this increase indicates inefficient use of water. The following reasons refute any such claim: 1) new plants constructed in the Southwest are more efficient than older plants; more production is obtained per gallon or acre-foot of water depleted; also, depletion rates of new water are greater indicating that water is being used more effectively 2) mineral industries in New Mexico must compete with other users for limited water supplies; consequently, these industries will find it to their advantage to conserve water. Thus, the increasing percentage of water depleted with respect to time assumes that water will be used more efficiently (rather than less) as these industries continue to grow.

In general, more efficient uses of water are expected as industries develop; however, efficiencies will vary between different extractive and processing methods of use. Data obtained in 1970 illustrates the wide variation of

present depletion rates (see tables 2 and 7); these rates were used as a guide in projecting future rates of depletion.

Water requirements for petroleum secondary recovery shown in tables 2 and 3 are based on present practices in New Mexico. Amounts could be reduced if oil companies begin to use secondary recovery methods other than waterflooding.

Projected water requirements for New Mexico mineral industries for the years 1980, 2000, and 2020 (as shown in table 1) were developed by the U.S. Bureau of Mines' Division of Statistics (currently the mineral supply Intermountain Field Operation Center, Denver, Colorado). The estimates were based on past and present mineral production in New Mexico; future demand was based on national-demand figures projected by the Division of Statistics. The projected water requirements were sent to the U. S. Bureau of Reclamation in 1968 (Letter dated 5 Sept. 1968 to J. A. Bradley, Acting Regional Director, U. S. Bureau of Reclamation, Region 5, from Ronald B. Stotelmeyer). Since the 1968 estimate was prepared, population projections have changed; however, the lower levels projected will not significantly affect the water requirements for mineral production in New Mexico.

A study of U. S. Primary Mineral Supply-Demand Relationships was made by the U. S. Bureau of Mines in January 1972. U. S. primary mineral supply/demand relationships prior to 1970 were compared with those anticipated for 2000.

Specifically, tabulations of the study show the quantity and value of primary minerals that would have to be derived from domestic sources in 2000, if 1) the 1970 production/demand ratio is maintained, and 2) if production trends of the past 20 years prevail. Differences between the constant ratio projections and those based on historical production trends indicate potential changes in the percentage of the U.S. demand for minerals that may be met from domestic sources.

In 1970, the U. S. demand for primary minerals totaled $43.1 billion. On the basis of 1970 constant dollars, the demand is expected to increase about fourfold to almost $170 billion by the year 2000.

By 2000, domestic production will supply substantially less of the demand for primary minerals than at present. For example, to maintain the present production/demand ratio in 2000 a domestic primary mineral production of $134 billion would be required. However, based on historical production trends of the past 20 years the value of domestic primary production in 2000 would be about $74 billion, $60 billion less than the $134 billion noted above. On this basis of comparison, the value of primary mineral net imports would be $60 billion in 2000, or about 7 times greater than in 1970.

Even though revised population projections are considerably lower in 1972 than those made in 1968, the supply/demand relationships discussed above indicate all minable resources in the United States and in New Mexico must be utilized to meet future requirements. Even then a considerable amount of the Nation's demand for minerals will probably have to be imported. For these reasons, no revision of the 1968 future requirements for mineral commodities in New Mexico will be made.

As noted above, the estimates for water were based on past and present mineral production in New Mexico. Future production was based on national-demand figures projected by the Bureau of Mines, Division of Statisics. However, the data furnished by the Division of Statistics was modified because of Stotelmeyer and Baker's knowledge of some of the categories as they pertain to the state. The requirements shown in table 1 could possibly occur for each of the categories listed because requirements are based on known mineral reserves, existing technology, and likely demand. But, New Mexico has other mineral resources not named specifically in that listing; some of these resources will probably be utilized in future years. Revisions are explained in tables 2 and 3.

The use, occurrence, distribution, and outlook for all known mineral commodities were discussed in considerable detail in "Mineral and Water Resources of New Mexico", the report of the U. S. Senate Committee on Interior and Insular Affairs in 1965 (also published as Bulletin 87 of the New Mexico State Bureau of Mines and Mineral Resources). Much of the data summarized in the tables of this memorandum was obtained from that report.

In that publication, a canvass of potash producers just prior to 1962 indicated a reserve of 1.5 billion tons of potash ores, mainly in Eddy, Chaves, and Lea counties. Other salines, for example potassium-sodium, and magnesium-bearing compounds, occur in possibly exploitable amounts in other counties as shown in table 3.

Uranium reserves as of January 1, 1963, were reported (Bull. 87) to be 32.5 million tons of ore, only 10 to 15 years of industry operation at 1963 extraction rates. However, subsequent exploration programs have resulted in the discovery of large additional reserves; future discoveries will probably be made as warranted by market conditions.

Known and partly developed copper reserves, possible reserves, plus statistically likely resources, constitute at least threefold all ore produced to date. As new prospecting methods are developed, other copper resources almost certainly will be discovered.

Past production of lead and zinc has mainly been from Grant, San Miguel and Socorro counties. However, the deposits occur in an area that extends from the southwest corner of the state to the Colorado border. From the standpoint of reserves, New Mexico probably will continue to be a significant producer of lead and zinc.

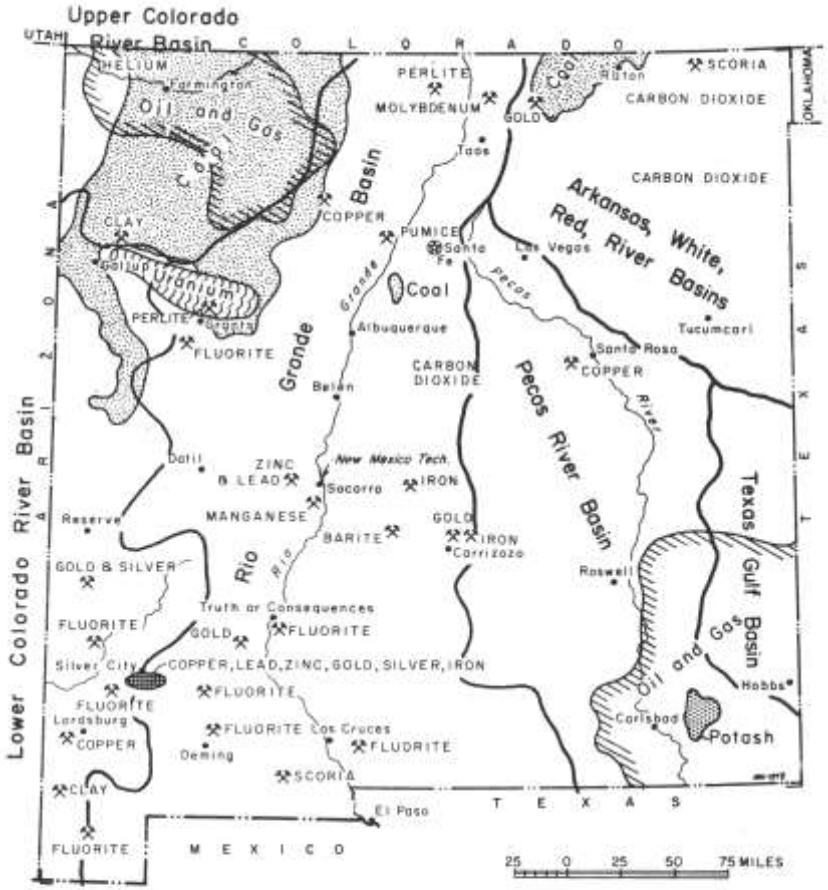

Figure 1 — General location of mineral resources and major river basins in New Mexico
(New Mexico State Bureau of Mines and Mineral Resources)

Molybdenum deposits are scattered across the central part of the state in a northeast-southwest belt, having been reported from more than 60 localities in 19 counties. The major resources in those counties are shown in table 3. Significant exploration activities were conducted in Lincoln County from the late 1960's to the present.

Most of the state's oil and natural gas production has been from counties in the southeast and northwest parts of the state, and has accounted, over the years, for 60 to 65 percent of the state's production value. Some of the largest known reserves of coal in the United States are located in the northwestern portion of New Mexico, and in Colfax County in the northeast. Other deposits are scattered across the central part of the state in a general north-south direction.

The value of minerals and fuels produced in New Mexico has shown a steady increase with only minor fluctuations. In comparison with other states in the nation New Mexico has ranked from 5th to 8th since 1962 in mineral and fuel production. This ranking will not change materially in the next 2 or 3 decades.

Production of copper, uranium, fluorspar, mica, molybdenum, cement, and general industrial and building minerals will expand.

Major expansion in the production of coal is expected to occur as the demand for low-sulfur coal and energy in the form of coal increases. Production for direct utilization as fuel, and for conversion to gaseous or liquid forms of fuel, is expected to more than triple in the next decade; and then stabilize as coal becomes a significant source of carbon in the chemical industry.

Increased demand for oil and gas production will continue. Requirements for these commodities will probably result in new price structures being developed, accompanied by accelerated exploration programs to locate additional reserves. Assuming oil and gas reserves in New Mexico will be extended under these conditions, then production in New Mexico should hold more or less constant for the next 20 to 30 years.

Future requirements for mineral commodities and their production in New Mexico can be based only upon available data. The impact of social and environmental constraints could be very significant but can only be presumed. Future programs will include mining and mineral processing methods that reduce environmental hazards to acceptable levels but, will also increase production costs.

Tables follow

TABLE 1 – New Mexico minerals industry requirements for water – State Estimated Requirements – 1962-2020

Mineral Commodity	1962		1980		2000		2020	
	Billion gal.	ac.-ft.	Billion gal.	ac.-ft.[2]	Billion gal.	ac.-ft.[2]	Billion gal.	ac.-ft.[2]
Potash	5.334	16,370	7.031	21,580	13.819	42,410	30.063	92,265
Uranium	1.516	4,653	8.369	25,685	11.760	36,090	21.502	65,990
Copper	2.827	8,676	6.339	19,455	15.350	47,110	23.826	73,120
Lead – zinc	0.269	826	0.394	1,210	0.670	2,060	1.222	3,750
Molybdenum	–	–	3.341	10,255	7.812	23,975	21.774	66,825
Sand and gravel	0.313	960	0.890	2,730	1.353	4,155	2.152	6,605
Cement	0.0095	29	0.023	70	0.050	155	0.078	240
Coal	0.029	89	0.036	110	0.052	160	0.076	235
Oil & gas well drilling	0.485	1,488	0.541	1,660	0.869	2,670	1.467	4,500
Petroleum secondary recovery	2.257	6,927	3.768	11,565	7.086	21,750	13.463	41,320
NGP – liquid [1]	2.763	8,480	6.233	19,130	13.032	40,000	26.064	79,990
NGP – carbon black	0.120	368	0.170	520	0.251	770	0.386	1,185
State totals	15.922	48,866	37.135	113,970	72.104	221,305	142.073	436,025

Notes:

These estimates are based on 1) 1962 quantities from table 3, U. S. Bureau of Mines IC 8276 and 2) table attached to letter dated September 5, 1968, Stotelmeyer to U. S. Bureau of Reclamation. These estimates have been revised as explained in the memorandum and shown in table 2.

[1] NGP – Natural gas processing. This item includes all natural gas (helium, CO_2, etc.) processing; petroleum refining; possible petrochemical activities; beneficiation of coal; transmission of natural gas

[2] Numbers rounded to nearest 5 acre-feet

TABLE 2 – New Mexico minerals industry requirements for water – State Estimated Requirements – 1970-2020

Mineral Commodity	1970			1980			2000			2020		
	New water	%	Depletion	New water	%	Depletion	New water	%	Depletion	New water	%	Depletion
Potash and other soluble salt minerals	12,177	43	5,294	21,580	45	9,710	42,410	50	21,210	56,510	55	31,090
Uranium	8,498	51	4,337	25,790	70	18,050	36,890	75	27,670	68,990	80	55,190
Copper	22,750	58	13,248	35,850	68	24,600	52,770	70	37,110	76,280	75	57,220
Molybdenum	6,033	17	1,032	12,260	50	6,130	33,980	55	18,690	82,830	60	49,700
Lead-zinc	350	12	42	2,410	40	960	4,060	50	2,030	7,750	60	4,650
Industrial stone and minerals	923	28	251	2,810	27	750	4,330	32	1,400	6,860	42	2,860
Oil and gas well drilling	1,561	10	156	1,660	10	170	2,670	10	270	4,500	10	450
Petroleum secondary recovery	17,769	neg.	0	16,000	neg.	0	18,000	neg.	0	20,000	neg.	0
Processing of fossil fuels	14,458	59	8,505	88,750	88	78,530	117,270	92	108,420	154,180	93	143,260
State totals	84,519	39	32,865	207,110	67	138,900	312,380	69	216,800	477,900	72	344,420

Notes (general):

1) All units except percent are in acre-feet, estimates were rounded to nearest 10 (except 1970)
2) All new water considered to be of good quality (fresh). Quantities estimated for petroleum secondary recovery are considered to be requirements for fresh water and do not include well brines or other saline water that might be used for this purpose. Depletion of water used for secondary recovery is negligible
3) Percents (%) are estimated percentages of new water that is depleted
4) The largest producer of molybdenum presently uses large quantities of water for pipeline transport to tailing ponds. There is a significant quantity of return flow with respect to diversion and these conditions are estimated to continue
5) Table 2 differs from table 1 in these respects: a) Sand, gravel, and cement combined into a single entry termed industrial stone and minerals; Coal, NGP-liquid, and NGP-carbon black combined into a single entry termed processing of fossil fuels (this entry includes a new item, namely, coal gasification; b)totals for potash revised in 2020; totals for uranium, copper, molybdenum, lead-zinc, and processing of fossil fuels revised in 1980, 2000, and 2020; totals for petroleum secondary recovery revised in 1980, 2000, and 2020; state totals revised in 1980, 2000, and 2020. These revisions explained in attachments to table 3

Attachment to Table 2

Details of changes in projected water requirements for mineral commodities in New Mexico

The following identifies changes made to estimated requirements of "New Water" projected in 1968 for the time frames of 1980, 2000, and 2020 (see table 1). The former (1968) and revised quantities of New Water are shown for each mineral commodity changed along with the difference between the two quantities and an explanation why the change was made.

The entry "Potash" in table 1 is called "Potash and Other Soluble Salt Minerals" in table 2. Except for the year 2020, no changes of water requirements were made for this item.

	Estimated for 2020
	New water (ac.-ft.)
Table 1 (potash)	92,270
Revised (table 2)	56,510
Difference	– 35,760

The reduction occurred because New Water requirements in the year 2020 in Chaves, Eddy, and Lea counties were projected to be the same as those estimated for the year 2000. Because of recent opening and development of potash sources in Canada, some curtailment can be expected in production of potash in New Mexico. This curtailment is estimated to occur in Chaves, Eddy, and Lea counties where most of the potash is presently produced.

The numbers for uranium in table 1 have been revised as follows:

	New water (ac.-ft.)		
	1980	2000	2020
Table 1 (uranium)	25,685	36,090	65,990
Revised (table 2)	25,790	36,890	68,990
Difference	+ 105	+ 800	+ 3,000

The estimate of water for uranium was revised to include the probable utilization of thorium for power generation. The revision reflects thorium resources in various sections of the state, particularly Lincoln County.

The numbers given for copper in table 1 have been revised as follows:

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	New water (ac.-ft.)		
	1980	2000	2020
Table 1 (copper)	19,455	47,110	73,120
Revised (table 2)	35,850	52,770	76,280
Difference	+16,395	+ 5,660	+ 3,160

Changes and anticipated changes that have taken place in Grant and Hidalgo counties since the estimate of water for copper (table 1) have resulted in revising estimated quantities of water required for this commodity in 1980, 2000, and 2020.

In Grant County, Phelps-Dodge Corporation is producing copper from a large mining-milling operation near Tyrone; Kennecott plans to about double their production from mine and smelter facilities near Hurley. In Hidalgo County, a new smelter and acid plant is planned and should be in operation by 1980. Prior estimates for 1980 in these counties did not anticipate this rapid expansion in production and were underestimated. Increases in requirements shown above will correct the estimate for 1980 and provide for additional requirements anticipated in 2000 and 2020.

The numbers of lead-zinc in table 1 have been revised as follows:

	New water (ac.-ft.)		
	1980	2000	2020
Table 1 (lead-zinc)	1,210	2,060	3,750
Revised (table 2)	2,410	4,060	7,750
Difference	+1,200	+2,000	+4,000

The revision was made so that water requirements for lead, zinc, and associated minerals reflect the resources of these metals in Lincoln and Socorro counties.

The numbers for molybdenum in table 1 have been revised as follows:

	New water (ac.-ft.)		
	1980	2000	2020
Table 1 (molybdenum)	10,255	23,975	66,825
Revised (table 2)	12,260	33,980	82,830
Difference	+ 2,005	+10,005	+16,005

Since the time water requirements for molybdenum were estimated (table 1), exploration has disclosed the existence of possible large resources

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of this ore in Lincoln and Otero counties. The estimate was increased to include future utilization of these mineral deposits.

The totals for industrial stone and minerals shown in table 2 combine the totals shown for sand and gravel, and cement shown separately in table 1.

Estimates of requirements of water for petroleum secondary recovery were revised after reviewing the amounts of water used for this purpose in recent years (1968, 1969), and consultation with personnel of the New Mexico Oil Conservation Commission. The following values are considered adequate for use in petroleum secondary recovery in New Mexico:

Year	Total requirement - ac.-ft.
1980	16,000
2000	18,000
2020	20,000

In 1967, production of oil, by county, ranked as follows:

County	Percent
Lea	59
San Juan	15
Eddy	14
Rio Arriba	5
Chaves	4
Roosevelt	3
McKinley	
Sandoval	

The above tabulation was used as a guide to prorate future requirements of water for secondary recovery of petroleum, by county, and for the state. Requirements (ac.-ft.) by decade are estimated to be as follows:

County	Percent	1980	2000	2020
Chaves	5	800	900	1,000
Eddy	10	1,600	1,800	2,000
Lea	50	8,000	9,000	10,000
McKinley	2	320	360	400
Rio Arriba	6	960	1,080	1,200
Roosevelt	9	1,440	1,620	1,800
Sandoval	2	320	360	400
San Juan	16	2,560	2,880	3,200
Totals	100	16,000	18,000	20,000

The numbers for secondary recovery of petroleum in table 1 were revised as follows:

	New water (ac.-ft)		
	1980	2000	2020
Table 1 (petroleum secondary recovery)	11,565	21,750	41,320
Revised (table 2)	16,000	18,000	20,000
Difference	+ 4,435	- 3,750	-21,320

The totals shown for processing of fossil fuels in table 2 combine the totals shown for coal, NGP-liquid, and NGP-carbon black shown separately in table 1. The estimates were then increased to provide for coal gasification requirements as explained below:

	New water (ac.-ft.)		
	1980	2000	2020
Table 1 (as noted above)	19,760	40,930	81,410
Revised (table 2)	88,750	117,270	154,180
Difference	+68,990	+76,340	+72,770

Since the time water requirements for processing of fossil fuels were made, coal gasification as a process has been developed and will probably be utilized extensively where large resources of coal are available in New Mexico. Increases in water requirements shown above will provide for coal gasification water requirements especially as indicated for the coal resources in McKinley and San Juan counties in the Upper Colorado River Basin. **In** San Juan County, proposals are under consideration for diverting and depleting as much as 74,000 acre-feet of water by the year 2000 for coal gasification.

TABLE 3 — New Mexico minerals water requirements — projection by category of use (all units are ac. ft.)

Type of use and county	1980 New water	1980 Depletion	2000 New water	2000 Depletion	2020 New water	2020 Depletion
Potash [1, 2]						
Chaves	80	35	540	270	540	300
Curry	430	190	1,270	635	3,690	2,030
De Baca	210	95	850	425	2,770	1,525
Eddy	7,400	7,830	13,790	15,900	13,790	17,490
Guadalupe	210	95	420	210	1,845	1,015
Harding	200	90	420	210	2,770	1,525
Lea	12,400	1,085	22,800	2,400	22,800	2,640
Quay	220	100	420	210	1,845	1,015
Roosevelt	430	190	1,270	635	3,690	2,030
Torrance	0	0	420	210	1,845	1,015
Union	0	0	210	105	925	505
Totals	21,580	9,710	42,410	21,210	56,510	31,090
Uranium [2, 3]						
Catron	260	180	360	270	1,975	1,580
Grant	0	0	360	270	1,975	1,580
Harding	260	180	360	270	1,325	1,060
Hidalgo	0	0	720	540	2,640	2,110
Lincoln	100	70	800	600	3,000	2,400
Luna	450	315	360	270	1,325	1,060
McKinley	5,935	4,155	7,470	5,605	11,875	9,500
Quay	0	0	360	270	1,325	1,060
Rio Arriba	0	0	360	270	1,975	1,580
Sandoval	260	180	360	270	3,300	2,640
San Juan	5,935	4,155	7,210	5,410	11,210	8,970
San Miguel	260	180	360	270	1,975	1,580
Santa Fe	450	315	820	615	1,975	1,580
Sierra	260	180	720	540	1,975	1,580
Socorro	0	0	360	270	1,975	1,580
Valencia	11,620	8,140	15,910	11,930	19,165	15,330
Totals	25,790	18,050	36,890	27,670	68,990	55,190

Copper [2, 3]

Catron	0	0	1,000	700	2,000	1,500
Colfax	0	0	390	270	1,000	750
Doña Ana	0	0	1,110	780	1,520	1,140
Grant	32,860	22,590	38,800	27,330	44,645	33,500
Guadalupe	0	0	680	475	1,155	865
Hidalgo	2,170	1,475	2,600	1,820	6,170	4,625
Lincoln	0	0	2,880	2,015	3,320	2,490
Los Alamos	0	0	0	0	2,500	1,875
Luna	0	0	1,650	1,160	3,735	2,800
Otero	70	45	200	140	2,865	2,150
Rio Arriba	0	0	600	420	3,000	2,250
Santa Fe	0	0	500	350	500	375
Sierra	0	0	0	0	2,185	1,640
Socorro	750	490	2,360	1,650	1,685	1,260
Totals	35,850	24,600	52,770	37,110	76,280	57,220

Lead-zinc [2, 4]

Hidalgo	730	290	1,240	620	2,250	1,350
Lincoln	600	240	1,000	500	2,000	1,200
Sierra	480	190	820	410	1,500	900
Socorro	600	240	1,000	500	2,000	1,200
Totals	2,410	960	4,060	2,030	7,750	4,650

Industrial stone and minerals [4]

Bernalillo	1,720	475	2,670	900	4,220	1,800
Doña Ana	1,090	275	1,660	500	2,640	1,060
Totals	2,810	750	4,330	1,400	6,860	2,860

Molybdenum [2, 3]

Catron	0	0	1,920	1,060	8,020	4,810
Doña Ana	0	0	240	130	3,340	2,000
Grant	260	130	1,500	825	3,340	2,000
Hidalgo	0	0	240	130	3,340	2,000
Lincoln	1,000	500	5,000	2,750	8,000	4,800
Luna	0	0	240	130	3,340	2,000
Mora	0	0	240	130	2,000	1,200
Otero	1,000	500	5,000	2,750	8,000	4,800
Rio Arriba	0	0	1,200	660	10,090	6,050

TABLE 3 — New Mexico minerals water requirements — projection by category of use (cont.) (all units are ac. ft.)

Type of use and county	1980 New water	1980 Depletion	2000 New water	2000 Depletion	2020 New water	2020 Depletion
San Miguel	0	0	240	130	3,340	2,000
Santa Fe	0	0	480	260	3,340	2,000
Sierra	0	0	1,200	660	3,340	2,000
Socorro	0	0	480	260	3,340	2,000
Taos	10,000	5,000	16,000	8,815	20,000	12,040
Totals	12,260	6,130	33,980	18,690	82,830	49,700
Oil and gas well drilling						
Chaves	180	20	200	20	440	40
Eddy	200	20	200	20	500	50
Lea	200	20	200	20	500	50
McKinley	200	20	200	20	500	50
Mora	100	10	510	50	400	40
Rio Arriba	200	20	200	20	500	50
Roosevelt	200	20	200	20	500	50
Sandoval	100	10	200	20	500	50
San Juan	200	20	280	30	500	50
Torrance	40	5	480	50	160	20
Union	40	5	0	0	0	0
Totals	1,660	170	2,670	270	4,500	450
Oil – Secondary recovery [2]						
Chaves	800	0	900	0	1,000	0
Eddy	1,600	0	1,800	0	2,000	0
Lea	8,000	0	9,000	0	10,000	0
McKinley	320	0	360	0	400	0
Rio Arriba	960	0	1,080	0	1,200	0
Roosevelt	1,440	0	1,620	0	1,800	0
Sandoval	320	0	360	0	400	0
San Juan	2,560	0	2,880	0	3,200	0
Totals	16,000	0	18,000	0	20,000	0

Processing of fossil fuels [2, 5]

Bernalillo		0	0	1,330	1,130	2,950	2,660
Catron		500	400	920	780	2,405	2,160
Chaves		450	360	1,000	850	2,000	1,800
Colfax		1,050	840	1,930	1,640	4,000	3,600
Curry		420	335	930	790	210	195
De Baca		290	230	1,150	980	1,130	1,020
Eddy		350	280	1,750	1,490	2,000	1,800
Guadalupe		0	0	400	340	0	0
Harding		0	0	220	190	0	0
Lea		2,520	2,070	5,170	4,430	16,190	14,570
Lincoln		1,200	960	720	610	4,680	4,210
McKinley		4,200	3,360	11,000	9,350	24,800	22,320
Quay		0	0	720	610	30	25
Rio Arriba		1,000	800	2,000	1,700	3,000	2,700
Roosevelt		1,800	1,440	2,930	2,490	1,910	1,720
Sandoval		270	215	3,600	3,060	6,675	6,000
San Juan		74,700	67,240	81,500	77,980	82,200	78,480
	Totals	88,750	78,530	117,270	108,420	154,180	143,260

[1] Used in all counties where soluble salt resources are available
[2] See attachment
[3] Used in part in those counties with good mineral resources
[4] Similar requirements in other counties adequately provided for from other categories of use
[5] Requirements for water in this category includes any processing of oil, natural gas (includes helium, CO_2, and the cooling requirements for transmission of natural gas), asphalt, or coal

TABLE 4 — Summary by basin of New Mexico mineral requirements for water — 1980, 2000, 2020
(all units in ac. ft.)

Basin	1980		2000		2020	
	New water	Depletion	New water	Depletion	New water	Depletion
Arkansas–White–Red River basin	1,870	1,225	5,780	3,955	15,620	10,780
Texas-Gulf basin	22,880	3,555	39,030	7,500	50,580	15,675
Pecos River basin	18,830	11,850	40,480	30,980	61,355	47,345
Rio Grande basin	57,010	36,225	96,880	64,940	172,865	123,985
Upper Colorado River basin	87,930	73,650	103,310	91,195	127,310	111,420
Lower Colorado River basin	18,590	12,395	26,900	18,230	50,170	35,215
State totals	207,110	138,900	312,380	216,800	477,900	344,420

TABLE 5 — New Mexico mineral requirements for water — 1980, 2000, and 2020
(all units are ac.-ft.)

County and basin	1980 New water	1980 Depletion	2000 New water	2000 Depletion	2020 New water	2020 Depletion	Resources
Arkansas–White–Red River							
Colfax	1,050	840	2,320	1,910	5,000	4,350	Coal; oil and gas; carbon dioxide gas; uranium; industrial stone; soluble salts; other miscellaneous metallic and non-metallic minerals.
Harding	460	270	1,000	670	4,095	2,585	
Mora	100	10	750	180	2,400	1,240	
Quay	220	100	1,500	1,090	3,200	2,100	
Union	40	5	210	105	925	505	
Totals	1,870	1,225	5,780	3,955	15,620	10,780	
Texas-Gulf							
Curry	850	525	2,200	1,425	3,900	2,225	Primarily oil and gas; soluble salts; industrial stone and minerals.
Lea (part)	18,160	1,380	30,810	2,930	38,780	9,650	
Roosevelt	3,870	1,650	6,020	3,145	7,900	3,800	
Totals	22,880	3,555	39,030	7,500	50,580	15,675	
Pecos River							
Chaves	1,510	415	2,640	1,140	3,980	2,140	Coal; uranium; thorium; molybdenum; oil and gas; soluble salts (esp. potash); industrial stone and other miscellaneous metallic and non-metallic minerals.
De Baca	500	325	2,000	1,405	3,900	2,545	
Eddy	9,550	8,130	17,540	17,410	18,290	19,340	
Guadalupe	210	95	1,500	1,025	3,000	1,880	
Lea (part)	4,960	1,795	6,360	3,920	10,710	7,610	
Lincoln (part)	1,090	530	6,090	3,620	10,160	6,650	
Otero (part)	750	380	3,750	2,060	6,000	3,600	
San Miguel	260	180	600	400	5,315	3,580	
Totals	18,830	11,850	40,480	30,980	61,355	47,345	
Upper Colorado River							
McKinley (part)	3,125	2,015	9,160	7,155	23,935	20,670	Oil and gas; uranium; coal; industrial stone; some metallic and miscellaneous non-metallic minerals.
Rio Arriba (part)	1,410	220	2,280	620	6,265	3,250	
San Juan	83,395	71,415	91,870	83,420	97,110	87,500	
Totals	87,930	73,650	103,310	91,195	127,310	111,420	

Rio Grande							
Bernalillo	1,720	475	4,000	2,030	7,170	4,460	Coal; oil and gas; uranium; soluble salts; industrial stone; copper, lead, and zinc (Grant County); molybdenum (Grant–Taos County especially); other metallic and non-metallic minerals.
Catron (part)	0	0	200	130	600	420	
Doña Ana	1,090	275	3,010	1,410	7,500	4,200	
Grant (part)	21,820	15,420	27,560	19,935	35,860	27,800	
Lincoln (part)	1,810	1,240	4,310	2,855	10,840	8,450	
Los Alamos	0	0	0	0	2,500	1,875	
Luna	450	315	2,250	1,560	8,400	5,860	
McKinley (part)	4,100	2,920	5,370	4,170	7,770	6,380	
Otero (part)	320	165	1,450	830	4,865	3,350	
Rio Arriba (part)	750	600	3,160	2,450	13,500	9,380	
Sandoval	950	405	4,520	3,350	10,875	8,690	
Santa Fe	450	315	1,800	1,225	5,815	3,955	
Sierra	740	370	2,740	1,610	9,000	6,120	
Socorro	1,350	730	4,200	2,680	9,000	6,040	
Taos	10,000	5,000	16,000	8,815	20,000	12,040	
Torrance	40	5	900	260	2,005	1,035	
Valencia (part)	11,420	7,990	15,410	11,630	17,165	13,930	
Totals	57,010	36,235	96,880	64,940	172,865	123,985	
Lower Colorado River							
Catron (part)	760	580	4,000	2,680	13,800	9,630	Coal; uranium; possible oil; copper; other metallic and non-metallic minerals.
Grant (part)	11,300	7,300	13,100	8,490	14,100	9,280	
Hidalgo	2,900	1,765	4,800	3,110	14,400	10,085	
McKinley (part)	3,430	2,600	4,500	3,650	5,870	4,820	
Valencia (part)	200	150	500	300	2,000	1,400	
Totals	18,590	12,395	26,900	18,230	50,170	35,215	

(2nd part follows)

TABLE 5 — New Mexico mineral requirements for water — 1980, 2000, and 2020 (cont)
(all units are ac. ft.)

Details of part counties

County and basin	1980 New water	1980 Depletion	2000 New water	2000 Depletion	2020 New water	2020 Depletion
Catron County [1]						
Rio Grande basin	0	0	200	130	600	420
Lower Colorado River basin	760	580	4,000	2,680	13,800	9,630
County totals	760	580	4,200	2,810	14,400	10,050
Grant County [2]						
Lower Colorado River basin	11,300	7,300	13,100	8,490	14,100	9,280
Rio Grande basin	21,820	15,420	27,560	19,935	35,860	27,800
County totals	33,120	22,720	40,660	28,425	49,960	37,080
Lower Colorado River basin						
Tyrone	11,200	7,000	12,000	7,500	12,000	7,500
Outside Tyrone [3]	100	300	1,100	990	2,100	1,780
Totals	11,300	7,300	13,100	8,490	14,100	9,280
Lea County *(See assumptions listed at end of table 5)*						
Texas–Gulf	18,160	1,380	30,810	2,930	38,780	9,650
Pecos River basin	4,960	1,795	6,360	3,920	10,710	7,610
County totals	23,120	3,175	37,170	6,850	49,490	17,260
Lincoln County [4]						
Pecos River basin	1,090	530	6,090	3,620	10,160	6,650
Rio Grande basin	1,810	1,240	4,310	2,855	10,840	8,450
County totals	2,900	1,770	10,400	6,475	21,000	15,100

McKinley County						
Upper Colorado River basin	3,125	2,015	9,160	7,155	23,935	20,670
Lower Colorado River basin	3,430	2,600	4,500	3,650	5,870	4,820
Rio Grande basin	4,100	2,920	5,370	4,170	7,770	6,380
County totals	10,655	7,535	19,030	14,975	37,575	31,870
Otero County [5]						
Pecos River basin	750	380	3,750	2,060	6,000	3,600
Rio Grande basin	320	165	1,450	830	4,865	3,350
County totals	1,070	545	5,200	2,890	10,865	6,950
Rio Arriba County						
Upper Colorado River basin [6]	1,410	220	2,280	620	6,265	3,250
Rio Grande basin	750	600	3,160	2,450	13,500	9,380
County totals	2,160	820	5,440	3,070	19,765	12,630
Less all oil [7]	−1,160	−20	−1,280	−20	−1,700	−50
Subtotal	1,000	800	4,160	3,050	18,065	12,580
Rio Grande basin (total)	(750)	(600)	(3,160)	(2,450)	(13,500)	(9,380)
Upper Colorado River basin (part)	(250)	(200)	(1,000)	(600)	(4,565)	(3,200)
Upper Colorado River basin:						
All oil	1,160	20	1,280	20	1,700	50
Part (from above)	250	200	1,000	600	4,565	3,200
Basin total	1,410	220	2,280	620	6,265	3,250
Valencia County						
Lower Colorado River basin [8]	200	150	500	300	2,000	1,400
Rio Grande basin	11,420	7,990	15,410	11,630	17,165	13,930
County totals	11,620	8,140	15,910	11,930	19,165	15,330

Assumptions *(Applicable to Lea County)*

New water requirements for potash and other soluble salts will be furnished from fresh ground-water sources in the Texas-Gulf Coast area of Lea County; however, all depletions will occur in the Pecos River basin area of Lea County or in Eddy County, see details below. Requirements for oil well drilling and secondary recovery is approximately 50-50 in the two basins; fossil-fuel processing is prorated 1/3 to Pecos River basin and 2/3 to Texas-Gulf Coast basin. Details of water requirements in each basin in Lea County are shown below *(all units are ac. ft.).*

Mineral Commodity	1980		2000		2020	
	New water	Depletion	New water	Depletion	New water	Depletion
Potash and other soluble salts[9]	12,400	1,085	22,800	2,400	22,800	2,640
In Pecos River basin	–	(1,085)	–	(2,400)	–	(2,640)
In Texas-Gulf	(12,400)	–	(22,800)	–	(22,800)	–
Oil and gas well drilling	200	20	200	20	500	50
In Pecos River basin	(100)	(10)	(100)	(10)	(200)	(20)
In Texas-Gulf	(100)	(10)	(100)	(10)	(300)	(30)
Petroleum secondary recovery	8,000	0	9,000	0	10,000	0
In Pecos River basin	(4,000)	0	(4,500)	0	(5,000)	0
In Texas-Gulf	(4,000)	0	(4,500)	0	(5,000)	0
Processing of fossil fuels	2,520	2,070	5,170	4,430	16,190	14,570
In Pecos River basin	(860)	(700)	(1,760)	(1,510)	(5,510)	(4,950)
In Texas-Gulf	(1,660)	(1,370)	(3,410)	(2,920)	(10,680)	(9,620)
Total requirements	23,120	3,175	37,170	6,850	49,490	17,260
In Pecos River basin	(4,960)	(1,795)	(6,360)	(3,920)	(10,710)	(7,610)
In Texas-Gulf	(18,160)	(1,380)	(30,810)	(2,930)	(38,780)	(9,650)

1 Coal resources (Datil Mountain Field) plus mineral resources of several kinds

[2] Primarily copper and co-products (lead, molybdenum, some silver and gold); some uranium

[3] In 1980 there are 300 acre-feet projected for use in a leaching operation of which 200 acre-feet are obtained from ground-water sources in the Mimbres basin (part of the Rio Grande basin) and 100 acre-feet obtained from ground-water sources in the Lower Colorado River basin. All of this water is depleted and there is no return flow. The same quantities are projected for 2000 and 2020

[4] Coal, thorium, iron, molybdenum, copper, and other miscellaneous metallic and non-metallic minerals

Molybdenum, copper, and other miscellaneous metallic and non-metallic minerals

[6] Oil, gas, and coal reserves

7 Most oil requirements located in Upper Colorado River basin

[8] Coal, miscellaneous metallic and non-metallic minerals

[9] Details of water requirements for potash and other soluble salts

New water totals	12,400	–	22,800	–	22,800	–
Diverted and used in Lea County	(2,400)	–	(4,800)	–	(4,800)	–
Diverted in Lea; used in Eddy Co.	(10,000)	–	(18,000)	–	(18,000)	–
Depletion totals	–	5,585	–	11,400	–	12,540
Depleted in Lea County	–	(1,085)	–	(2,400)	–	(2,640)
Depleted in Eddy County	–	(4,500)	–	(9,000)	–	(9,900)

TABLE 6 — Sources of water for mineral use in New Mexico in 1980, 2000, and 2020

Location of surface water use by basin and county	1980, ac.-ft.		2000, ac.-ft.		2020, ac.-ft.	
	New water	Depletion	New water	Depletion	New water	Depletion
Pecos						
Eddy County (Total–Pecos) [1]	2,000	2,000	0	0	0	0
Rio Grande						
Grant County	950	760	950	760	950	760
Taos County	3,000	600	3,000	900	3,000	1,000
Total–Rio Grande	3,950	1,360	3,950	1,660	3,950	1,760
Upper Colorado River						
San Juan County (Total–Upper Colorado)	81,000	69,600	89,500	81,600	92,000	83,400
Lower Colorado River						
Grant County (Total–Lower Colorado)	11,200	7,000	13,000	8,190	14,000	8,980
State totals – Surface water	98,150	79,960	106,450	91,450	109,950	94,140

Note: Only details of location and use of surface water is shown in this table; all other uses of water for minerals are from ground-water sources.

[1] The potash company who owns surface-water rights presently plans to furnish its future supplies from ground water in Lea County

TABLE 7 — 1970 mineral water requirements in New Mexico

Mineral commodity and place of use (county)	New water (ac.-ft.)	%	Depletion (ac.-ft.)
Potash and other soluble salt minerals			
Eddy	3,520.8	–	4,693.9
Lea	8,655.8 [1]	–	600.2
Total – potash	12,176.6	43	5,294.1
Uranium			
McKinley	5,861.9	–	1,864.7
Valencia	2,636.3	–	2,472.8
Total – uranium	8,498.2	51	4,337.5
Copper			
Grant	22,379.6	–	13,049.1
Hidalgo	112.0	–	95.2
Luna	258.0	–	103.2
Total – copper	22,749.6	58	13,247.5
Molybdenum			
Taos (Total – molybdenum)	6,032.6	17	1,032.3
Lead-zinc			
Grant (Total – lead-zinc)	350.0	12	42.0
Industrial stone and minerals			
Bernalillo	260.5	–	134.3
Chaves	30.0	–	1.5
Colfax	10.0	–	1.5
Doña Ana	100.0	–	15.0
Eddy	65.0	–	13.0
Grant	20.0	–	3.0
Lea	25.0	–	3.8
Luna	48.0	–	9.6
Otero	85.0	–	17.0
San Juan	75.0	–	11.2
Santa Fe	175.0	–	35.0
Valencia	30.0	–	6.0
Total – industrial stone & minerals	923.5	28	250.9
Oil and gas well drilling			
Chaves	20.0	–	2.0
Colfax	4.0	–	0.4
Curry	5.0	–	0.5

Eddy	140.0	–	14.0
Lea	850.0	–	85.0
Luna	3.0	–	0.3
McKinley	15.0	–	1.5
Quay	5.0	–	0.5
Rio Arriba	175.0	–	17.5
Roosevelt	60.0	–	6.0
Sandoval	30.0	–	3.0
San Juan	250.0	–	25.0
Torrance	2.0	–	0.2
Union	2.0	–	0.2
Total – drilling	1,561.0	10	156.1
Petroleum secondary recovery			
Chaves	259.3	–	negligible
Eddy	1,047.0	–	"
Lea	13,671.2 [2]	–	"
McKinley	135.9	–	"
Rio Arriba	14.7	–	"
Roosevelt	75.4	–	"
San Juan	2,565.5	–	"
Total – secondary recovery	17,769.0	–	negligible
Processing of fossil fuels			
Chaves	46.0	–	27.6
Colfax	360.0	–	180.0
Doña Ana	4,011.8 [3]	–	41.9
Eddy	489.0	–	430.4
Hidalgo	32.3	–	18.4
Lea	4,871.2	–	4,141.6
Lincoln	95.0	–	56.0
Luna	429.0	–	257.4
McKinley	1,056.6	–	1,022.9
Rio Arriba	44.4	–	34.9
San Juan	2,845.7	–	2,187.2
Valencia	177.2	–	106.3
Total – fossil fuels	14,458.2	59	8,504.6
State Totals	84,518.7		32,865.0

[1] Of the total diverted in Lea County, 6,655.3 ac. ft. is furnished by pipeline to Eddy County

[2] Of the total diverted in Lea County, 6,000 ac. ft. is furnished from ground-water sources to Eddy County

[3] Of the total of 4,011.8 ac. ft. shown, 3,942 ac. ft. is used in a once-through cooling process for a natural gas transmission line. Because the location of the pumping plant and cooling plant are some 50 miles apart, there is serious consideration being given to moving the cooling plant to the immediate vicinity of the pumping plant and discontinuing the cooling process in Doña Ana County

TABLE 8 — Summary by basin of New Mexico mineral requirements of water in 1970

Basin and county		ac.-ft. New water	Depletion
Arkansas–White–Red			
Colfax		374.0	181.9
Harding		–	–
Mora		–	–
Quay		5.0	0.5
Union		2.0	0.2
	Total – AWR	381.0	182.6
Texas-Gulf			
Curry		5.0	0.5
Lea (part) [1]		22,218.7	3,438.6
Roosevelt		135.4	6.0
	Total – Texas-Gulf	22,359.1	3,445.1
Pecos			
Chaves		355.3	31.1
De Baca		–	–
Eddy		5,261.8	5,151.3
Guadalupe		–	–
Lea (part)		5,854.5	1,392.0
San Miguel		–	–
	Total – Pecos	11,471.6	6,574.4
Rio Grande			
Bernalillo		260.5	134.3
Doña Ana		4,111.8	56.9
Grant (part)		15,136.4	9,564.5
Lincoln		95.0	56.0
Los Alamos		–	–
Luna		738.0	370.5
McKinley		5,861.9	1,864.7
Otero		85.0	17.0
Rio Arriba		45.0	4.5
Sandoval		30.0	3.0
Santa Fe		175.0	35.0
Sierra		–	–
Socorro		–	–
Taos		6,032.6	1,032.3
Torrance		2.0	0.2
Valencia		2,843.5	2,585.1
	Total – Rio Grande	35,416.7	15,724.0

Upper Colorado River		
McKinley (part)	150.9	1.5
Rio Arriba (part)	189.1	47.9
San Juan	5,736.2	2,223.4
Total – Upper Colorado	6,076.2	2,272.8
Lower Colorado River		
Catron	–	–
Grant (part)	7,613.2	3,529.6
Hidalgo	144.3	113.6
McKinley (part)	1,056.6	1,022.9
Total – Lower Colorado	8,814.1	4,666.1
State Totals	84,518.7	32,865.0
Detail of part counties		
Grant County [2]		
Lower Colorado River	7,613.2	3,529.6
Rio Grande basin	15,136.4	9,564.5
Total – Grant	22,749.6	13,094.1
Lea County		
Texas-Gulf basin	9,563.4	3,438.6
Pecos basin	5,854.5	1,392.0
Diverted to Eddy County [3]	12,655.3	0
Total – Lea	28,073.2	4,830.6
McKinley County		
Rio Grande basin	5,861.9	1,864.7
Upper Colorado River basin	150.9	1.5
Lower Colorado River basin	1,056.6	1,022.9
Total – McKinley	7,069.4	2,889.1
Rio Arriba County		
Rio Grande basin	45.0	4.5
Upper Colorado River basin	189.1	47.9
Total – Rio Arriba	234.1	52.4

[1] Diversion to Eddy County included; see detail of part counties

[2] In 1970 there was a copper-leaching operation located in the vicinity of Tyrone that used a total of 230.6 acre-feet of water. Of this amount, 210.4 acre-feet were obtained from ground-water sources in the Mimbres basin (Rio Grande) and the remainder (20.2 acre-feet) from ground-water sources in the Lower Colorado River basin. All of the water that was diverted (new water) was depleted in the Lower Colorado River basin (230.6 acre-feet) and there was no return flow

[3] The 12,655.3 acre-feet are diverted from the Texas-Gulf portion of Lea County and used in Eddy County as follows: 6,000 acre-feet for secondary oil recovery; 6,655.3 by potash industry

TABLE 9 — Sources of water for mineral use in New Mexico in 1970

Location of surface water use by basin and county	ac.-ft. New water	ac.-ft. Depletion
Pecos		
Eddy County (Total–Pecos)	2,932.8	2,903.5
Rio Grande		
Grant County	930.0	740.0
Taos County	2,420.0	411.4
Total – Rio Grande	3,350.0	1,151.4
Upper Colorado River		
San Juan County (Total–Upper Colorado)	4,716.2	1,518.4
Lower Colorado River		
Grant County (Total–Lower Colorado)	7,593.0	3,299.0
State totals – surface water	18,592.0	8,872.3

Note: Other than shown above, source of water used by the minerals industries in 1970 was from ground water.