Appendix A

Population projections to 2050
for the Middle Rio Grande Water Planning Region

POPULATION PROJECTIONS TO 2050
for
STATE PLANNING AND DEVELOPMENT DISTRICT 3

Middle Rio Grande Council of Governments

May 18, 2000

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EXECUTIVE SUMMARY

The Middle Rio Grande Council of Governments (MRGCOG) has prepared a series of population projections to 2050 for State Planning and Development District 3 (SPDD3) which includes the New Mexico counties of Bernalillo, Sandoval, Torrance, and Valencia. The MRGCOG is the designated planning organization for SPDD3. These forecasts are prepared primarily to support the MRGCOG Water Planning Program.

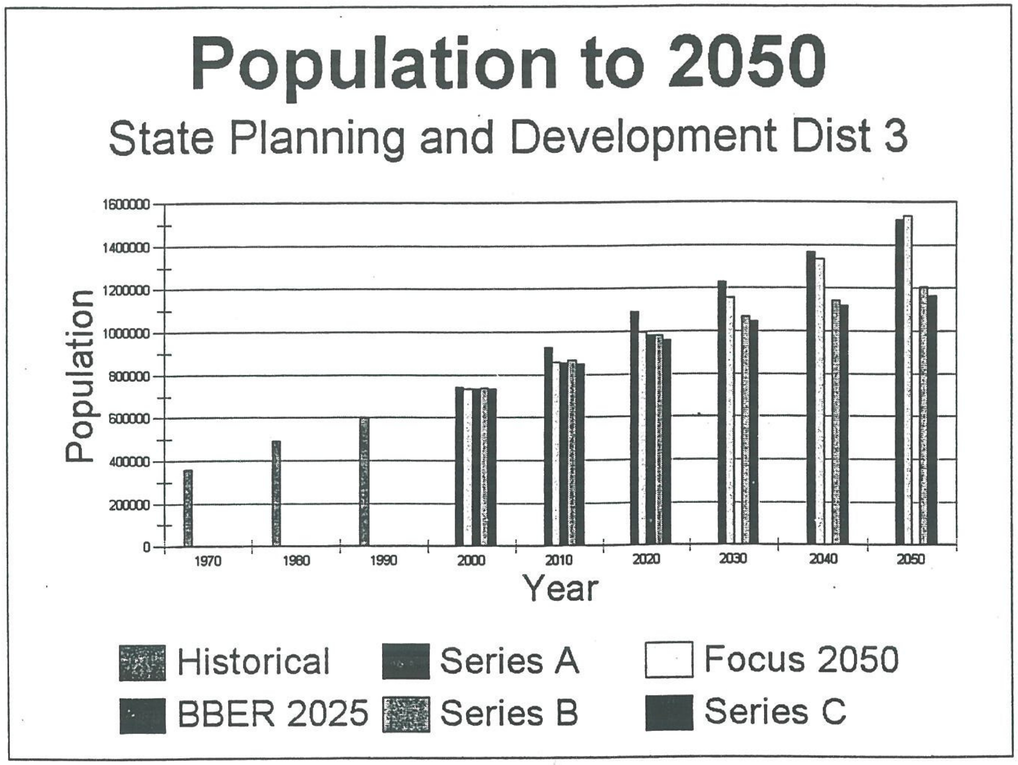
A series of forecasts were prepared for the Middle Rio Grande Regional Water Plan to provide a reasonable range for expectations of a future population for SPDD3. Recognizing the uncertainty associated with any forecast, especially a 50-year forecast, MRGCOG chose to generate three forecasts as part of this project. These forecasts were labeled SERIES A, SERIES B, and SERIES C. SERIES A was designed to be the highest and SERIES C was designed to be the lowest. SERIES B is best described as the standard forecast given current information, it lies between SERIES A and SERIES C. Taken together, SERIES A and SERIES C provides a range which is intended to accommodate the uncertainty associated with the future. Generally forecasts are more or less linear while actual population growth in this area has tended to be very cyclical. The intent of generating a forecast range is to provide some degree of comfort that the future population will fall within or near the projected range; during a period of rapid growth the future population may be closer to SERIES A, during a period of slow growth the population may be nearer SERIES C. The projected range for SPDD3 for 2050 is 1,166,586 (SERIES C) to 1,517,394 (SERIES A). MRGCOG estimated the 1999 population at 714,300. Given current data, SERIES B would appear to be the most probable scenario, but as any student of population growth can testify, current data can change and tomorrow's most probable scenario may be closer to either SERIES A or SERIES B.

SERIES A, SERIES B, and SERIES C were each generated from the REMI Model. The REMI Model is commercially available from REMI, but it is calibrated by REMI personnel for the individual client region. The calibration of the model uses 29 years of local economic and demographic data. The model uses a large number of equations which are documented; this documentation is available in the MRGCOG office. The economic and demographic equations are integrated to allow a realistic simulation of the interaction between the economy and the population. REMI is especially suited for generating alternative forecasts as it is designed to allow an operator to introduce assumptions of changed or new conditions in the future which will alter the forecast. REMI models future employment and population to 2035, MRGCOG staff extended the forecasts to 2050.

Two other forecast series are included in this report, both are based on forecasts by the University of New Mexico Bureau of Business and Economic Research (UNM-BBER). The inclusion of these other forecasts is related to other MRGCOG projects and the desire of the MRGCOG to maintain consistency between different planning programs. One of the other forecasts is the MRGCOG Focus 2050 forecast which was originally prepared in 1996 based on then current UNM-BBER forecasts. The Focus 2050 forecast is documented in MRGCOG publication TR-127, it is of importance since it is the underlying forecast for the proposed land use in the recently adopted Focus 2050 Regional Plan for SPDD3. The second of the other forecasts is the BBER 2025 which is UNM-BBER's most current forecast to 2025, it is of importance since it will be the basis for the new Metropolitan Transportation Plan (MTP) forecast which is anticipated to be adopted by the MRGCOG Board later this year.

SERIES B, the Standard REMI forecast for 2025 is very close to the current UNM-BBER 2025 forecast that is to be used in the MTP. The similarity of these independent forecasts lends credence to both and to the usefulness of the REMI tool. REMI is especially suited for this project since it is designed to generate alternative forecasts and the desire was to establish a higher and a lower alternative forecast.

The five forecasts are graphically displayed by decade on page 2 along with actual growth since 1970. The UNM-BBER 2025 forecast ends with 2020 since the forecast does not extend past 2025. SERIES A, B, and C are directly from the REMI Model through 2030; MRGCOG extended the forecasts to generate the 2040 and 2050 points. It is noted that the Focus 2050 Forecast is slightly higher than SERIES A in 2050, this is explained in the following report. The forecast methodologies including the extensions to 2050 for SERIES A, B, and C are provided in this



report. Tables presenting the historical population for SPDD3 and SERIES A, B, and C forecasts for SPDD3 and forecasts each of the four counties are presented in the Tables at the end of this report.

Forecasting Methodology

The REMI Forecasting Model

The REMI model was used to generate three forecast series. REMI is a nationally recognized model that is commercially available. REMI staff installed a model for SPDD3 on the MRGCOG computers using data for the local historical economic and demographic data for the period 1969 to 1997. It is updated annually so the forecasts from the model continue to be current. The REMI Model relies heavily on Bureau of Economic Analysis (BEA) data, 1997 is the most recent year available for complete BEA data. The model is designed to forecast to 2035 and incorporates national forecasts into the forecasting equations. MRGCOG extended the forecast from 2035 to 2050 with an analysis of the forecast annual growth rate of the region as the forecast approached 2035.

Forecasts from this model are for SPDD3 and for three subareas within SPDD3. The subareas are the City of Albuquerque, the Balance of Bernalillo County (outside Albuquerque), and the combined counties of Sandoval, Torrance, and Valencia. The forecast for Bernalillo County was the sum of the City of Albuquerque and the Balance of Bernalillo County. The county forecasts for Sandoval, Torrance, and Valencia were derived from the REMI total for the three counties by a procedure outside of the REMI Model.

REMI is designed primarily as an economic model and a tool to examine the impact on a regional economy and population if an economic change occurs or is anticipated. In referring to this as an economic model, it is not implied that the REMI Model deals only with the economy. To the contrary, REMI deals with both employment and population and it deals with migration that is both related to job growth and migration for reasons other than employment. It is an economic model in that it views the economy as the primary driving force for population growth.

Internal to the REMI Model are separate equations for 49 economic sectors, each sector has a 29-year history coded into the model. In addition, there are a set of demographic equations that project population by age, sex, race and Hispanic cohorts. The population cohorts are carried through the projection with separate rates for births and deaths. The final piece of the population projection is migration which may vary by age, sex, and race. Migration is forecast by two types of equations. One set of equations integrate the demand for more workers in the economy with the supply of new workers that can be expected from the existing population so that migration is introduced to provide new labor when there is a need for additional workers. A second set of migration equations address the population that migrates for reasons other than work, such as retirees, this population creates a demand for new jobs. The model further integrates the economic and demographic sides by introducing feedback equations that calculate the change in demand for certain goods and services (change in number of jobs) from a change in a particular component of the population. A need for more workers results in a demand for increased migration while a need for fewer workers would result in an incentive for population to leave the area. The equations for migration in and out are lagged behind the actual stimulus since population does not usually move immediately. The number of new workers also varies depending on the industry that is expanding, so that the model is sensitive to the differing impacts of various industries. Growth in some economic sectors will produce more of an impact than growth in other sectors.

The calibrated and installed REMI Model is set up with a Standard Forecast which is the result of the equations based on historical data and national projections for the various economic and demographic variables. The Standard Forecast is used as a baseline and for this project is used as the SERIES B Forecast. SERIES A and C were created by altering variables in the model to produce a higher and lower series. MRGCOG staff consulted with REMI staff on which variables to modify to obtain meaningful and reasonable alternative forecasts.

Series A Forecast

SERIES A grew out of an analysis of the calibration of the model and consequently the Standard or SERIES B forecast. Regardless of how good a model is or how many variables are included, there will always be some difference in the model calibration between what can be explained in the historical data by the model and the actual historical data. The difference between the historical actual and what can be explained by the model may be called the "unexplained difference." In the case of SPDD3 for the 1969 to 1997 period, the unexplained difference is in most years unexplained growth as this region grew more during that 29-year period than could be explained by the variables in the model. The model results were adjusted to the actual data by applying correction factors to each of the 49 economic sectors. Positive correction factors had been computed for 29 of the 49 sectors, however, some sectors were computed with negative factors, and some had a factor of zero. Given that the unexplained difference for SPDD3 was generally positive (growth), the most important (for this region) correction factors were positive. These factors are available in the model. The SERIES B (Standard) forecast does not contain the unexplained difference or correction factors, it is calculated with all the factors at zero so that the forecast is only what can be predicted by the variables in the model.

Clearly it is unknown as to what generated the unexpected growth in the 1969 to 1997 period. One assumption would be that whatever was operating during this period can not be expected to continue to operate, therefore, the forecast (SERIES B) is generated without any correction factors. In consultation with REMI, an alternate and common assumption was recommended which became the basis for SERIES A. It is a common assumption because users of REMI in other areas who wish to design an alternative to the Standard forecast often look at the unexplained growth factors.

In the development of SERIES A, if it is assumed that whatever factors were operating over these three decades to cause the region to grow at a faster rate than explained by REMI will continue to operate then an alternative forecast will be generated. MRGCOG ran a REMI scenario by incorporating the 1969 to 1997 unexplained growth correction factors into the 1997 to 2035 projection. As it turned out the positive correction factors had an impact on the future projection so that this scenario came out considerably higher than the baseline.

It was not necessarily a given that the net positive adjustments for the historical period would produce a positive result for the future. If the positive factors in the historical base were for economic sectors that were shrinking in the future, the positive adjustment for these sectors could be negated by negative factors for sectors that were perhaps becoming more important in the future. The importance of economic sectors in the future for this model is determined by a combination of national economic forecasts and the local share of that sector.

When MRGCOG ran the REMI Model with all of the unexplained difference factors active, a forecast for 2035 was generated which was 17 percent higher than the baseline. This became SERIES A. The assumption for SERIES A is that the factors which made this region desirable for growth beyond what could be explained by the available variables over the last three decades will continue to operate for the next three or more decades.

To project SERIES A to 2050, the pattern of growth from 1997 to 2035 was analyzed. It was found that the growth rate was slowing, but was still above one percent per year. The average population growth rate from 2030 to 2035 was 1.05 percent. The population growth rate was held constant at 1.05 percent per year for the period 2035 to 2050. Normally, unless an expansion is projected, the population growth rate could be expected to decline over time so the assumption here is that there would be enough of an expansion over the final 15 years to maintain the annual growth rate at the average for the final 5 years of the REMI forecast.

An initial county forecast was developed from the REMI Model and the UNM-BBER county level forecast to 2025. Bernalillo County was forecast from the model by combining the forecasts for the City of Albuquerque and the Balance of Bernalillo County and continuing a constant growth rate for the County from 2035 to 2050. The forecast for Sandoval, Torrance, and Valencia Counties was divided into its component parts by relying on the UNM-BBER forecast for the respective counties. A trend line for each county (1990 - 2025) was computed from the UNM-BBER data using a least squares linear regression method. The trend line was extended to 2050. The sum of the forecasts for the three counties was adjusted to the SERIES A forecast for the three-county total from the REMI Model.

The initial county forecast was adjusted to the Focus 2050 county distribution. The Focus 2050 Regional Plan called for a distribution different from what could be expected from previous land use patterns. Since the SPDD3 total for SERIES A was closest to the regional total (SPDD3) for the Focus 2050 Regional Plan, the county distribution for

Series A was adjusted to follow the county distribution proposed in the Regional Plan. A minor adjustment using a proportioning technique was applied to the initial SERIES A county forecasts to produce a set of county forecast with an SPDD3 total equal to the REMI output, but a county distribution consistent with the county distribution in the Focus 2050 Regional Plan.

Series B Forecast

Forecast SERIES B is the Standard forecast generated by the REMI Model. Based on nearly 30 years of local data and expectations of the future changes in the economy and in demographic cohorts, the Standard forecast should be regarded as the most probable forecast given the current situation and what is currently known. The REMI Standard forecast, as previously noted, is very similar to the most recent UNM-BBER forecast which is UNM-BBER's view as to the most probable future scenario given current information. Given the similarity of these independent sources, it appears very reasonable to consider SERIES B as the most probable forecast based on current information.

To extend the forecast from 2035 to 2050, the forecast trend was examined. It was found that the growth rate slowed in a curvilinear pattern after 2020. This curvilinear trend was extended to 2050 using a log conversion in a linear regression equation. The Bernalillo County forecast and the forecast for the combined three counties of Sandoval, Torrance, and Valencia were both extended using the curvilinear trend technique. The three-county REMI area was divided into county forecasts by applying the county specific UNM-BBER forecast proportions to the 2000 to 2025 period. The 2025 to 2050 period was allocated by extending a least squares trend line for each of the three counties from 2000 to 2025 and projecting that trend line to 2050, balancing to the REMI three-county total. This was similar to the technique used for the initial SERIES A forecast.

Series C Forecast

SERIES C was designed to be an alternative forecast that would be lower than SERIES B. It would be impossible to determine the lowest forecast scenario or even the lowest reasonable scenario. A scenario can be defined based on reasonable assumptions which will produce a lower forecast. With the assistance of REMI staff, MRGCOG reviewed the current situation and identified a potential scenario which could reasonably occur and would produce a lower forecast.

A review of the current situation in SPDD3 shows that the economy has been growing for the past several years and likewise the population growth for the total region has been slower in recent years. These recent events have caused the local economy and consequently local population growth to lag behind earlier projections. A contributing, perhaps major cause, of this lag has been the decline in the sector in the REMI model called Electrical Equipment Manufacturing which includes the manufacture of semiconductors and related components. The REMI Standard forecast which is calibrated on data through 1997 projects this economic sector to continue to grow in the local economy at a rate well above the growth for this sector in the national forecast.

Consider the situation, the Electrical Equipment Manufacturing sector does not rebound to its former level but instead grows at more modest rates. To produce SERIES C, the REMI model was run assuming that future local growth in the Electrical Equipment Manufacturing sector would be approximately equal to the projected national rate of growth. The result was a 2035 projection that was slightly more than three percent lower than the Standard forecast.

SERIES C was modified slightly in the 1997 to 2005 period. Population and economic growth has been slower in the past several years than the raw projection from REMI for SERIES C. Therefore, SERIES C to 2005 was modified by incorporating the UNM-BBER projection. After 2005, UNM-BBER grows faster and approaches SERIES B. A trend line was computed from 2000 to 2035 data using a least squares linear regression to extend the forecast to 2050. The forecasts for Bernalillo County and the three-county REMI area were computed in the same manner. The three county area was divided into county components with the same method as was used for SERIES B.

Use of SERIES A and SERIES C creates an envelope from 1997 (the REMI base year) to 2050 that widens over time. At 2035, the envelope extends from 1,086,282 to 1.297,339; a range in the population forecast of 211,057. At 2050, the envelope extends from 1,166,586 to 1,517,394; a range in the population forecast of 350,808. The current most probable forecast, SERIES B is much closer to SERIES C than SERIES A. The intent was not to center SERIES B. The intent was to create a reasonable higher forecast and a reasonable lower forecast. There was a consideration regarding the size of the range. The range of 350,000 out of a upper forecast of 1.5 million is probably as large a range as is desirable. SERIES C is somewhat lower than SERIES B and follows a reasonable set of assumptions.

There were three other considerations that argued in favor of a SERIES C that in 2050 was only three percent lower than the preferred. First, given the history of population growth in this region (see Tables A-1 to A-3), SERIES B already forecasts a considerable slowing of population growth. Second, SERIES A with the assumptions regarding previous unexplained growth was considered an almost necessary scenario so that to some extent SERIES A constrained the assumptions for SERIES C. Finally, generally in planning it is better to error on the side of planning for more growth than what occurs than to error by planning for less growth. If growth occurs at a rate that is slower than projected it is a relatively simple matter to delay any proposed actions so that a 2040 plan becomes a 2060 or 2080 plan. To error by planning for less growth than what occurs produces many more problems.

Other Forecast Series

There are two other forecasts being used in projects within the responsibility of the MRGCOG: Focus 2050 Forecast and UNM-BBER 2025. A short discussion of these forecasts is provided. Both of these forecasts are displayed in the chart in the Executive Summary to illustrate how they compare to the three series presented by this report. In general, both the 2050 Forecast and the UNM-BBER 2025 forecasts are within the parameters of the three REMI series; the exceptions are noted and explained in the following paragraphs.

Focus 2050 Forecast Series: In spring 1996, the MRGCOG developed a forecast to 2050 based on the current (1996) BBER forecast to 2020. In extending this forecast to 2050, MRGCOG considered a 50-year history in the area as well as long term national economic and demographic projections. This forecast was published the following year, 1997, in document number TR-127 as part of a major regional planning activity on the part of the MRGCOG. Originally the Study Area for the forecast was for the 4-county SPDD3 plus southern Santa Fe County. In the forecast, the portion of the original Study Area for SPDD3 was 1,524,789; southern Santa Fe County was forecast at 30,269. The separate forecasts for SPDD3 and southern Santa Fe County were not reported as the intention of the planning process was to determine, among other issues, how the population should be distributed among the region. The published forecast was a rounded total for the original Study Area which was 1,555,000.

The Focus 2050 project resulted in adoption of a Balanced Communities Scenario. One goal of the Balanced Communities Scenario was that more of the population related to metropolitan Albuquerque employment should be housed near that employment center. When this goal was implemented in the land use and population projection the result was more population within SPDD3. The proposed population for SPDD3 for purposes of the Focus 2050 Regional Plan was 1,536,000, slightly higher than the original projection since it assumed containing suburban and exurban sprawl. It is noted that prior to adoption, southern Santa Fe County was removed from the Study Area so that the population forecast reported in the published Focus 2050 Regional Plan was the revised population projected for SPDD3.

The Focus 2050 population forecast since it was used in a recently adopted regional land use plan is discussed in this report even though the forecast is four years old. One of the underlying assumptions for this forecast was that the region would have a strong economy that would continue to attract numerous in-migrants. The forecast based on assumptions of a strong economy, four years ago, are somewhat similar to the forecast produced in SERIES A. Given Albuquerque's history for cyclical growth, the current slow down could easily be reversed by a new cycle of strong growth which would generate populations consistent with either the Focus 2050 forecast or the SERIES A forecast.

UNM-BBER 2025: This is the current, but at this time unpublished, forecast provided to MRGCOG for use in the Metropolitan Transportation Plan (MTP) 2025. This forecast was provided to MRGCOG in a fax for use in the MTP 2025. This forecast was available to the MRGCOG since the MRGCOG was engaged with UNM-BBER and the City of Albuquerque in a forecasting project. One of the products of this forecasting project was intended to be a new MRGCOG 2025 MTP forecast. The MRGCOG should publish the 2025 MTP forecast later this year in a report. In April 2000, the City of Albuquerque Planning Department published Urban Growth Projections 1999 - 2010 which contained the portion of the UNM-BBER 2025 forecast to 2010 for most of Bernalillo County and part of southern Sandoval County. The City of Albuquerque funded the work by UNM-BBER, MRGCOG participated by providing certain historical data.

The UNM-BBER forecast to 2025 was for counties. MRGCOG summed the forecasts for the four counties within SPDD3 to create an SPDD3 forecast. Combining counties was legitimate since UNM-BBER created the county forecasts as parts of a State forecast so that the sum of the county forecasts equal the State forecast. Therefore, any group of counties can be summed to create a total for a given cluster of counties.

This forecast used data through the end of 1999 and reflects the current situation of relatively slow growth. However, this forecast assumes that the local economy will gain strength over time and generate relatively significant growth by 2025. Given that this forecast is based on the most recent data, it was used to modify the REMI results generating SERIES C to produce a slightly lower near term forecast in that series.

Use of data through 1999 included the current slow growth period that this region is experiencing which produced a near term forecast slightly lower than the raw output for REMI SERIES C. This was noted in the discussion of REMI SERIES C and the adjustment that was applied to create SERIES C.

General Comments on the Data

Historical data is presented in table form in Tables A-1 to A-3. SERIES A, B, and C are presented in data tables in B, C, and D. Table A contains an estimate by the MRGCOG for July 1999 based on updating from the 1990 Census using the number of residential building permits for new construction, analyzing the change in residential electrical connections since 1990, and the change in school enrollments since 1990. These are of course estimates, an actual count for 2000 will be available in spring 2001. There are other current estimates, the UNM-BBER estimates which are incorporated in the UNM-BBER 2025 forecast are slightly higher than the MRGCOG for SPDD3 when the counties are summed. The U.S. Bureau of Census estimates for counties, when summed to SPDD3, are slightly lower than the MRGCOG estimates.

Since there was little growth between July 1999 and the 2000 Census date of April 2000, it is very possible the actual 2000 count will be lower than any of the three series for 2000. Given this concern, SERIES C was adjusted to the UNM-BBER 2025 forecast for 2000 and 2005. As apparent from the previous paragraph, this revised SERIES C may still be higher than the 2000 count. Implicit in all of these forecast series is a statement that growth for SPDD3 will continue at some level. Based on MRGCOG modeling with the REMI Model and the UNM-BBER forecasts, the recent period of slow growth is temporary. Therefore, if the 2000 Census count should fall below any of the 2000 data points in the three series, it should be regarded as a temporary deviation from a longer term trend of growth unless there is some new evidence that would argue for a long term period of little or no growth.

A major purpose of generating three series of forecasts was to produce a range for SPDD3 and for each county. A table providing the high and the low forecast for SPDD3 and each county is provided in Table E.

Table A-1: Historical Populations for SPDD3 and County 1950 - 1990

Year	SPDD3	Bernalillo County	Sandoval County	Torrance County	Valencia County*
1950	179,653	145,673	12,438	8,012	13,530
1960	299,043	262,199	14,201	6,497	16,146
1970	359,007	315,774	17,492	5,290	20,451
1980	492,759	419,700	34,799	7,491	30,769
1990	599,416	480,577	63,319	10,285	45,235

Source: U.S. Bureau of the Census
* Valencia County was split in 1981 to form Valencia and Cibola Counties. The Valencia populations for 1950 - 1990 are computed from sub-county data to provide populations for the area that is currently within the boundaries of Valencia County.

Table A-2: Historical Annual Average Population Growth Rates for SPDD3 and County 1950 - 1990

Year	SPDD3	Bernalillo County	Sandoval County	Torrance County	Valencia County*
1950 - 1960	5.23	6.05	1.33	-2.11	1.78
1960 - 1970	1.84	1.88	2.11	-2.08	2.39
1970 - 1980	3.22	2.89	7.12	3.54	4.17
1980 - 1990	1.98	1.36	6.17	3.22	3.93

Source: U.S. Bureau of the Census
* Valencia County was split in 1981 to form Valencia and Cibola Counties. The Valencia populations for 1950 - 1990 are computed from sub-county data to provide populations for the area that is currently within the boundaries of Valencia County.

Table A-3: MRGCOG Population Estimates for July 1999 for SPDD3 and County

Year	SPDD3	Bernalillo County	Sandoval County	Torrance County	Valencia County
1999 Estimate	714,300	544,000	89,500	16,200	64,600
Growth Rate 1990 - 1999	1.91	1.25	3.52	4.65	3.63

Table B-1: Series A Forecast of Populations for SPDD3 and County 2000 - 2050

Year	SPDD3	Bernalillo County	Sandoval County	Torrance County	Valencia County
2000	746,831	561,724	97,347	17,129	70,631
2010	925441	663,050	139,803	24,505	98,083
2020	1,095,032	770,097	175,260	30,972	118,703
2030	1,231,370	863,952	200,191	35,668	131,559
2040	1,366,895	960,863	224,067	39,773	142,192
2050	1,517,394	1,068,973	250,684	44,185	153,552

Table B-2: Series A Annual Average Population Growth Rates for SPDD3 and County 2000 - 2050

Year	SPDD3	Bernalillo County	Sandoval County	Torrance County	Valencia County
2000 - 2010	2.17	1.67	3.69	3.65	3.34
2010 - 2020	1.70	1.51	2.29	2.37	1.93
2020 - 2030	1.18	1.16	1.34	1.42	1.03
2030 - 2040	1.05	1.07	1.13	1.10	0.78
2040 - 2050	1.05	1.07	1.13	1.06	0.77

Table C-1: Series B Forecast of Populations for SPDD3 and County 2000 - 2050

Year	SPDD3	Bernalillo County	Sandoval County	Torrance County	Valencia County
2000	739,388	557,045	95,893	16,894	69,576
2010	866,908	633,107	125,608	20,822	87,371
2020	981,064	713,473	146,654	23,274	97,663
2030	1,068,074	780,012	160,624	24,490	102,949
2040	1,142,104	839,570	171,968	24,968	105,598
2050	1,205,897	894,432	180,415	24,931	106,119

Table C-2: Series B Annual Average Population Growth Rates for SPDD3 and County 2000 - 2050

Year	SPDD3	Bernalillo County	Sandoval County	Torrance County	Valencia County
2000 - 2010	1.60	1.29	2.74	2.11	2.30
2010 - 2020	1.24	1.20	1.56	1.12	1.12
2020 - 2030	0.85	0.90	0.91	0.51	0.53
2030 - 2040	0.67	0.74	0.68	0.19	0.25
2040 - 2050	0.54	0.63	0.48	-0.01	0.05

Table D-1: Series C Forecast of Populations for SPDD3 and County 2000 - 2050

Year	SPDD3	Bernalillo County	Sandoval County	Torrance County	Valencia County
2000	735,802	555,140	95,009	16,718	68,935
2010	849,951	619,581	123,764	20,517	86,089
2020	957,240	694,249	144,133	22,874	95,984
2030	1,046,407	762,188	158,480	24,163	101,576
2040	1,119,820	824,877	167,652	24,342	102,949
2050	1,166,586	886,670	162,140	22,406	95,370

Table D-2: Series C Annual Average Population Growth Rates for SPDD3 and County 2000 - 2050

Year	SPDD3	Bernalillo County	Sandoval County	Torrance County	Valencia County
2000 - 2010	1.45	1.10	2.68	2.07	2.25
2010 - 2020	1.20	1.14	1.54	1.09	1.09
2020 - 2030	0.89	0.94	0.95	0.55	0.57
2030 - 2040	0.68	0.79	0.56	0.07	0.13
2040 - 2050	0.41	0.73	-0.33	-0.83	-0.77

Table E: Forecast Populations Ranges for SPDD3 and County 2000 - 2050 in thousands

	SPDD 3	SPDD 3	Bern. Co.	Bern. Co.	Sand. Co.	Sand. Co.	Torr. Co.	Torr. Co.	Valen. Co.	Valen. Co.
Year	High	Low	High	Low	High	Low	High	Low	High	Low
2000	746.8	735.8	561.7	555.1	97.3	95.0	17.1	16.7	70.6	68.9
2010	925.4	850.0	667.9	619.6	139.8	123.8	24.5	20.5	98.1	86.1
2020	1095.0	957.2	781.7	694.2	175.3	144.1	31.0	22.9	118.7	96.0
2030	1231.4	1046.4	883.2	762.2	200.2	158.5	35.7	24.2	131.6	101.6
2040	1366.9	1119.8	988.4	824.9	224.1	167.7	39.8	24.3	142.2	102.9
2050	1517.4	1166.6	1105.9	886.7	250.7	162.1	44.2	22.4	153.6	95.4

Appendix B

Information on Diversions and Irrigated Agriculture provided by the Middle Rio Grande Conservancy District

MIDDLE RIO GRANDE CONSERVANCY DISTRICT

MIDDLE RIO GRANDE CONSERVANCY DISTRICT
Estimated Irrigated Acreage as of July, 2000
April 30, 2001

NOTE: The following irrigated acreage figures are preliminary estimates based upon July, 2000 imagery from a satellite remote sensing study. The figures were adjusted to include an estimate of lands temporarily idle or fallow. The adjustment was made because, at any given time during a typical irrigation season (March – October), some fields are unirrigated due to annual crop rotations, variable planting times for different crops, or other management decisions. Therefore, regardless of the time-of-year at which it is taken, a single satellite image cannot give a complete picture of irrigated acreage. Results of the study using the July, 2000 imagery will be available later this year. Irrigated acreage figures will be updated as new information and techniques become available.

MRGCD Division	Irrigated Acres (July, 2000)
Cochiti	3,070
Albuquerque	16,258
Belen	37,173
Socorro	16,831
TOTALS	73,602

COUNTY	Irrigated Acres (July, 2000)
Sandoval	6,733
Bernalillo	12,870
Valencia	30,938
Socorro	23,063
TOTALS	73,604

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MIDDLE RIO GRANDE CONSERVANCY DISTRICT

HOW MUCH WATER DOES THE MIDDLE RIO GRANDE CONSERVANCY DISTRICT *DIVERT* FROM THE RIO GRANDE? WHERE DOES IT *GO*?

Before We Get to the Numbers, A Little Background

The Middle Rio Grande Conservancy District was created in 1925 to control flooding, drain waterlogged soils, and divert water from the Rio Grande to supply farmers along 150 miles of the river. Irrigation has been practiced in the middle Rio Grande valley for many centuries, since long before the Spanish arrived. Now, some 11,000 irrigators rely on 834 miles of canals, laterals, and ditches to carry the water from the river to their fields. From those fields, water that hasn't seeped into the aquifer or is not consumed by crops returns to the river through 404 miles of drains and return flows. The return flow channels are also known to the engineers as "wasteways," an unfortunate term that leaves the false impression that water is wasted. The truth is that most of the water is actually recycled, as explained below. The big drains that parallel the river, known locally as "clear ditches," during the winter carry the clear water that flows out of the shallow underground aquifer back to the river.

Irrigation water for the Conservancy District's farmers is diverted from the river at four dams: Cochiti, Angostura (near Algodones), Isleta, and San Acacia (north of Socorro). Those four dams set the Conservancy District apart from other irrigation districts in a significant way: Most irrigation districts have only one "point of diversion" from their source of water, so they rely on pumps to move the water around to where it is needed. In contrast, the Conservancy District was designed to rely on gravity flow to move the water to the fields. As a result there is only one pump that is used regularly in the Conservancy District's low-tech, low-energy-consuming, 150-mile-long water delivery system.

The Numbers

On average, the Conservancy District diverts 350,000 acre-feet of water over the span of the eight-month irrigation season (March 1 to October 31). That number is derived by adding the amounts of water diverted at each of the four dams, <u>and subtracting the water that returns to the Rio Grande between each dam</u>. That subtraction of return flows is unusual in irrigation system water accounting, but in the case of the Conservancy District it makes sense. The following description illustrates how the water diversion and return flow system works. A diagram following this text shows the same thing in graphic form.

In an average year at Cochiti Dam, 95,000 acre-feet of water is diverted into the irrigation system, and 60,000 acre-feet returns to the river through several return flows. <u>That means the net diversion at Cochiti is 35,000 acre feet.</u> The water returned to the river below Cochiti is diverted again at Angostura Dam, where the

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average diversion is 165,000 acre-feet. Below Angostura, about 100,000 acre-feet returns to the river (called "net return flow" on the diagram).

MIDDLE RIO GRANDE CONSERVANCY DISTRICT

At Isleta Dam, 250,000 acre-feet of water is diverted, and about 160,000 acre-feet returns to the river through many return flow channels below the dam. The last dam on the system, San Acacia, is a special case because of a particularly big channel upstream, called Drain Unit 7, that carries a large amount of return flow from the farms upstream in Valencia County. Because of Drain Unit 7 and the 160,000 acre-feet of return flow from upstream, the average net annual diversion at San Acacia Dam is a negative 34,000 acre-feet. That means that at and below San Acacia Dam, on average more water is returned to the Rio Grande than is diverted from it.

In summary, the net diversion of water from the Rio Grande amounts to 350,000 acre feet. The approximately 70,000 acres of irrigated farmland in the Conservancy District actually use about 238,000 acre-feet of water in an average year. That is about 3.4 acre-feet of water used per irrigated acre, which is a reasonable rate of use in a desert environment, when you consider that the water that is not consumed by crops or doesn't flow on down to Elephant Butte Reservoir is consumed by some 50,000 acres of bosque and ditchbank vegetation, or it infiltrates into the aquifer, or is lost to evaporation from the canals and ditches.

How "Efficient" Is the Conservancy District?

According to the New Mexico Office of the State Engineer Technical Report 49 (OSE 1997), efficient irrigation systems divert about seven acre-feet of water for each acre irrigated. By that standard, the Conservancy District is an efficient system. On page 39, that report says 37 percent losses (63 percent efficiency) is the statewide average rate for surface-water conveyance for irrigation. New Mexico flood irrigation typically operates at about 55 percent on-farm efficiency.

That 1997 report of the State Engineer includes the following inventory for the Conservancy District in 1995. (Please note that these numbers are different from the average numbers used above. However, the story these numbers tell is the same).

Total Withdrawal of Surface Water	=	402,648 AF
Conveyance Losses of Surface Water	=	203,982 AF
Total Farm Withdrawal of Surface Water	=	198,666 AF
Total Consumptive Use of Surface Water	=	113,593 AF
Total Acres Irrigated	=	52,065 acres

Implied off-farm efficiency is 49 percent and on-farm efficiency is 60 percent. Both values indicate the MRGCD is reasonably within the range reported for other New Mexico irrigation systems. The OSE 1997 report indicates that the Conservancy District's duty of water (total amount diverted divided by acres irrigated) in 1995 was 7.7 acre-feet per acre, with 3.81 acre-feet per acre used on the

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Middle Rio Grande Conservancy District

farms. If you take into consideration return flows to the river from the irrigation system (see above), the Conservancy District's net diversions reduce to 350,000 acre-feet.

Increased efficiency is possible, but the environmental cost could be significant. For example, the "leaky" Conservancy District canals and ditches support not only the farmlands but also tens of thousands of acres of the riverside bosque and ditchbank vegetation. If the volume of water "lost" to seepage from those unlined canals and ditches were decreased, that would mean less water recharging the aquifer, and less water available to the vegetation that lines the ditchbanks. If the total amount of water diverted is reduced, return flow to the river will be similarly reduced, resulting in less water in the river, less water available for endangered species, and less water available to the bosque from the conveyance system. Although some people assume that less water in the canals and ditches would mean more water in the river, the fact is that conveyance losses from the Rio Grande appear to be greater than conveyance losses from the canals and ditches.

What About Wildlife?

A "more efficient" Conservancy District could have serious consequences for wildlife. The middle Rio Grande valley is part of the Rio Grande Flyway, which is one of the main corridors through which hundreds of thousands of birds travel between their wintering grounds to the south and their breeding grounds in North America. The huge flocks of ducks, geese and sandhill cranes are only the most visible signs of this magnificent semi-annual migration; thousands of other smaller birds make the trip as well. All of those birds, and many of the animals and plants that make up the interdependent ecosystem, depend on the irrigated farm fields, the bosque, and the wet soils that are the products of the Conservancy District's irrigation system. If there is less water is available for that system, there will be less water for wildlife.

In Conclusion

While the Conservancy District's principal function is to support the region's $30 million-a-year agricultural economy, the benefits of maintaining the District's flood control, drainage, and irrigation water conveyance systems extend far beyond farming. The bosque we see today was largely created by the structures installed to control river flooding, and the ditch roads serve double duty as recreational trails enjoyed by thousands of New Mexicans who run, hike, ride their horses, and birdwatch. The trees that line the river and the ditches, and the abundant wildlife that depends on those trees, would be at serious risk if the amount of water in the Conservancy District's system were reduced. That is why decisions that could lead to a reduction in the water available for irrigation must be evaluated for their impacts on the whole ecosystem, including the humans who are part of it.

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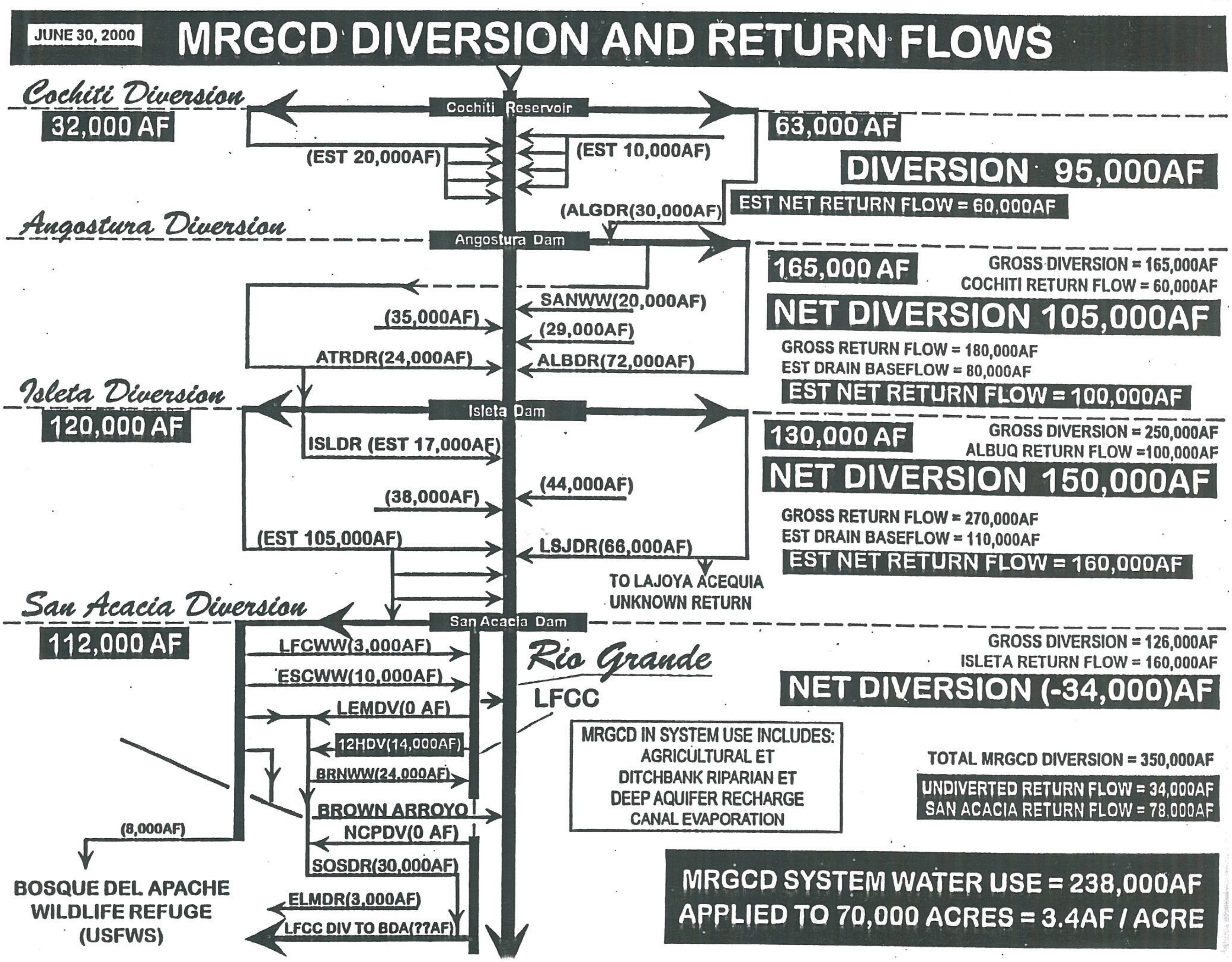
JUNE 30, 2000
MRGCD DIVERSION AND RETURN FLOWS
Cochiti Diversion
32,000 AF
Cochiti Reservoir
63,000 AF
(EST 20,000AF)
(EST 10,000AF)
DIVERSION 95,000AF
ALGDR(30,000AF)
EST NET RETURN FLOW = 60,000AF
Angostura Diversion
Angostura Dam
165,000 AF
GROSS DIVERSION = 165,000AF
COCHITI RETURN FLOW = 60,000AF
SANWW(20,000AF)
(35,000AF)
(29,000AF)
NET DIVERSION 105,000AF
ATRDR(24,000AF)
ALBDR(72,000AF)
GROSS RETURN FLOW = 180,000AF
EST DRAIN BASEFLOW = 80,000AF
EST NET RETURN FLOW = 100,000AF
Isleta Diversion
120,000 AF
Isleta Dam
130,000 AF
GROSS DIVERSION = 250,000AF
ALBUQ RETURN FLOW =100,000AF
ISLDR (EST 17,000AF)
NET DIVERSION 150,000AF
(38,000AF)
(44,000AF)
GROSS RETURN FLOW = 270,000AF
EST DRAIN BASEFLOW = 110,000AF
(EST 105,000AF)
LSJDR(66,000AF)
EST NET RETURN FLOW = 160,000AF
TO LAJOYA ACEQUIA
UNKNOWN RETURN
San Acacia Diversion
San Acacia Dam
112,000 AF
GROSS DIVERSION = 126,000AF
ISLETA RETURN FLOW = 160,000AF
LFCWW(3,000AF)
Rio Grande
ESCWW(10,000AF)
NET DIVERSION (-34,000)AF
LEMDV(0 AF)
LFCC
MRGCD IN SYSTEM USE INCLUDES:
AGRICULTURAL ET
DITCHBANK RIPARIAN ET
DEEP AQUIFER RECHARGE
CANAL EVAPORATION
12HDV(14,000AF)
BRNWW(24,000AF)
TOTAL MRGCD DIVERSION = 350,000AF
UNDIVERTED RETURN FLOW = 34,000AF
SAN ACACIA RETURN FLOW = 78,000AF
BROWN ARROYO
(8,000AF)
NCPDV(0 AF)
SOSDR(30,000AF)
BOSQUE DEL APACHE
WILDLIFE REFUGE
(USFWS)
ELMDR(3,000AF)
LFCC DIV TO BDA(??AF)
MRGCD SYSTEM WATER USE = 238,000AF
APPLIED TO 70,000 ACRES = 3.4AF / ACRE