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Water as a Parameter for Development of Energy Resources in the Upper Great Plains — Socioeconomic Effects of Alternative Patterns of Coal-Based Energy Development

by

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**Water as a Parameter for Development of
Energy Resources in the Upper Great Plains —
Socioeconomic Effects of Alternative
Patterns of Coal-Based Energy Development**

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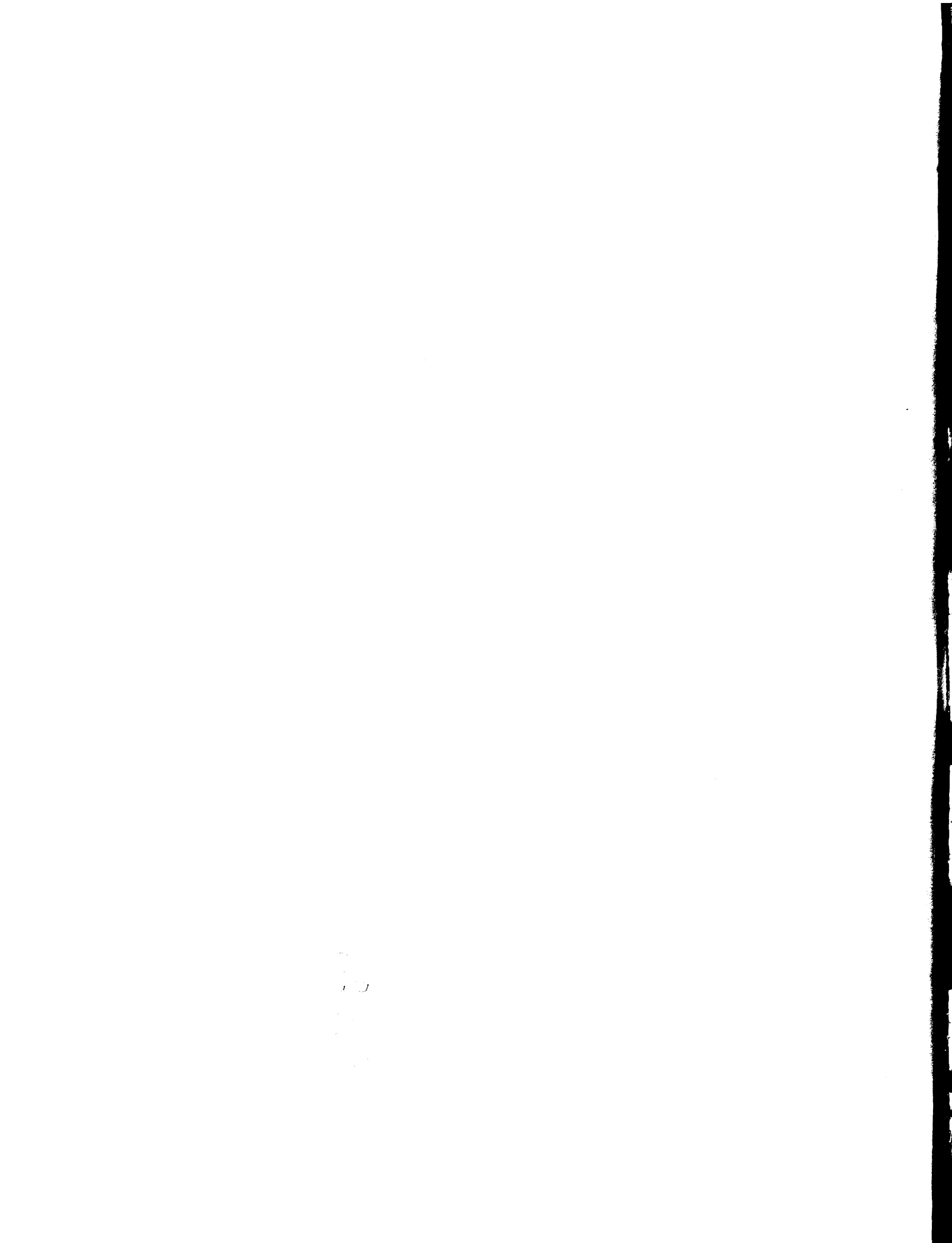


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FOREWORD

The growth in energy demands and the demand for clean energy has focused attention on the extensive lignite and subbituminous deposits of the Upper Great Plains. The Fort Union coal beds, which underlie a large area of northeastern Wyoming, southeastern Montana, and western North Dakota offer the greatest potential for development. Massive development of the region's coal reserves would dramatically affect the socioeconomic structure of the region, alter the use of land and water resources, and lead to fiscal impacts that may be positive or negative, depending on the level of government. The purpose of this study was to analyze the impacts associated with alternative levels of coal-based energy development in the Upper Great Plains.

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PREFACE

In an era of dwindling domestic supplies of oil and natural gas and an increasing demand for energy, attention has focused on western coals, particularly the extensive lignite and subbituminous deposits of the Upper Great Plains. The Fort Union coal beds, which underlie a large area of northeastern Wyoming, southeastern Montana, and western North Dakota offer the greatest potential for development.

The Upper Great Plains accounts for almost 61 percent of surface minable coal reserves in the United States and 40 percent of total reserves. The relatively low costs of mining and the low sulfur content of the region's coal are its major advantages over coal mined in other parts of the country and serve to offset its lower heat (Btu) content.

Upper Great Plains coal is expected to play an increasingly important role in meeting national energy needs. By 1990, coal production in the region could be four to nine times the 1974 production level of 41.3 million tons. Extensive environmental and socioeconomic impacts will accompany such development. The coal-related industrial developments will produce a dramatic change in the present social and economic structure of the region. Public decision makers and area residents face a number of issues (and associated environmental impacts) related to coal development. These include: (1) the allocation of limited supplies of land and water; (2) the effect on population, employment, and income in affected areas; (3) the effect on the level of services demanded from state and local governments and the revenues available to these governmental units; and (4) the effect of different types and levels of development on the economic future of the region.

The purpose of this study was to analyze the effects of alternative patterns of coal-based energy development in the Upper Great Plains on resource use, economic activity, and population distribution in the region. The study report is contained in two volumes. Volume I (North Dakota Research Report Number 71), "Water as a Parameter for Development of Energy Resources in the Upper Great Plains—Socioeconomic Effects of Alternative Patterns of Coal-Based Energy Development," addresses the effects on economic activity, population growth and settlement patterns, and the costs and revenues to state and local levels of government of coal development in the region. Volume II (North Dakota Research Report Number 70), ". . . Effects on Land and Water Resources of Alternative Patterns of Coal-Based Energy Development," addresses the effects of coal-based energy development on the region's land and water resources.

In this volume a detailed conceptual description of a computerized model that has proven useful in North Dakota for projection of the economic, demographic, and fiscal effects of coal development is presented in Chapter I. Chapter II provides an in-depth analysis of the effects of three alternative levels of coal development in North Dakota, as well as brief summaries for Montana and Wyoming. Existing and potential measures for the alleviation of adverse fiscal effects resulting from coal development are discussed in Chapter III. Socio-economic characteristics of the coal industry's work force in the Upper Great Plains and a local labor supply model are discussed in Chapter IV.



CHAPTER I

CONCEPTUAL FRAMEWORK

Projections of the economic, demographic, and fiscal effects of coal development in North Dakota were provided by the state's Regional Environmental Assessment Program (REAP) Economic-Demographic Model (Regional Environmental Assessment Program). The REAP Economic-Demographic Model 1 (RED-1) is a multiphase projection model. The model contains five basic components or sub-models. These are:

1. An Economic Input-Output Module.
2. A Cohort-Survival Demographic Module.
3. An Economic-Demographic Interface Module.
4. A Gravity Module.
5. A Fiscal Impact Module.

The input-output module provides projections of gross business volume from which employment requirements by sector and development phase are derived. The demographic module provides projec-

tions of population by age and sex and an estimate of the available labor force. The interface component links the projections of required employment from the input-output module with the projections of available labor force from the demographic module to determine the level of employment needs that can be met by the indigenous population and those that must be met by the in-migration of new workers. The gravity module estimates the settlement patterns of new workers and their families and the fiscal-impact module provides projections of the expected costs and revenues resulting from the associated economic and demographic changes. These factors operate differentially at the regional, county, and municipal level. A generalized flow diagram of the model is presented in Figure I-1. A more detailed description of each component is provided in the following section.

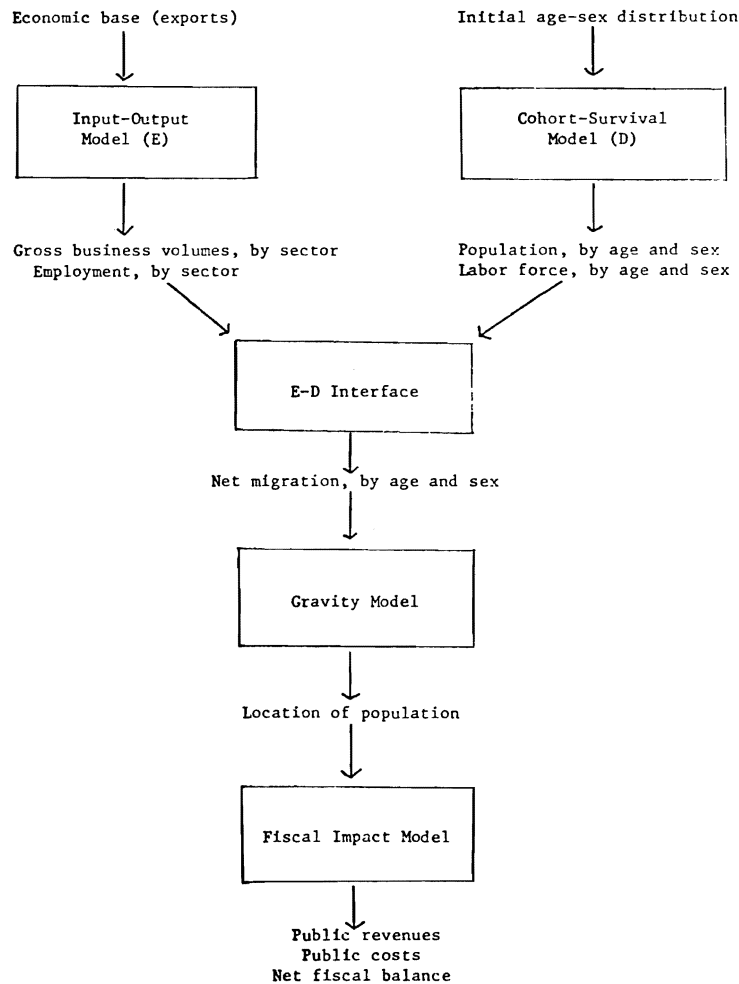


Figure I-1. Data and Output Flows of REAP Economic-Demographic Model 1 (RED-1)

THE INPUT-OUTPUT MODULE

Input-output analysis is a technique for tabulating and describing the linkages or interdependencies between various industrial groups within an economy. The economy considered may be the national economy or (in RED-1) an economy as small as that of a multicounty area served by one of the state's major retail trade centers. The industrial groups included are shown in Table I-1 and are referred to as sectors of the economy.

The input-output analysis used in this model assumes that economic activity in a region is dependent upon the basic industries that exist in an area, referred to as its economic base. The economic base is largely a region's export base, i.e., those industries (or "basic" sectors) that earn income from outside the area. These activities in western North Dakota consist of livestock and crop production, manufacturing, mining, tourism in the area, and federal government outlays in the area. The remaining economic activities are the trade and service sectors, which exist to provide the inputs required by other sectors in the area.

Production by any sector requires the use of production inputs, such as materials, equipment, fuel, services, labor, etc., by that sector. These inputs are referred to as the direct requirements of that sector. Some of these inputs will be obtained from outside the region (imported), but many will be produced by and purchased from other sectors in the area economy. If so, these other sectors will require their own inputs from still other sectors, which in turn will require inputs from yet other sectors, and so on. These additional rounds of input requirements that are generated by production of the direct input requirements (of the initial sector) are known as the indirect requirements.

The total of the direct and indirect input requirements of each sector in an economy is measured by set of coefficients that is known as the input-output interdependence coefficients. Table I-1 contains the coefficients for a 13-sector delineation of the North Dakota economy that have been developed in previous research (see Sand; Bartch; and Senechal). Each coefficient indicates the total (direct and indirect) input requirement that must be produced by the row sector per dollar of output for final demand by the column sector. Final demand is defined as output by a basic sector that is sold outside the region. Final demand consists of receipts from sales of livestock (receipts of Sector 1), receipts by Sector 2 for sale of crops, receipts by Sector 3 for exports of mine products, receipts by Sector 4 for federal government outlays for construction, receipts by Sector 7 for processed agricultural products and other manufacturing, receipts by Sectors 8 and 10 for tourist expenditures, and receipts by Sector 12 for federal payrolls in the region. For any of these

basic sectors which produce for final demand, the sum of the values in Table 1 for that column indicates the multiplier effect in the region's economy resulting from a dollar's worth of sales outside the region by that sector. For example, if the column total of interdependence coefficients for the livestock producing sector is 4.51, \$4.51 worth of output is required by all sectors in the economy in order that \$1.00 worth of livestock be produced for final demand. Thus, it can be said that the output multiplier for the livestock producing sector is 4.51 or that the original dollar "turns over" about 4.5 times in the region.

If the level of output of any of the basic sectors were to increase, the level of output of other sectors also would be expected to increase. The amount of the increase in other sectors would be equal to the dollar amount of the increase in the basic sector's output times the respective interdependence coefficients in the column for the basic sector. For example, the effect of a \$1 million increase in federal government outlays for construction in the region could be estimated from Column 4 of Table 1. Livestock production in the region could be expected to increase by \$30,000 (0.03 of Table 1 times \$1 million); crop production by \$10,000 (0.01 of Table 1 times \$1 million); retail trade volume by \$410,000 (0.41 of Table 1 times \$1 million); personal income (the income of households, Sector 12) by \$610,000 (0.61 of Table 1 times \$1 million); and the total for all sectors in the economy by \$2,440,000 (2.44 of Table 1 times \$1 million). These increases in the respective sectors represent both the direct and the indirect effects of expanded final demand that is injected into the region via the contract construction sector because of increased federal expenditures to it.

Given these basic procedures, the gross business volumes of each sector in the area economy can be estimated by multiplying the output of the "basic" sectors (payments received from outside the area) by the interdependence coefficients for those sectors.

The multiplier effect for a sector (which is measured by the sum of the sector's column of interdependence coefficients) results from the spending and respending within the region's economy of income that is received from sale of its exports. For example, the establishment of a new manufacturing plant in a region would result in expenditures by the plant for some locally supplied inputs, such as materials, labor, etc. These expenditures will generate additional rounds of spending in the region because the firms providing materials to the plant will now purchase some additional inputs in the region and employees of the plant will spend a part of their income in the region. These expenditures, in turn, will generate another round of spending and so on.

Table I-1. Interdependence Coefficients for Basic Economic Sectors, North Dakota

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Ag. Livestock	Ag. Crops	Mining	Contract Construction	Transportation	Utilities	Ag Processing and Misc. Mfg. ^a	Retail Trade	Fin., Ins., & Real Estate	Bus. & Pers. Service	Prof. & Soc. Service	Households	Government ^b
(1) Ag. Livestock	1.21	.08	.04	.03	.05	.04	.19	.09	.06	.04	.06	.07	0.00
(2) Ag. Crops	.40	1.09	.03	.01	.02	.02	.66	.03	.04	.02	.02	.03	0.00
(3) Mining	.01	.01	1.00	.03	.01	c	.01	c	c	c	.01	.01	0.00
(4) Contract Construction	.07	.08	.05	1.05	.05	.06	.06	.03	.07	.05	.08	.09	0.00
(5) Trans- portation	.02	.01	.01	.01	1.01	.01	.01	.01	.01	.01	.01	.01	0.00
(6) Utilities	.09	.08	.07	.06	.08	1.10	.08	.05	.13	.11	.12	.11	0.00
(7) Ag Processing and Misc. Mfg. ^a	.50	.16	.06	.02	.03	.02	1.77	.05	.07	.02	.04	.04	0.00
(8) Retail Trade	.71	.81	.40	.41	.55	.43	.62	1.27	.68	.45	.67	.74	0.00
(9) Fin., ins., & Real Estate	.15	.17	.08	.08	.12	.11	.13	.06	1.14	.11	.14	.17	0.00
(10) Bus. & Pers. Service	.06	.07	.03	.03	.05	.04	.05	.02	.08	1.05	.05	.06	0.00
(11) Prof. & Soc. Service	.07	.06	.05	.04	.05	.05	.05	.03	.08	.05	1.10	.10	0.00
(12) House- holds	1.05	.96	.67	.61	.79	.79	.80	.40	1.20	.72	1.04	1.55	0.00
(13) Govern- ment	.10	.10	.05	.05	.26	.10	.08	.04	.11	.08	.09	.11	1.00
Gross Receipts Multiplier	4.51	3.69	2.57	2.44	3.05	2.79	4.52	2.09	3.68	2.71	3.41	3.08	1.00

^aWholesale trade, although relatively insignificant, is included in Sector 7.

^bDirect and indirect requirements of the local government sector are assumed to be exogenous to the model.

^cLess than 0.005.

Multiplication of the interdependence coefficients (Table I-1) by the sales of the basic sectors (income received from outside the region or sales for final demand) yields estimates of the gross business volumes of each of the sectors in the region. The resulting product for the household sector (Sector 12) is personal income received from the respective business sectors in the form of wages and salaries, profits, rents, and interest income of individuals. The estimates of gross business volume for other sectors are used to estimate employment in those sectors.

The procedures for translating gross business volume in the respective sectors to employment involves dividing gross business volume in each sector by gross business volume per worker in that sector. Gross business volume per worker was computed from historic employment data for the years since 1958 for each of the sectors.

This procedure was employed to estimate trends in baseline employment on the basis of time series projections of the final demand vectors and projections of gross business volume per employee in the respective sectors. The same procedure was used to estimate economic impacts of construction and operation of energy plants on the basis of estimated local expenditures for construction and operation of these plants. The end result was, for the economic baseline and for any set of development projects, an estimate of total required employment.

Input-Output Interdependence Coefficients

The technical input-output interdependence coefficients (Table I-1) for the North Dakota economy were derived from actual expenditures data. Data for business firms, households, and units of government in southwestern North Dakota were collected for 1965 (see Sand; Batch). The development of the coefficients follows a three-step approach. First, a transactions table is constructed showing the purchases and sales by each of the sectors to each of the other industrial sectors. The table is arranged so the columns show the purchases from (and payments to) each row sector, and the rows indicate the sales of that row sector to the column sectors. Next, the technical input-output coefficients table is derived from the transactions table. It is the transactions table expressed as decimal fractions of column totals in the transactions table. Thus, each coefficient in that table indicates the fraction of total inputs of the column sector that is obtained from the row sector. In other words, each coefficient indicates the direct requirements (per dollar of output) that the column sector obtains from the row sector. Finally, the interdependence coefficients (multipliers) table is derived from the technical input-output coefficients table. The interdependence coefficients table shows the total input

requirements (direct and indirect) that must be obtained from the row sector per dollar of output for final demand by the column sector. Each coefficient includes the direct input requirement from the transactions table, the indirect input requirements due to the multiplier effect, and, if appropriate, output for final demand by the column sector. The column totals of this table are the total output requirements of all row sectors in the economy per dollar of output for final demand by the column sector.

The input-output coefficients are used to determine the gross business volume for North Dakota or one of its eight state regions. The coefficients are applied to the sales for final demand for a region or the state to obtain the gross business volume for the region or state, respectively.

The coefficients used for North Dakota are for an economy based on 13 sectors. The 13 sector model is a reduction from the original 30 sector model. The 13 sector model is less confusing than the 30 sector one because sector definitions are more easily understood.

Final Demand Vectors

The final demand vectors are sales for final demand by sectors of the economy. The sectors included as final demand vectors in input-output analysis are referred to as "basic sectors" because they constitute the economic base of the area. The activities that constitute the "basic sectors" include the production of livestock, crops, mining, and manufacturing within the area, as well as expenditures by the federal government and tourists in the area.

Sales by these sectors typically are the sources of income from outside the area that generate gross business volume to the basic sectors, as well as to the other trade and service sectors within the local economy. Gross business volume is derived by application of the final demand vectors to the input-output coefficients. The final demand vectors, allocated to the appropriate sectors, are shown in Table I-2 for North Dakota State Regions 7 and 8 for 1958 to 1973 (Figure I-2). The final demand vectors are expressed in terms of 1972 dollars (prices) to eliminate the effect of inflation. This is accomplished by adjusting final demand vectors in current dollars (prices) by an index computed using 1972 prices as a base.

Gross Business Volumes

Application of the **input-output** multipliers to the final demand vectors yields estimates of gross business volume of all sectors of the economy. Application of adjusted final demand vectors to the coefficients results in adjusted gross business volumes. Table I-3 contains the gross business volumes for State Regions 7 and 8 adjusted to a 1972 base.

Table I-2. Adjusted Final Demand Vectors for 13 Sector Input-Output Model for State Regions 7 and 8, 1958-1973 (Million Dollars) (1972 = Base)

Sector	1958		1959		1960		1961		1962		1963		1964		1965	
	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8
1. Ag; Livestock	56.3	31.9	59.1	33.4	48.4	27.3	60.0	33.8	54.9	31.1	59.7	33.9	62.9	36.4	66.6	37.7
2. Ag; Crops	59.8	49.7	36.7	32.6	55.3	35.4	26.0	28.3	76.5	43.9	69.1	56.1	56.8	34.8	76.9	48.0
3. Mining	3.5	3.4	3.3	3.3	3.2	4.7	3.2	6.0	3.0	7.1	2.9	8.4	2.9	8.2	2.8	8.3
4. Construction	6.0	1.8	8.8	2.6	10.3	3.1	7.6	2.2	4.9	1.5	5.2	1.5	8.8	2.5	8.6	2.6
7. Whls. & Ag Proc.	14.8	3.3	13.0	3.3	14.7	4.1	14.7	4.6	13.3	4.7	14.8	5.8	16.0	6.2	15.6	6.1
8. Retail	3.8	1.6	4.0	1.7	3.3	1.5	3.8	1.7	4.2	1.8	4.8	2.1	5.6	2.4	7.0	3.0
10. Bus. & Pers. Serv.	1.6	.7	1.7	.7	1.3	.7	1.6	.7	1.8	.8	1.9	.8	2.3	.9	2.7	1.2
12. Households	35.2	9.0	39.1	10.4	43.9	11.7	45.2	11.7	56.0	12.1	56.6	13.0	73.7	14.5	61.9	14.9
	1966		1967		1968		1969		1970		1971		1972		1973	
	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8
1. Ag; Livestock	65.3	37.0	71.0	40.1	65.2	32.7	68.6	37.7	69.8	38.3	78.9	43.4	90.3	49.5	80.4	44.1
2. Ag; Crops	85.1	58.9	73.8	62.8	81.0	49.9	104.0	58.9	99.5	65.5	94.8	60.8	132.6	86.8	160.0	111.4
3. Mining	2.9	8.4	3.0	8.7	3.0	8.6	2.7	7.9	2.6	7.5	2.6	7.7	2.5	7.2	2.2	6.5
4. Construction	6.3	1.9	6.3	1.8	6.8	2.0	7.9	2.7	5.4	2.3	4.5	4.4	4.8	1.4	3.8	1.1
7. Whls. & Ag Proc.	16.3	6.4	18.1	4.8	19.0	7.4	29.1	11.5	25.8	10.1	27.3	10.7	27.2	10.7	26.0	10.3
8. Retail	9.4	4.1	11.2	4.9	13.8	6.0	14.4	6.2	15.6	6.7	16.3	7.0	14.6	6.3	15.0	6.5
10. Bus. & Pers. Serv.	3.6	1.6	4.3	1.8	5.1	2.2	5.2	2.2	5.3	2.3	5.5	2.4	4.9	2.1	5.1	2.2
12. Households	69.0	15.7	64.2	15.3	69.8	16.8	88.9	25.6	91.1	31.9	101.4	24.1	113.1	23.9	123.3	23.0

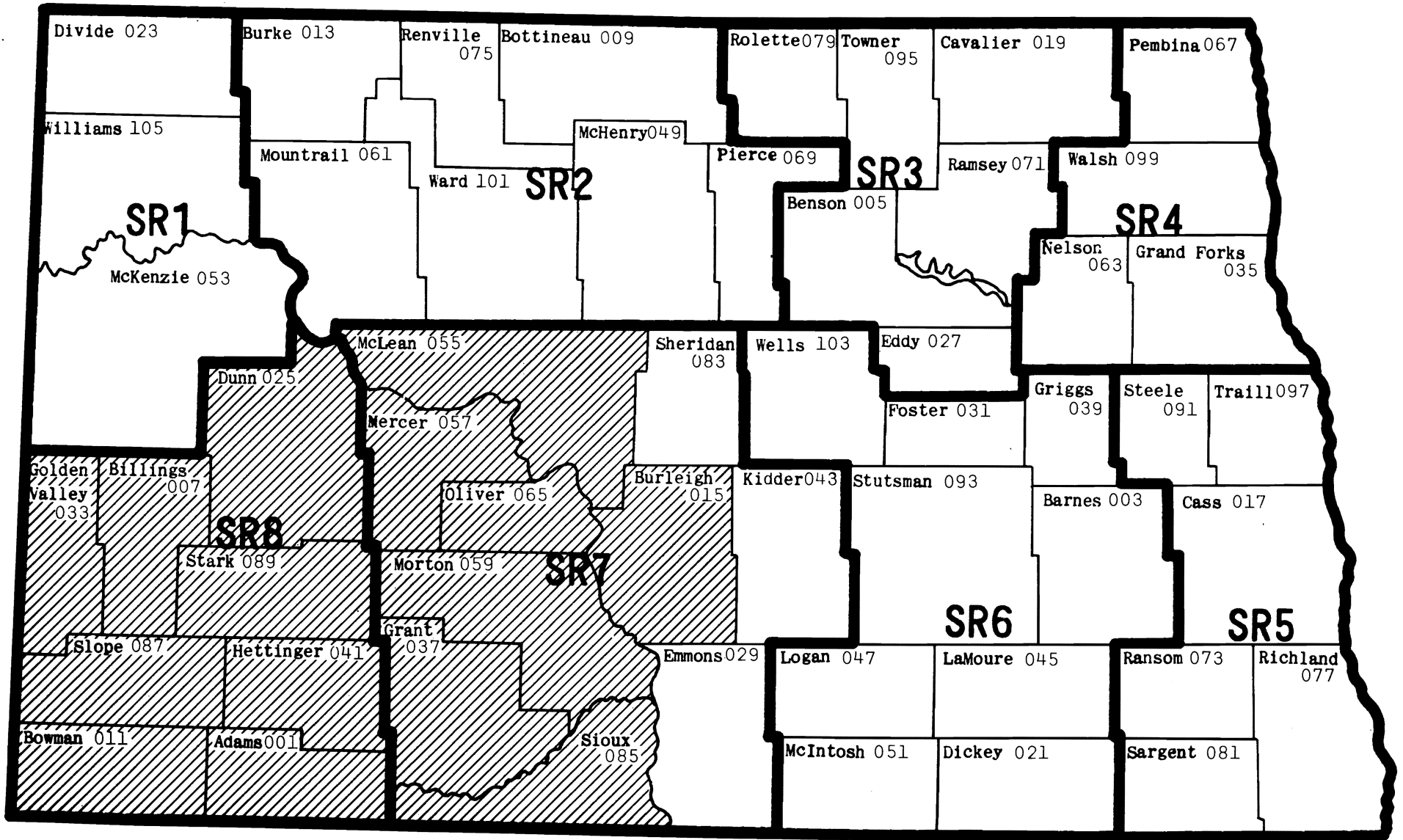


Figure I-2. North Dakota State Planning Regions and the 15-County Area Included in the Economic-Demographic Model.

Table I-3. Estimated Adjusted Gross Business Volume of Economic Sectors for 13 Sector Input-Output Model, by Year, for State Regions 7 and 8, 1958-1973 (1972 = Base) (Million Dollars)

Sector	1958		1959		1960		1961		1962		1963		1964		1965		1966	
	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8
1. Ag. Livestock	78.7	44.0	78.1	44.7	69.3	37.8	81.2	45.2	79.4	43.2	85.0	47.9	89.5	49.6	94.8	52.2	94.6	52.4
2. Ag. Crops	98.7	69.6	72.7	51.5	88.7	52.7	63.5	47.9	116.0	64.0	110.8	79.2	99.9	57.2	122.9	72.1	132.0	84.0
3. Mining	5.0	4.3	4.6	4.1	4.7	5.5	4.6	6.8	4.7	8.1	4.6	9.5	4.7	9.3	4.8	9.4	4.8	9.7
4. Construction	19.4	9.3	18.3	9.1	23.6	9.6	19.6	8.7	21.2	9.0	21.4	10.4	26.1	10.2	26.8	11.4	25.7	11.7
5. Transportation	2.3	1.3	1.8	1.2	2.2	1.2	2.0	1.2	2.6	1.4	2.6	1.6	2.7	1.5	2.9	1.6	3.1	1.8
6. Comm. & Util.	16.3	9.1	11.8	8.0	16.1	8.1	14.9	8.3	19.6	10.0	19.6	11.2	21.1	9.9	21.9	11.3	23.4	12.3
7. Whls. & Ag. Proc.	70.8	33.1	64.2	31.3	65.2	29.6	67.5	33.2	70.7	34.4	75.1	40.1	77.8	38.9	82.1	41.6	84.3	43.6
8. Retail	133.8	76.7	95.4	65.3	130.1	65.3	116.9	65.0	160.7	76.7	160.5	90.9	168.9	77.6	180.6	90.5	194.6	100.9
9. Fin., Ins., R.E.	27.8	15.9	20.0	13.5	27.2	13.6	24.5	13.5	33.6	15.9	33.5	18.8	35.3	16.1	37.3	18.6	39.8	20.6
10. Bus. & Pers. Serv.	12.3	6.9	8.3	5.9	11.7	5.9	10.8	5.8	14.6	7.0	14.6	8.1	15.6	7.1	16.9	8.4	18.8	9.5
11. Prof. & Soc. Serv.	12.7	6.9	8.9	6.1	12.7	6.1	11.8	6.1	15.6	7.0	15.6	8.2	17.0	7.3	17.4	8.3	18.6	9.0
12. Households	192.5	103.1	133.2	90.8	193.2	91.1	179.9	92.0	237.2	105.6	237.8	123.8	259.5	109.2	264.8	124.4	283.2	136.1
13. Government	17.2	9.7	12.4	8.4	16.9	8.4	15.4	8.4	20.7	9.8	20.7	11.5	22.0	10.0	23.1	11.5	24.6	12.6
Total	687.4	389.9	529.7	339.9	661.6	334.9	612.6	342.1	796.7	392.1	801.8	461.2	840.1	403.9	896.3	461.3	947.5	504.2

Sector	1967		1968		1969		1970		1971		1972		1973	
	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8
1. Ag. Livestock	100.9	56.3	95.2	47.0	104.5	55.2	105.1	56.6	116.7	62.1	134.3	71.2	124.7	66.5
2. Ag. Crops	123.1	88.5	129.5	73.3	163.2	88.0	156.6	94.7	156.4	91.9	206.4	122.6	227.9	147.0
3. Mining	4.9	10.0	5.0	9.8	5.0	9.2	4.9	8.9	5.0	9.1	5.3	8.7	5.1	8.1
4. Construction	25.1	12.1	26.3	11.1	31.9	13.9	29.1	14.5	29.5	16.0	34.8	15.3	35.7	16.4
5. Transportation	3.1	1.9	3.2	1.7	3.8	2.0	3.7	2.1	3.9	2.1	4.6	2.4	4.8	2.6
6. Comm. & Util.	22.8	12.8	23.8	11.5	28.9	13.9	28.5	15.1	30.1	14.5	35.7	16.9	37.7	18.2
7. Whls. & A. Proc.	88.9	43.3	88.6	41.7	113.2	53.5	107.3	52.9	115.0	55.9	128.7	63.5	125.2	63.6
8. Retail	189.9	106.2	200.0	94.8	242.8	114.9	240.1	124.8	251.9	120.7	300.0	143.5	319.1	158.5
9. Fin., Ins., R.E.	38.4	21.5	40.1	18.9	49.1	23.2	48.3	25.2	50.9	24.2	61.4	29.1	65.3	32.1
10. Bus. & Pers. Serv.	18.9	10.1	20.3	9.5	23.9	11.1	23.7	12.0	24.8	11.7	28.3	13.4	30.1	14.8
11. Prof. & Soc. Serv.	18.0	9.4	18.8	8.4	23.0	10.4	22.8	11.4	24.2	10.9	28.7	12.8	30.5	13.8
12. Households	273.6	141.9	285.7	126.8	350.0	157.6	346.6	172.9	368.7	163.8	437.7	192.2	464.6	207.9
13. Government	23.8	13.2	24.8	11.7	30.3	14.3	29.9	15.5	31.6	14.9	37.8	17.8	40.1	19.4
Total	931.4	527.2	961.3	466.2	1,169.6	567.2	1,146.6	606.6	1,208.7	597.8	1,443.7	709.4	1,510.8	768.9

Table I-4. Estimated Gross Business Volume of Economic Sectors for 13 Sector Input-Output Model, by Year, for State Regions 7 and 8, 1958-1973 (Million Dollars)

Sector	1958		1959		1960		1961		1962		1963		1964		1965		1966	
	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8
1. Ag. Livestock	63.3	35.6	61.1	34.1	52.8	28.6	60.4	33.8	60.1	32.8	62.2	35.4	63.7	35.3	73.3	40.4	81.1	45.1
2. Ag. Crops	82.8	58.9	59.7	42.4	72.6	43.5	51.1	39.6	98.9	54.8	95.5	69.5	84.5	48.8	105.7	62.4	117.6	75.3
3. Mining	3.9	3.4	3.7	3.2	3.6	4.3	3.5	5.4	3.7	6.4	3.6	7.5	3.7	7.3	3.8	7.6	4.0	8.0
4. Construction	13.9	7.1	14.3	6.6	16.1	6.9	13.5	6.3	15.8	7.0	15.9	8.2	18.9	7.6	20.1	8.9	20.6	9.8
5. Transportation	1.8	1.1	1.6	.9	1.7	.9	1.5	.9	2.0	1.1	2.0	1.3	2.1	1.1	2.3	1.3	2.6	1.5
6. Comm. & Util.	12.8	7.3	11.4	6.2	12.2	6.3	11.2	6.4	15.1	7.6	15.1	9.0	15.9	7.7	17.1	9.0	19.6	10.6
7. Whls. & Ag Proc.	56.9	27.0	50.9	24.4	50.7	23.1	51.7	25.5	55.5	27.0	58.0	31.4	59.0	29.4	65.6	33.3	72.1	37.6
8. Retail	103.9	61.8	91.5	51.3	100.0	51.4	88.3	51.0	124.1	60.6	123.3	73.3	126.3	59.5	139.4	71.6	164.6	87.4
9. Fin., Ins., R.E.	22.0	13.0	19.0	10.6	20.9	10.7	18.5	10.6	26.5	12.8	26.3	15.4	27.1	12.6	29.7	15.1	33.7	17.8
10. Bus. & Pers. Serv.	9.3	5.5	8.2	4.5	8.8	4.5	7.9	4.5	10.3	5.0	10.2	6.1	10.4	4.9	11.5	5.9	15.4	8.0
11. Prof. & Soc. Serv.	9.9	5.6	8.9	4.7	9.6	4.7	8.8	4.7	12.1	5.6	12.1	6.6	12.9	5.6	13.7	6.7	15.6	7.8
12. Households	149.9	83.3	134.5	70.5	146.0	70.8	134.2	71.3	183.9	84.0	184.0	100.0	196.8	84.7	208.4	100.2	236.3	116.9
13. Government	13.5	7.8	11.9	6.5	12.9	6.5	11.6	6.6	16.2	7.8	16.1	9.4	16.8	7.8	18.3	9.3	20.7	10.9
Total	544.1	317.3	476.6	266.0	507.4	262.2	462.2	266.6	624.1	312.4	624.5	373.1	638.0	312.3	709.0	372.0	803.9	436.6

Sector	1967		1968		1969		1970		1971		1972		1973	
	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8	SR7	SR8
1. Ag. Livestock	82.8	46.4	81.0	40.1	97.4	51.5	99.7	53.7	110.9	58.9	134.1	71.2	176.9	98.0
2. Ag. Crops	105.0	76.0	112.8	64.0	141.2	76.0	139.8	84.2	146.6	85.9	202.4	122.6	319.0	208.4
3. Mining	4.1	8.3	4.3	8.4	4.5	8.2	4.4	8.2	4.7	8.6	5.2	8.7	29.6	77.7
4. Construction	19.9	9.9	21.7	9.3	27.5	12.0	26.3	13.0	27.9	15.1	34.5	15.3	46.9	25.2
5. Transportation	2.5	1.6	2.7	1.4	3.4	1.7	3.4	1.9	3.7	2.0	4.6	2.4	6.9	5.3
6. Comm. & Util.	18.7	10.7	20.2	9.9	25.4	12.3	26.0	13.7	28.6	13.7	35.4	16.9	51.5	34.7
7. Whls. & Ag. Proc.	73.7	35.1	76.0	35.8	102.2	48.5	99.6	49.0	109.0	52.9	128.1	63.5	164.7	87.3
8. Retail	156.8	89.2	170.6	81.5	213.1	101.0	218.9	113.3	239.0	113.9	297.1	143.5	421.5	248.2
9. Fin., Ins., R.E.	31.7	18.1	34.2	16.3	43.1	20.4	44.1	22.9	48.2	22.8	60.8	29.1	86.7	51.1
10. Bus. & Pers. Serv.	15.2	8.3	16.9	8.0	20.7	9.6	21.6	10.9	23.6	11.1	28.1	13.4	38.7	22.3
11. Prof. & Soc. Serv.	14.8	7.9	16.0	7.2	20.2	9.2	20.8	10.4	23.0	10.3	28.5	12.8	39.7	22.2
12. Households	224.4	118.5	242.5	108.6	307.5	138.8	316.9	157.5	350.2	154.7	434.2	192.2	602.8	333.9
13. Government	19.6	11.1	21.1	10.0	26.6	12.6	27.3	14.1	29.9	14.1	37.5	17.8	53.3	31.8
Total	769.4	442.0	819.9	400.4	1,032.7	501.8	1,048.7	552.9	1,145.3	564.0	1,430.5	709.5	2,038.2	1,246.2

Applying the unadjusted final demand vectors to the multipliers results in unadjusted gross business volumes or gross business volumes expressed in current dollars (prices). The gross business volumes for State Regions 7 and 8 expressed in current dollars (prices) are shown in Table I-4.

Personal Income

The accuracy of the input-output model has been tested by comparing personal income from the model and personal income reported by the Bureau of Economic Analysis, U.S. Department of Commerce. Personal income estimates by the input-output model are the household sector (sector 12) gross business volumes. Table I-5 compares personal income from the two sources for State Regions 7 and 8. The results of these comparisons indicate that personal income from the I-O estimates for State Region 7 have an average deviation of 5.5 percent while State Region 8 has an average deviation of 22.8 percent.

North Dakota Employment

Employment data are available from information published annually by the North Dakota Employment Security Bureau, Bismarck, North Dakota. The North Dakota labor force data were reorganized into a classification similar to the sectors of the input-output model (Table I-6).

Productivity Ratios

The ratio of gross business volume to employment is called the productivity ratio. This ratio indicates the gross business volume required in each sector to generate one more worker in that sector. Gross business volumes for all sectors in North Dakota for 1958 to 1973 were available, as were employment data for each sector during that time period. The productivity ratios for each sector for each year for North Dakota are presented in Table I-7. Sector 12 (household) has no productivity ratio because it is assumed to have no employment, although it has a gross business volume (personal income). Productivity ratios for North Dakota as a whole were used as they were assumed to more accurately represent trends occurring from development than those of a particular state region.

Projected Final Demand Vectors

Final demand vectors for the basic sectors were projected for the years 1980, 1985, 1990, 2000, and 2010. These projections were made on the basis of linear regression analysis and indicate baseline growth of the economy excluding abnormal injections to one or more of the basic sectors. The projections, calculated by linear regressions of final demand vectors (adjusted to 1972 base), can be applied to the input-output coefficients to project gross business volumes. The projected final demand vectors for all eight North Dakota state regions and North Dakota are presented in Table I-8 for the years 1980, 1985, 1990, 2000, and 2010. The regression equations used to project the final demand vectors are presented in Table I-9.

Table I-5. Comparison of Personal Income from Input-Output Model and from Bureau of Economic Analysis Data for State Regions 7 and 8, 1958-1973 (\$000)

Year	State Region 7			State Region 8		
	I/O	BEA	% Error	I/O	BEA	% Error
1973	602,800	516,820	+ 16.6	333,900	220,006	+ 51.8
1972	434,200	408,994	+ 6.2	192,200	151,017	+ 27.3
1971	350,200	346,460	+ 1.1	154,700	123,452	+ 25.3
1970	316,900	315,813	+ .3	157,500	116,017	+ 35.8
1969	307,500	298,470	+ 3.0	138,800	113,981	+ 21.8
1968	242,500	259,639	- 6.6	108,600	95,758	+ 13.4
1967	224,400	250,605	- 10.5	118,500	95,462	+ 24.1
1966	236,300	242,985	- 2.8	116,900	95,278	+ 22.7
1965	208,400	231,558	- 10.0	100,200	91,759	+ 9.2
1964	196,000	N/A	—	84,700	N/A	—
1963	184,000	N/A	—	100,000	N/A	—
1962	183,900	179,075	+ 2.7	84,000	83,807	+ .2
1961	134,200	N/A	—	71,300	N/A	—
1960	146,000	N/A	—	70,800	N/A	—
1959	134,500	135,849	- 1.0	70,500	59,413	+ 18.7
1958	149,900	N/A	—	83,300	N/A	—
Average Deviation			5.5			22.8

Table I-6. North Dakota Employment by Sector^a

Year	1&2 Ag	3 Mining	4 Const.	5 Trans.	6 Comm. & Util.	7 Whls. & Ag. Proc.	8 Retail	9 Fin., Ins., & R.E.	10 Bus. & Pers. Serv.	11 Prof. & Soc. Serv.	12 House- holds	13 Gov't.
1975	48,583	1,820	12,280	4,792	8,158	30,532	39,218	8,750	18,391	20,739	--	52,770
1974	52,670	1,660	12,130	4,792	8,158	28,915	38,045	8,150	17,446	19,674	--	51,790
1973	51,080	1,550	11,410	4,666	7,944	26,706	36,454	7,720	16,516	18,624	--	50,730
1972	51,580	1,570	11,920	4,547	7,743	24,236	34,394	7,440	15,543	17,527	--	50,180
1971	51,410	1,610	10,380	4,533	7,717	22,701	32,249	7,190	14,683	16,557	--	49,280
1970	51,920	1,610	9,790	4,514	7,686	22,199	31,601	7,040	13,886	15,664	--	49,240
1969	60,750	1,860	7,980	4,514	7,686	21,060	30,910	6,800	13,259	14,951	--	48,330
1968	63,500	1,790	8,020	4,510	7,680	20,784	30,456	6,740	13,155	14,835	--	47,270
1967	65,170	1,830	8,460	4,536	7,724	20,354	29,966	6,710	12,657	14,273	--	44,420
1966	70,660	1,930	9,010	4,503	7,667	20,539	30,031	6,450	11,999	13,531	--	42,080
1965	74,750	1,930	11,110	4,396	7,484	20,358	29,196	6,360	11,557	13,033	--	40,320
1964	78,000	1,740	11,100	4,407	7,503	19,414	28,476	6,230	11,473	12,937	--	38,740
1963	82,750	1,680	10,480	4,447	7,573	18,515	27,475	6,070	11,045	12,455	--	36,370
1962	87,670	1,770	11,260	4,481	7,629	17,145	26,165	5,940	10,533	11,877	--	33,920
1961	87,670	1,950	9,680	4,514	7,686	16,644	26,496	5,710	10,077	11,363	--	37,310
1960	91,750	1,850	9,930	4,718	8,032	16,983	26,957	2,580	9,753	10,997	--	31,500
1959	94,670	2,310	11,410	4,769	8,121	17,197	26,863	5,380	9,565	10,785	--	31,280
1958	99,670	2,410	10,330	4,695	7,995	16,843	26,057	5,070	8,930	10,070	--	30,260

^aBased on data provided by the Employment Security Bureau, Bismarck, North Dakota, disaggregated to compare to the 13 sector input-output model.

Table I-7. Gross Business Volume to Employment Ratios (Productivity Ratios) by Sector for North Dakota, 1958-1973 (in 1972 Dollars)

Sector	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
1&2	11,432	11,622	11,132	11,862	13,436	15,575	15,691	18,470	20,474	22,021	22,524	25,886	30,499	30,947	38,265	40,928
3	41,203	36,970	44,892	59,128	69,096	77,321	75,172	68,031	69,275	75,082	76,034	68,118	78,385	77,578	76,688	71,807
4	12,381	12,235	12,857	14,008	12,744	14,275	16,369	15,968	19,490	19,905	22,069	24,799	38,325	21,686	21,602	23,839
5	3,536	3,355	3,313	3,700	4,307	4,610	4,947	5,005	5,197	5,004	5,233	5,627	6,048	5,780	6,554	6,644
6	15,047	14,284	14,075	15,873	19,229	20,296	22,631	21,940	23,112	21,919	23,086	24,967	26,698	25,774	29,110	29,796
7	23,618	22,434	22,099	24,195	23,774	24,445	24,005	23,868	24,505	22,158	25,361	30,489	27,677	28,320	29,526	26,312
8	36,528	34,236	33,176	35,088	43,279	43,520	45,400	44,116	46,675	44,974	46,562	50,417	52,511	49,982	53,893	54,118
9	39,172	35,613	34,628	34,168	40,152	41,318	43,772	42,091	44,884	40,984	42,641	46,515	47,742	45,341	50,874	52,215
10	9,664	8,772	8,353	8,316	9,608	9,715	10,163	10,279	11,018	10,280	10,650	11,464	11,494	10,706	11,220	11,262
11	8,987	8,150	7,918	8,079	9,506	9,426	10,273	9,622	10,066	9,010	9,107	9,845	10,055	9,265	9,973	9,912
12	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
13	11,042	3,782	3,651	3,767	4,363	4,267	4,401	4,112	4,209	3,838	3,772	4,035	4,210	4,093	4,629	4,849

Table I-8. Projected Final Demand Vectors by State Planning Region and North Dakota, 1980, 1990, 2000, 2010 (Million Dollars) (1972 Prices)

Final Demand Vector	State Planning Region								State
	1	2	3	4	5	6	7	8	
<u>1980</u>									
1	20.2	34.6	19.2	13.2	55.7	77.9	96.4	50.9	368.1
2	74.7	183.1	132.3	163.7	169.3	197.3	169.5	106.7	1,196.6
3	60.3	32.8	--	--	--	--	2.0	10.2	105.3
4	1.8	3.8	3.4	83.1	13.0	2.9	3.4	2.2	113.6
7	7.0	33.2	7.6	46.1	63.2	17.7	34.7	14.9	224.4
8	7.8	21.8	12.1	19.4	25.9	20.1	23.9	10.3	141.3
10	2.6	7.3	4.1	6.5	8.7	6.8	8.1	3.4	47.5
12	31.3	181.4	79.8	176.8	154.6	79.6	147.6	34.6	885.7
<u>1985</u>									
1	21.8	36.6	19.2	12.6	56.4	82.4	107.0	55.7	391.7
2	87.2	212.6	149.7	184.6	196.4	228.7	200.2	124.4	1,383.8
3	60.8	32.6	--	--	--	--	1.7	11.3	106.4
4	1.9	3.5	3.3	103.7	14.3	2.3	2.3	2.2	133.5
7	8.0	38.9	8.6	55.0	73.2	20.0	40.0	17.6	261.3
8	9.5	26.4	14.7	23.5	31.4	24.4	29.0	12.5	171.4
10	3.2	8.7	5.0	7.8	10.4	8.1	9.7	4.1	57.0
12	36.5	209.3	95.5	200.8	169.6	93.2	174.1	40.6	1,019.6
<u>1990</u>									
1	23.3	38.5	19.1	11.9	57.1	87.0	117.6	60.6	415.2
2	99.8	242.2	167.1	205.5	223.4	260.1	230.9	142.2	1,571.2
3	61.3	32.3	--	--	--	--	1.3	12.5	107.4
4	1.9	3.2	3.1	124.3	15.7	1.6	1.2	2.1	153.1
7	9.0	44.6	9.7	63.9	83.3	22.3	45.4	20.4	298.6
8	11.1	31.0	17.2	27.6	36.9	28.6	34.1	14.7	201.2
10	3.7	10.1	5.8	9.1	12.1	9.5	11.3	4.8	66.4
12	41.7	237.3	111.3	224.8	184.6	106.9	200.6	46.7	1,153.9
<u>2000</u>									
1	26.5	42.4	19.2	10.6	58.4	96.0	138.8	70.3	462.2
2	125.0	301.3	201.9	247.3	277.5	323.0	292.4	177.7	1,946.1
3	62.2	31.9	--	--	--	--	0.7	14.7	109.5
4	2.0	2.7	2.9	165.4	18.4	0.4	--	2.1	193.9
7	11.0	56.0	11.7	81.7	103.3	26.9	56.1	25.9	372.6
8	14.5	40.2	22.4	35.8	47.9	37.1	44.2	19.1	261.2
10	4.8	13.0	7.4	11.7	15.6	12.2	14.5	6.2	85.4
12	52.1	293.1	142.8	272.9	214.5	134.2	253.6	58.7	1,421.9
<u>2010</u>									
1	29.6	46.3	19.1	9.3	59.7	105.0	160.0	80.0	509.0
2	150.1	360.3	236.8	289.0	331.6	385.8	353.8	213.1	2,320.5
3	63.2	31.5	--	--	--	--	0.1	16.9	111.7
4	2.0	2.2	2.6	206.6	21.1	--	--	2.0	236.5
7	13.1	67.5	13.8	99.5	123.3	31.4	66.9	31.4	446.9
8	17.8	49.5	27.5	44.0	58.8	45.6	54.4	23.4	321.0
10	5.8	15.9	9.1	14.3	19.1	14.9	17.8	7.6	104.5
12	62.5	348.9	174.3	320.9	244.5	161.5	306.6	70.8	1,690.0

Table I-9. Regression Equations for Projecting Final Demand Vectors for 13 Sector I-O Model for State Regions and State (1972 Prices).

Sector No.	Name	Equation	r ²
<u>Region 1</u>			
1	Ag. Livestock	$Y = -602.93 + .347 (x)$	.606
2	Ag. Crops	$Y = -4906.20 + 2.51559 (x)$	.723
3	Mining	$Y = -128.35 + .09529 (x)$	.006
4	Construction	$Y = -10.99 + .00647 (x)$	.003
7	Wholesale & Ag. Proc.	$Y = -397.48 + .20426 (x)$	.700
8	Retail	$Y = -649.37 + .33191 (x)$	.903
10	Bus. & Pers. Service	$Y = -209.04 + .10691 (x)$	.870
12	Households	$Y = -2028.23 + 1.04015 (x)$	.886
<u>Region 2</u>			
1	Ag. Livestock	$Y = -738.17 + .39029 (x)$	.369
2	Ag. Crops	$Y = -11,512 + 5.90691 (x)$	.689
3	Mining	$Y = 120.14 - .04412 (x)$	.0004
4	Construction	$Y = 105.97 - .051618 (x)$	.049
7	Wholesale & Ag. Proc.	$Y = -2232.78 + 1.14441 (x)$	.871
8	Retail	$Y = -1807.40 + .92382 (x)$	.902
10	Bus. & Pers. Service	$Y = -562.28 + .28765 (x)$	.877
12	Households	$Y = -10,876.02 + 5.58456 (x)$	.514
<u>Region 3</u>			
1	Ag. Livestock	$Y = 27.393 - .00412 (x)$	.0001
2	Ag. Crops	$Y = -6763.64 + 3.48279 (x)$	.703
3	Mining		
4	Construction	$Y = 53.18 - .02515 (x)$	.008
7	Wholesale & Ag. Proc.	$Y = -405.62 + .20868 (x)$	.638
8	Retail	$Y = -1005.28 + .51382 (x)$	.896
10	Bus. & Pers. Service	$Y = -324.32 + .16588 (x)$	.858
12	Households	$Y = -6157.78 + 3.15029 (x)$	.821
<u>Region 4</u>			
1	Ag. Livestock	$Y = 267.67 - .12852 (x)$	.073
2	Ag. Crops	$Y = -8108.31 + 4.17779 (x)$	.567
3	Mining		
4	Construction	$Y = -8065.75 + 4.11559 (x)$	.218
7	Wholesale & Ag. Proc.	$Y = -3478.02 + 1.77985 (x)$	.920
8	Retail	$Y = -1605.07 + .82044 (x)$	.893
10	Bus. & Pers. Service	$Y = -505.08 + .25838 (x)$	.875
12	Households	$Y = -9337.42 + 4.80515 (x)$	.424

- continued -

Table I-9. Regression Equations for Projecting Final Demand Vectors for 13 Sector I-O Model for State Regions and State (1972 Prices) (Continued).

Sector No.	Name	Equation	r ²
<u>Region 5</u>			
1	Ag. Livestock	$Y = -206.04 + .13221 (x)$	.011
2	Ag. Crops	$Y = -10,540.45 + 5.40897 (x)$	.717
3	Mining	$Y = 34.45 - .01750 (x)$	.475
4	Construction	$Y = -523.39 + .27088 (x)$	.272
7	Wholesale & Ag. Proc.	$Y = -3901.72 + 2.0025 (x)$	.796
8	Retail	$Y = -2148.32 + 1.09809 (x)$	.900
10	Bus. & Pers. Service	$Y = -677.34 + .34647 (x)$	.882
12	Households	$Y = -5776.96 + 2.99574 (x)$	.328
<u>Region 6</u>			
1	Ag. Livestock	$Y = -1709.59 + .90279 (x)$	.395
2	Ag. Crops	$Y = -12,247.60 + 6.28529 (x)$	.768
3	Mining		
4	Construction	$Y = 254.77 - .12721 (x)$	.089
7	Wholesale & Ag. Proc.	$Y = -888.15 + .45750 (x)$	.561
8	Retail	$Y = -1,664.06 + .85059 (x)$	.900
10	Bus. & Pers. Service	$Y = -527.23 + .26971 (x)$	.882
12	Households	$Y = -5322.89 + 2.72853 (x)$	.941
<u>Region 7</u>			
1	Ag. Livestock	$Y = -4101.74 + 2.12029 (x)$	.827
2	Ag. Crops	$Y = -11,998.50 + 6.14544 (x)$	.756
3	Mining	$Y = 127.47 - .06338 (x)$	.849
4	Construction	$Y = 438.46 - .21971 (x)$	.313
7	Wholesale & Ag. Proc.	$Y = -2090.05 + 1.07309 (x)$	.779
8	Retail	$Y = -198696 + 1.01559 (x)$	.902
10	Bus. & Pers. Service	$Y = -633.40 + .32397 (x)$	.883
12	Households	$Y = -10,346.38 + 5.30 (x)$	.916
<u>Region 8</u>			
1	Ag. Livestock	$Y = -1872.37 + .971324 (x)$	.689
2	Ag. Crops	$Y = -6919.98 + 3.54882 (x)$	.643
3	Mining	$Y = -432.06 + .22338 (x)$	.359
4	Construction	$Y = 10.31 - .00412 (x)$	.006
7	Wholesale & Ag. Proc.	$Y = -1077.04 + .55147 (x)$	.841
8	Retail	$Y = -856.52 + .43779 (x)$	.904
10	Bus. & Pers. Service	$Y = -269.38 + .13779 (x)$	.880
12	Households	$Y = -2354.22 + 1.20647 (x)$	.763

- continued -

Table I-9. Regression Equations for Projecting Final Demand Vectors for 13 Sector I-O Model for State Regions and State (1972 Prices) (Continued)

Sector No.	Name	Equation	r ²
<u>State</u>			
1	Ag. Livestock	Y = -8664.78 + 4.56132 (x)	.447
2	Ag. Crops	Y = -72,997.23 + 37.47162 (x)	.764
3	Mining	Y = -1,583.81 + .85897 (x)	.094
4	Construction	Y = -7737.45 + 3.96515 (x)	.189
7	Wholesale & Ag. Proc.	Y = -14,514.40 + 7.44382 (x)	.831
8	Retail	Y = -11,769.92 + 6.01588 (x)	.900
10	Bus. & Pers. Service	Y = -3708.07 + 1.89676 (x)	.879
12	Households	Y = -52,199.89 + 26.810882 (x)	.791

Year Key: (x) = Use the year for which the final demand vector is to be projected.

Productivity Ratio Projections

The productivity ratios are also projected for the years 1980, 1985, 1990, 2000, and 2010. Linear regression analysis was applied to the productivity ratios by sector for North Dakota (Table I-7) to obtain projections. The results of these projections are presented in Table I-10 and the regression equations used as the basis for these projections in Table I-11. These productivity ratios are in 1972 dollars (prices) as the ratios for North Dakota for 1958 to 1973 were in constant dollars.

THE COHORT-SURVIVAL DEMOGRAPHIC MODULE

The demographic component of the REAP Economic-Demographic Model consists of a Cohort-Survival Population Projection Module. The rationale underlying this technique is that, given the number of persons of each age and sex (referred to as cohorts) at a given place and point in time and given the rates at which persons in each of these cohorts may be expected to die (or conversely, survive) and move (migrate in or out) during a given period of time, one can determine the number in that cohort at a given point in the future. Given, in addition, the rate at which new persons will be added to the population by birth, the total population of an area can be found for any future period by adding the number of persons born during the period to the sum of all cohorts at the end of the period. Thus the procedure employs the logic of the basic population equation:

$$P_2 = P_1 + B - D + M$$

Where: P_2 = Population at a given future time

P_1 = Population at a preceding base period

B = Births between P_1 and P_2

D = Deaths between P_1 and P_2

M = Migration between P_1 and P_2

The computations are made for each cohort and total population is obtained by summing cohort values. Thus for each cohort the procedure is as follows:

1. The number of persons remaining in each age-sex cohort at a given time in the future is determined by applying a projected series of age-sex specific migration and death rates to the number in that age-sex cohort in the preceding period.
2. The number of births occurring during the projection period is determined by applying a projected series of age specific fertility rates to the number of women in the childbearing age groups (15-49 years of age).
3. Population under each series of assumptions is then aggregated across appropriate age-sex groups to obtain a series of projected populations for each areal unit.

In the model, **1970 Census of Population** data by age and sex were employed to determine cohorts. Rates for the process of migration¹ (for those older than 65), mortality², and fertility³ were based on historic data. In projecting future patterns, migration rates for persons less than 65 years old were determined through the interface procedure described below, death rates were assumed to follow

¹Age-sex specific migration rates for North Dakota counties for 1960-1970 were taken from **Net Migration of the Population, 1960-70 by Age, Sex and Color** by Gladys Bowles, Calvin L. Beale, and Everett S. Lee, Economic Research Service, USDA: Institute for Behavioral Research Applied to National Needs, Athens, Georgia; University of Georgia Printing Department, 1975.

²For mortality, survival rates were computed from life tables from **North Dakota Abridged Life Tables, 1960-70**, by Richard Ludtke and Richard Blair, Division of Health Statistics, North Dakota State Department of Health, 1974.

³Age-specific fertility rates were computed from births by age of mother for 1972, 1973, and 1974. These data were obtained from the Division of Health Statistics, North Dakota State Department of Health.

Table I-10. Projected Gross Business Volume to Employment Ratios (Productivity Ratios) for North Dakota, 1972 Dollars

Sector	1975	1980	1985	1990	2000	2010
1 & 2	39,704	49,391	59,078	68,765	88,139	107,513
3	86,438	96,538	106,636	116,735	136,933	157,131
4	29,170	34,508	39,845	45,183	55,858	66,533
5	7,011	8,104	9,198	10,291	12,478	14,665
6	31,409	36,494	41,579	46,664	56,834	67,004
7	29,074	31,125	33,176	35,227	39,329	43,431
8	57,639	64,475	71,311	78,147	91,819	105,491
9	52,241	57,339	62,437	67,535	77,731	87,927
10	12,001	12,963	13,924	14,886	16,809	18,732
11	10,283	10,793	11,302	11,812	12,831	13,850
12	-	-	-	-	-	-
13	4,488	4,676	4,865	5,053	5,430	5,807

Table I-11. Regression Equations for Calculating Gross Business Volume to Employment Ratios (Productivity Ratios) for North Dakota, 1972 Dollars

Sector No.	Name	Equation	r ²
1 & 2	Agriculture	$Y = 4.8303 + 1.9374 (x)$	.917
3	Mining	$Y = 50.0813 + 2.0198 (x)$	.569
4	Construction	$Y = 9.9551 + 1.0675 (x)$	.583
5	Transportation	$Y = 3.0743 + .2187 (x)$	.950
6	Comm. & Util.	$Y = 13.1029 + 1.0170 (x)$	.939
7	Whls. & Ag Proc.	$Y = 21.6899 + .4102 (x)$	.572
8	Retail	$Y = 33.0296 + 1.3672 (x)$	.893
9	Fin., Ins., & R. E.	$Y = 33.8877 + 1.0196 (x)$	.797
10	Bus. & Pers. Serv.	$Y = 8.5404 + .1923 (x)$	.737
11	Prof & Soc. Serv.	$Y = 8.4488 + .1019 (x)$	.402
13	Government	$Y = 3.8089 + .0377 (x)$	.293

Where y = Productivity ratio
 x = year

Year Key: 1975 (18), 1980 (23), 1985 (28), 1990 (33), 2000 (43), 2010 (53).

the rates for 1960 to 1970, and fertility rates were assumed to follow trends that would result in an average of 2.1 births per adult female. This fertility level is one which would result in a replacement level of births and is reflective of current levels of fertility in North Dakota.

The number of available workers is obtained from the cohort-survival model by application of labor force participation rates to each age-sex cohort. The participation rates employed in the model are the maximum values that are likely to exist and were based on historic rates for urbanized counties in North Dakota.

INTERFACE OF THE ECONOMIC AND DEMOGRAPHIC MODULES

The interface component of the REAP Economic-Demographic Model 1 (RED-1) consists of procedures for integrating the economic and demographic modules through their respective required and available employment functions. The procedures for effecting this integration for any given period of time and level of employment are as follows:

1. The required employment levels (as determined by the input-output model) and the available workers (as determined by the cohort-survival model) are compared to determine whether the indigenous population can provide the necessary labor force or whether in-migration will be necessary. The difference between available workers (from the cohort-survival model) and required workers (from the input-output model) is defined in this model as the "unallocated labor pool." The upper and lower limits for the unallocated labor pool can be specified by the user. If the user does not specify otherwise, the limits will be 13 percent and 5 percent. If the difference between available work force and required employment reaches 13 percent, out-migration will occur at a rate that will keep the unallocated labor pool at its upper limit of 13 percent. Conversely, if the difference between available work force and required employment reaches 5 percent of the available work force, in-migration will occur to keep the rate at 5 percent.
2. The characteristics (marital status, age of spouse, number of children, age of children, and labor force participation rates of dependents) of in-migrating and out-migrating workers were assumed to be similar to those indicated by available data for such workers. Data have been collected for in-migrating construction and operating workers through surveys conducted at North Dakota coal mines and power plants (Table I-12). Census data profiles

of previous out-migrants provide the basis for estimating characteristics of future out-migrants from the area.

3. The in-migrating workers and their dependents are allocated to the respective municipalities in the proportions determined by the gravity model (described in the next section).

THE GRAVITY MODULE

The gravity allocation component of the model is used to determine the probable location patterns of in-migrating populations. These allocations are made at the municipal level and depend upon the basic assumptions of the gravity model.⁴ These assumptions are that in-migrants will tend to settle in centers in direct proportion to the population of those centers, but that the number of in-migrants moving to a city will be inversely related to the distance between that city and the employment site. Finally the model assumes that qualitative differences between possible settlement locations will affect settlement choices. In symbolic form these assumptions may be stated as follows for each work site:

$$M_i = \frac{\left[\frac{P_i}{D_i^a} \right] W_i}{\sum_{i=1}^n \left[\frac{P_i}{D_i^a} W_i \right]}$$

- Where: M_i = Fraction of total in-migrants locating in city i
 P_i = Population of city i
 D_i = Distance between city i and the work site, raised to the power a
 W_i = The relative qualitative attractiveness of city i

⁴For a review of the historical development of the gravity concept see:

Carrothers, Gerald P., "An Historical Review of the Gravity and Potential Concepts of Human Interaction," *Journal of the American Institute of Planners*, Vol. 22, Spring, 1956, pp. 94-102.

Isard, Walter, et al., *Ecologic-Economic Analysis for Regional Development*, The Free Press, New York, 1972.

Richardson, Harry W., *Elements of Regional Economics*, Penguin Modern Economic Texts, Baltimore, Maryland, 1969.

Table I-12. Demographic Characteristics of In-migrating Construction, Operation, and Indirect Work Forces.

Characteristic	Work Force		
	Construction ^a	Operation ^b	Indirect ^c
Sex ^d	94% Male, 6% Female	87% Male, 13% Female	57% Male, 43% Female
Per 100 Workers:			
Unmarried	24.6	20	20
Married, Family Absent	26.5	0	0
Married, Family Present (number of spouses)	48.9	80	80
Immigrating Children	78.9	170	170
Total Persons (including workers)	227.8	350	350
Total Workers ^e	121.5	130.2	130.2
Age Distribution of Workers: ^f	(percent)	(percent)	(percent)
14-24	24.0	19.6	19.6
25-34	40.6	52.6	52.6
35-44	15.9	16.7	16.7
45-64	18.9	10.1	10.1
65+	0.8	1.0	1.0
Age Distribution of Children:	(percent)	(percent)	(percent)
Under 5	35.4	39.2	39.2
5-11	36.1	34.8	34.8
12-14	11.4	13.3	13.3
15-17	10.8	9.5	9.5
18-19	3.8	2.5	2.5
20-24	1.9	0.7	0.7
25+	0.6	0.0	0.0

^aSOURCE: Mountain West Research, Inc., Construction Worker Profile, a study for the Old West Regional Commission, December, 1975.

^bSOURCE: Leholm, Arlen G., F. Larry Leistritz, and James S. Wieland, Profile of North Dakota's Coal Mine and Electric Power Plant Operating Work Force, Agricultural Economics Report Number 100, North Dakota Agricultural Experiment Station, Fargo, 1975.

^cIndirect work force characteristics were assumed to be identical to those of the operating work force, except for sex distribution.

^dSex distribution was estimated on the basis of the distribution of workers by sex for the service industries from 1970 census data. Sex distribution of children was assumed to be 50% male, 50% female.

^eIndicates that there is more than one worker in some families.

^fSpouses of workers were assumed to have the same age distribution as the workers.

The user may specify values of the power (a) to which the distance is raised and the value of the community attractiveness index (W) for any city. Separate gravity model allocations are made for each type of worker. Unless the user specifies otherwise, the gravity powers are 1.5 for construction workers, 2.9 for operating workers, and 1.6 for project related indirect workers. This results in a smaller proportion of construction workers being allocated to municipalities near the plant site than is the case for operating workers. A slightly greater proportion of indirect workers is allocated to nearby cities than are construction workers. Previously collected data on commuting patterns of workers were used as the basis for the gravity process (Leholm and Mountain West Research, Inc.).

The community attractiveness index (W) allows the user to give weights to particular cities if he believes they will attract fewer or more people than that determined by their population and distance from the employment site. Values of 1.0 (meaning no weights are assigned) are assumed for all cities unless otherwise specified by the user. User choice of a number larger than 1.0 will result in more in-migrants being assigned to that city, while choice of a value less than one will reduce that city's share.

For example, if the coefficients $\frac{P}{D^a}$ (W) for each of six cities using a w equal to 1 were determined to be:

- city 1 = 10
- city 2 = 9
- city 3 = 6
- city 4 = 15
- city 5 = 30
- city 6 = 20

Then the summation of the coefficients $[\frac{P}{D^a} (W)]$ would equal 90, and the fraction of total in-migrants locating in each city could be estimated by dividing the coefficient for each city by the sum of all coefficients:

	$\frac{P}{D^a}$	$\frac{M}{(Previous M)}$
city 1	10	0.11
city 2	9	0.10
city 3	6	0.07
city 4	15	0.17
city 5	30	0.33
city 6	20	0.22
sum	90	1.00

If, however, the user believes that city 5 will attract more people than that determined by its population and distance from the work site, he may assign w a value of, for example, 2 and the new M becomes:

	$\frac{P}{D^a}$	W	Coefficient	M	(Previous M)
city 1	10	x 1 =	10	0.08	0.11
city 2	9	x 1 =	9	0.07	0.10
city 3	6	x 1 =	6	0.05	0.07
city 4	15	x 1 =	15	0.13	0.17
city 5	30	x 2 =	60	0.50	0.33
city 6	20	x 1 =	20	0.17	0.22
sum	90		120	1.00	1.00

The counties and cities presently included in the model are indicated in Table I-13. Distances between cities and work sites are computed using the latitude and longitude of each city.

THE FISCAL IMPACT MODULE

The final component of the REAP Economic-Demographic Model-1 is the fiscal impact component. This module, utilizing the expected settlement patterns from the gravity module and subsequent population changes determined for each area by the economic and demographic modules, determines the expected public costs and revenues associated with such changes. The module provides for the estimation of both total state and local costs and revenues.

In each case the model works through a three-step procedure which involves:

1. Computation of expected increased public revenues.
2. Computation of expected increased public costs.
3. Computation of net difference between increased costs and revenues referred to as the net fiscal balance.

At the state level the revenue sources included are:

1. The sales and use tax.
2. Personal income tax.
3. Corporate income tax.
4. State share of coal severance tax.
5. State share of coal conversion tax.
6. Business and corporate privilege tax.
7. Motor vehicle tax.
8. Liquor and tobacco tax.

At the local level, revenue sources included in the model are:

1. Ad valorem property taxes.
2. User fees.
3. Special assessments.
4. Transfer payments, including school foundation program payments, federal revenue sharing payments, highway fund payments, and cigarette and tobacco tax payments.
5. Local share of coal severance tax.
6. Local share of coal conversion tax.

Table I-13. County and City Identification—Reap E-D Model 1.

County	1970 ^a Population	City	1970 ^a Population
Adams	3,832	Reeder	306
		Bucyrus	42
		Hettinger	1,655
		Haynes	53
Billings	1,198	Medora	129
Bowman	3,901	Rhame	206
		Bowman	1,762
		Scranton	360
		Gascoyne	34
Burleigh	40,714	Regan	74
		Wing	223
		Bismarck/Mandan	45,796
Dunn	4,895	Killdeer	615
		Dunn Center	107
		Halliday	413
		Dodge	121
Golden Valley	2,611	Sentinel Butte	125
		Beach	1,408
		Golva	104
Grant	5,009	New Leipzig	354
		Elgin	839
		Lieth	92
		Carson	466
Hettinger	5,075	New England	906
		Regent	344
		Mott	1,368
McLean	11,251	Garrison	1,614
		Max	301
		Ruso	15
		Butte	193
		Turtle Lake	712
		Mercer	132
		Underwood	781
		Washburn	804
		Wilton	695
		Falkirk	45 (est.)
Mercer	6,175	Golden Valley	235
		Zap	271
		Beulah	1,344
		Pick City	119
		Hazen	1,240
		Stanton	517
Morton	20,310	Hebron	1,103
		Glen Ullin	1,070
		New Salem	943
		Almont	109
		Flasher	467
Oliver	2,322	Center	619
Sioux	3,632	Solen	180
		Selfridge	346
		Fort Yates	1,153
Slope	1,484	Marmarth	247
		Amidon	54
Stark	19,613	Belfield	1,130
		Dickinson	12,405
		Gladstone	222
		Taylor	162
		Richardton	799

^aSOURCE: U.S. Census of Population, 1970.

At the state level the costs included are:

1. Per capita costs of general government functions.
2. Highway maintenance costs.
3. Highway construction costs.
4. School foundation program payments.

At the local level the costs included are:

1. School construction and operating costs.
2. Street construction and operating costs.
3. Water and sewer system construction costs.
4. Law enforcement operating costs.
5. Fire protection costs.
6. Social service costs.
7. Local general government costs.

The interrelationships that are involved in calculation of project-related revenues are shown in Figure I-3 and those involved for project-related costs are shown in Figure I-4. Changes in state sales and use tax revenues are estimated on the basis of historic relationships between sales tax collections and the gross receipts of the retail trade sector. Changes in state personal income tax collections are estimated on the basis of the historic relationship between personal income tax collections and total personal income. The same procedure is followed in estimating increased corporate income tax and business and corporate privilege tax collections except that collections are based on total gross business volume of all business sectors. Increases in collections of the various highway taxes and liquor and tobacco taxes are estimated on a per capita basis.

Severance tax collections are based on a per ton rate for all coal mined in North Dakota with receipts allocated according to the prevailing statutory formula. The coal conversion tax applies to coal-fired electric generating plants, coal gasification plants, and other coal conversion facilities. The conversion taxes are in lieu of all ad valorem taxes except those on the land occupied by the plants (North Dakota Century Code, 1975, pp. 1,476-1,481) and receipts from this tax are divided between the state general fund and the county in which the facility is located. The county's portion is further subdivided between the county general fund, school districts, and municipalities.

The estimate of added property tax revenue is obtained by applying the prevailing statewide average property tax rate to the estimated taxable value of additional business structures and residences resulting from the industrial development and associated population growth. The estimated average investment cost for houses, apartments, and business structures is used as the basis for estimating taxable value for those structures and the taxable value for mobile homes is estimated using one-half the purchase price.

State school foundation program payments associated with increased enrollments are based on payments per pupil. Federal revenue sharing payments are estimated on a per capita basis. Increased user fees are estimated on the basis of present rates per household, while special assessment revenues are based on amortized capital investments for streets, water and sewer, and solid waste disposal.

The model also accounts for reductions in tax revenue resulting from decreased agricultural production. The potential reduction in agricultural production is estimated on the basis of the acreage to be used for the plant site; the acreage to be mined; and the acreage expected to be used for residential, transportation, and related uses. The reduction in acreage is translated into a reduction in sales to final demand by the agricultural sectors. Hence, the estimated changes in employment, income, and state and local tax revenues are **net** changes (i.e., increases resulting from industrial expansion less decreases resulting from reduced agricultural production).

Estimates of capital costs for new facilities are based primarily on recent engineering data, while operation and maintenance cost estimates are based primarily on cross-sectional regression analysis of county and city budget data from counties and cities in western North Dakota. The counties and cities sampled covered the range of potential populations of the communities likely to be affected by the new industrial developments.

All cost and revenue components are computed on the basis of the most current data available and adjusted to the 1975 price level to permit comparison of net fiscal balances for the years in which costs and revenues are realized. Then, those components that are subject to price level changes are inflated at an assumed rate of 7 percent (which could be changed if desired) per year through the life of the development. Increased costs are subtracted from increased revenues to obtain an estimate of the net fiscal balance by year for the state and local units of government.

DATA BASE

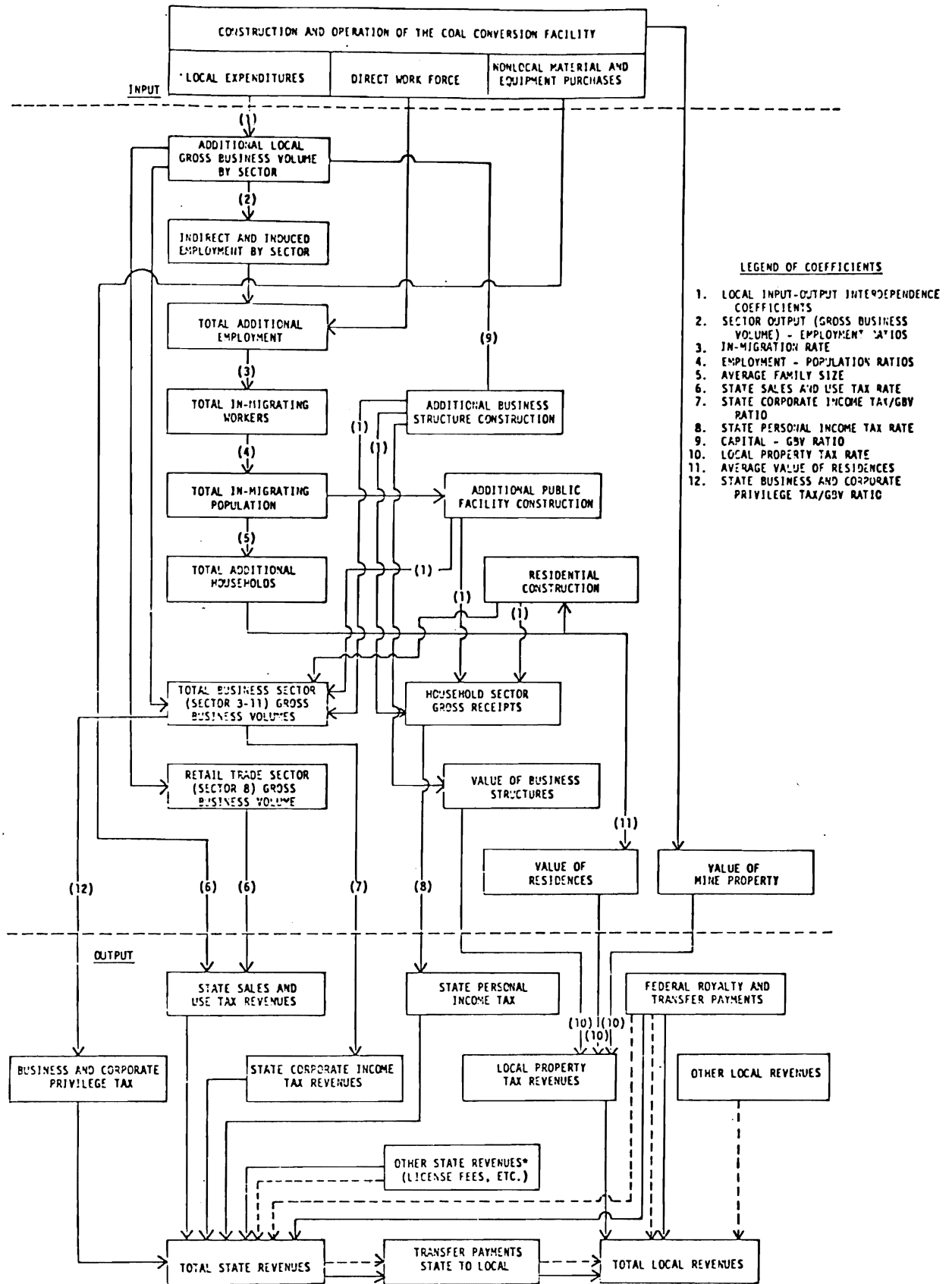
Revenue Estimation

State

1. State Sales Tax:

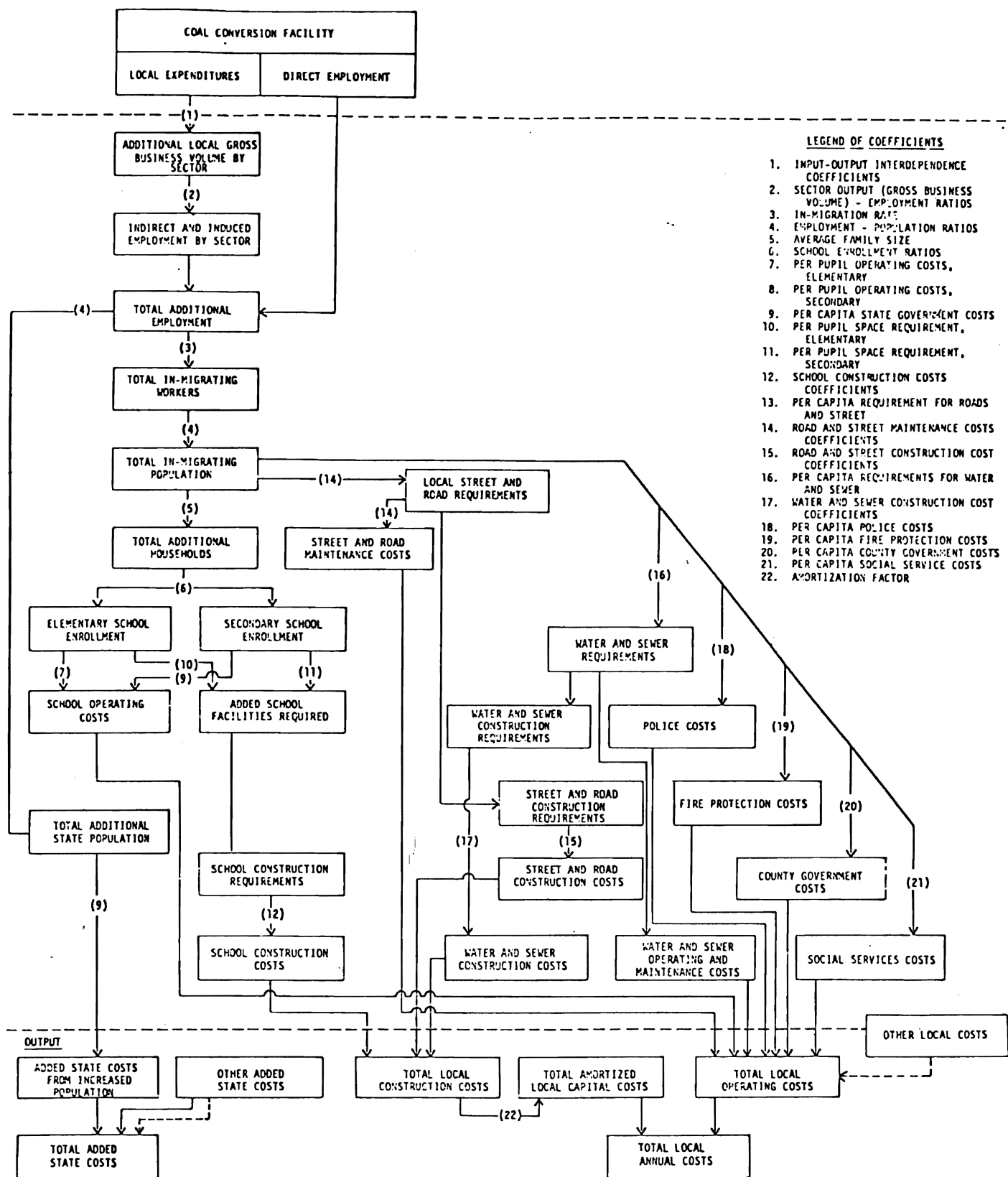
Revenue is estimated by applying a 3.00 percent (or an estimator selected by the user) sales and use tax estimator to the increased gross business volume of the retail trade sector.

A 3.96 percent estimator was originally derived by comparing the ratio of actual taxable sales to the projected gross business volumes for the years 1970 to 1973. The actual taxable sales for years 1970 to 1973 (\$6,618,560,367) divided by the projected gross business volumes for these years (\$678,323,000) equals 0.99. Therefore, to estimate sales and use tax



*INCLUDES COAL SEVERANCE TAX AND TAXATION OF CONVERSION FACILITIES.
 DASHED LINES (---) REPRESENT REVENUE FLOWS NOT ESTIMATED BUT INCLUDED FOR CONCEPTUAL COMPLETENESS.

Figure I-3. Flow Chart of Revenue Estimation for a Coal Conversion Facility, North Dakota.



DASHED LINES (---) REPRESENT COST FLOWS NOT ESTIMATED BUT INCLUDED FOR CONCEPTUAL COMPLETENESS.

Figure I-4. Flow Chart of Cost Estimation for a Coal Conversion Facility, North Dakota.

collections from gross business volume, the former sales tax rate (4 percent) was reduced to 99 percent of that rate or 3.96 percent.

However, later, more detailed analysis (regression analysis) based on 18 years of data indicated the estimated sales and use tax marginal rate to be 4.413 percent of the gross business volume of the retail trade sector. In addition, the approval of an initiated measure in an election on November 2, 1976, reduced sales and use and motor vehicle excise tax to 3 percent; sales and use tax on farm machinery and irrigation equipment to 3 percent; and eliminated sales and use tax on electricity—all effective January 1, 1977. Conversations with C. William Cudworth, Research Analyst, State Tax Department, have indicated that the effect of this change in the tax structure will be to reduce sales and use tax collections by about 32 percent in fiscal years 1977-78, 1978-79, and in the fourth quarter of fiscal year 1976-77. Reduction of the 4.413 percent marginal rate by 32 percent $[(4.413) \cdot (0.68)]$ yields a rate of 3 percent.

2. State Personal Income Tax:

The personal income tax estimator is 1.18 percent of total personal income.

This was derived by dividing the total personal income tax collections for 1973 and 1974 (\$73,676,925) by estimated total personal income for those years (\$6,255,800,000).

3. State Corporate Income Tax:

The corporate income tax estimator is 0.112 percent of the gross business volume of all business sectors. This was derived by comparing corporate income tax collections for the years 1963 to 1973 to the estimated gross business volume of all business sectors for those years.

4. State Business and Corporate Privilege Tax:

The business and corporate privilege tax estimator was 0.077 percent of the gross business volume of all business sectors. This was derived by comparing business and corporate privilege tax collections for 1972 and 1973 to the estimated gross business volumes for those years.

5. Other State Collected Taxes:

The various highway taxes, the liquor and beer tax, and the cigarette and tobacco tax were estimated on a per capita basis from data obtained from the State Treasurer's Office and the State Tax Department. Highway taxes were defined for this purpose to include revenues from the motor vehicle excise and use tax, motor vehicle fuel and special fuel tax, and the motor vehicle registration tax. The estimates per capita in 1975 prices were:

Highway taxes	\$100.67
Cigarette and tobacco tax	13.18
Liquor and beer tax	9.51

6. Coal Conversion Tax:

Conversion tax revenues were computed on the basis of 0.25 mills per kilowatt hour produced for

sale by electric generating plants and \$0.10 per thousand cubic feet of gas produced by gasification plants.

Revenues from this tax are divided between the state general fund and the county in which the facility is located according to the following formula:

Annual Revenues	County	State
First \$100,000	100%	0%
Second \$100,000	50%	50%
\$200,000 to \$500,000	25%	75%
\$500,000 to \$1,000,000	15%	85%
Over \$1,000,000	10%	90%

7. Coal Severance Tax:

Revenues from severance taxes were based on an initial rate of \$0.52 per ton of coal mined as of July 1975, and adjusted for inflation annually. Statutory formula provides that 30 percent of these receipts are allocated to the state general fund, 30 percent to a special state trust fund, 35 percent to a fund for distribution to impacted political subdivisions, and 5 percent to the county in which the coal is mined. However, only the county's share of receipts was disaggregated from the total state receipts.

8. County Equalization Payments to the State:

Local

1. Ad Valorem Property Tax:

The local property tax estimator was 1.48 percent of the market value of the property. This estimator was based on the 1973 state average sales assessment ratio of 17.4 percent and the state average mill rate of 170. Added property tax revenue was estimated by applying the estimator to the taxable value of additional business structures and residences.

The estimated investment cost for houses, apartments, and business structures was used as estimated taxable value for those structures and the taxable value for mobile homes was estimated at one-half the purchase price. The estimated average investment costs for residences were based on a survey of mobile home dealers and on information obtained from the Fargo-Moorhead Home Builders Association. Capital investment in business structures was estimated by Prestgard at \$0.22 per dollar of gross business volume.

The estimates of investment cost per unit in 1975 prices were:

Houses	\$35,500
Apartments	15,700
Mobile Homes	9,100

Housing type preferences were estimated for the four types of workers as follows:⁵

⁵Based on data from "Construction Worker Profile," a study done for the Old West Regional Commission by Mountain West Research, Inc., and on construction and operation worker surveys completed by the Department of Agricultural Economics, North Dakota State University, Fargo.

Percent by Type of Worker

Type Housing	Construction	Operation	Indirect	Baseline
House	15	60	61	82
Apartment	10	20	12	4
Mobile Home	60	15	25	13
Other*	15	5	2	1
Total	100	100	100	100

*Includes such housing as campers, sleeping rooms, and motel rooms.

On the basis of data from the North Dakota League of Cities, property tax revenues were disbursed (using the mean levy) to:

County (includes special levies)	21%
School equalization (treated as a payment to the state)	11%
City (including park district)	32%
School districts	36%
Total	100%

(The county levy includes a 1.00 mill state levy which represents approximately one-half of 1 percent.)

Property tax revenues from mine property were estimated in 1975 prices as follows:

- Capital investment in mine = (\$8.46) • (size of mine, in tons per year)
- Mine value = (capital investment) • (10%)
- Tax revenue = (mine value) • (1.48%)

2. Educational Transfers From State:

Transfers were estimated on the basis of per pupil payments for elementary and secondary students as follows:⁶

Category	Payment Per Pupil (1975 \$)
Elementary	\$ 737
High School	1,147

3. Highway Fund Transfers From State:

Transfers were estimated on the basis of a per capita share of the state collected highway taxes. These estimates, in 1975 dollars, were:

- County share per capita = \$16.23
- Municipal share per capita = \$10.24

4. Cigarette and Tobacco Tax Transfers From State:

Transfers of these taxes were estimated on a per capita basis with a portion of the total being returned to the cities. This estimate, in 1975 dollars, was \$3.60 per capita.

5. Coal Conversion Tax Transfers From State:

The total county share of conversion tax receipts (see the section on state collected taxes) is further distributed as follows:

a. 15 percent is allocated to incorporated cities based on population according to the last official decennial federal census.

b. 45 percent is allocated to school districts within the county on the basis of enrollments. (The statutory formula calls for distribution on the basis of average daily attendance; however, enrollments were used as a proxy in the model.)

c. The remaining 40 percent is deposited in the county general fund. (This is the amount shown on the county fiscal impact report eliminating the need for a "pass through" account to show the city and school district share.)

6. Severance Tax Transfers From State:

The county share of severance tax receipts is 5 percent of the total.

7. Federal Revenue Sharing Transfers:

These were estimated on a per capita basis for counties and municipalities. Estimates in 1975 dollars were:

- Counties = \$12.21 per capita
- Municipalities = \$10.20 per capita

Revenue was based on population according to the last official decennial federal census and adjusted for inflation in 10-year increments.

8. User Fees:

User fee revenues were estimated on the basis of average per household expenditures for water, sewer, and solid waste from data provided by the North Dakota League of Cities. The total annual user fee per household for these items was estimated at \$117.67 in 1975 dollars.

9. Special Assessments:

Revenues from special assessments were estimated by amortizing the capital investments for streets, water, sewer, and solid wastes at 7 percent interest for 20 years.

10. Loss of Property Tax Revenues:

Property tax revenues lost due to energy development were based on the land removed from production during strip mining operations plus land used for project facilities, businesses, and residential uses. An average price per acre of \$134.40 in 1975 prices was used in conjunction with the property tax revenue estimator of 1.48 percent. An estimate of land taken for annual strip mining operations was provided by each company involved. Land used for project facilities was as estimated by the company or at standard amounts of 500 acres per gasification or power plant and 100 acres per mine. Land taken for businesses and residences was estimated based on the following function:

$$u = 0.5637P$$

where: u = acres of urban and built-up land
p = population change

⁶Based on information provided by the North Dakota Department of Public Instruction, Bismarck.

Cost Estimation

State

1. Education Transfers to School Districts:

Cost to the state was estimated at the total of per pupil payments (see the local revenue, education transfers from the state section).

2. Highway System Operating Expenditures:

Increased operating costs for all highway department functions were estimated on a per capita basis to be \$204.29 in 1975 dollars.⁷

3. General Government Function:

These were estimated on a per capita basis to be \$355.07 in 1975 dollars (Prestgard).

4. Highway Fund and Cigarette and Tobacco Tax Transfers to Local Governments:

Cost to the state is equal to the local government's increased revenue from these sources. (See revenue section referring to these taxes.)

5. Capital investment in Highway Systems:

Capital costs for highway improvement were estimated on the basis of a per operating worker cost of \$30,100 in 1975 prices.⁸ Based on the present funding procedures for construction of other than interstate highways, 70 percent of the total construction costs were assumed to be funded by the federal government. Costs were amortized at 7 percent for 20 years.

Local

1. Schools:

a. Operating Expenditures

Operating expenditures were estimated to be \$925.23 in 1975 prices per pupil regardless of school size cohorts (Superintendent of Public Instruction).

b. Capital Investment⁹

Expansion costs of school facilities were estimated on the basis of \$29 per square foot in 1975 prices. Standards used were 145 square feet per secondary student and 92.5 square feet per elementary student.

2. Streets

a. Operating and Maintenance Expenditures

Operating costs were estimated to be \$2,669 in 1975 prices per mile regardless of city size cohorts (North Dakota State Highway Department). The relevant cost per mile was multiplied by the number

of new street miles required for a given population growth. An expansion requirement for streets was estimated at 0.003 miles of street per person by assuming a population of 15 persons per acre in blocks 300 feet by 300 feet with 66-foot wide streets.

b. Capital Investment

Expansion costs for streets were estimated at \$608.26 per capita in 1975 dollars on the basis of data provided by North Central Consultants, Ltd., of Jamestown, North Dakota, in July, 1974.

3. Distribution and Treatment of Water

Expansion costs of water distribution and treatment facilities were estimated at \$1,574 per capita in 1975 dollars on the basis of data provided by North Central Consultants, Ltd., of Jamestown, North Dakota, in July, 1974.

4. Waste-Water System and Treatment

Expansion costs and waste-water systems and treatment facilities were estimated at \$168 per capita in 1975 dollars on the basis of data provided by North Central Consultants, Ltd., of Jamestown, North Dakota, in July, 1974.

5. Solid Waste Disposal

Expansion costs for waste disposal were estimated at \$3.60 per capita in 1975 dollars on the basis of data provided by North Central Consultants, Ltd., of Jamestown, North Dakota, in July, 1974.

6. Law Enforcement, Fire Protection, and Other Local Government Functions

Operational expenditures for city and county government functions were estimated by separate regression equations using city and county budget data, respectively. The budgets used in the regression analysis were adjusted to 1972 prices, and the resulting coefficients were then readjusted to 1975 prices. Estimating equations were developed for police protection, fire protection, and total city operating expenditures on the city government, social services, and total county operating expenditures on the county government level (where $x = 1970$ county population and $n = 28$). The best-fit equations were:

a. $Y = 9,415 + 4.01X$ ($R^2 = .94$)

where Y = total county social services cost

b. $Y = 6,528 + 3.11X$ ($R^2 = .79$)

where Y = total county law enforcement costs

c. $Y = 253,412 + 64.51X$ ($R^2 = .79$)

where Y = total county operating costs

d. $Y = -11,780 + 13.41X$ ($R^2 = .92$)

where Y = total city fire protection costs

e. $Y = -3,662 + 16.87X$ ($R^2 = .99$)

where Y = total city police protection costs

f. $Y = -85,433 + 172.50X$ ($R^2 = .95$)

where Y = total city operating costs

⁷ The cost per capita was estimated by dividing the total net disbursements for highways by the state's population from 1970 census data. Source: **North Dakota Highway Statistics, 1973**, State Highway Department, Bismarck.

⁸ Based on information from a North Dakota Highway Department planning overview, 1976.

⁹ Estimated on the basis of data obtained from the State Department of Public Instruction, Bismarck, July, 1974.

These equations result in costs per capita in 1975 prices as follows:

County social services	\$ 5.13
County law enforcement	3.98
County general government.....	73.46
City fire protection	17.16
City police protection	21.59
City general government	182.05

MODEL ASSUMPTIONS, LIMITATIONS, AND FURTHER DEVELOPMENT

Although the REAP Economic-Demographic Model 1 (RED-1) is a flexible and versatile interactive model, like any model it is based on certain assumptions and possesses limitations which must be made evident. In addition, there are several aspects of the present model for which further extensions and elaborations should be explored. This section of the model description describes the major assumptions and limitations of the model and the areas where further refinements in procedures and data bases would be desirable.

Assumptions

Perhaps the major general assumption that underlies any projection procedure is the assumption that historical relationships and trends in these relationships and interdependencies will persist throughout the projection period. Thus, growth of the basic economic sectors of the input-output model and the basic trends in demographic processes are assumed either to follow historical patterns or to follow some path clearly discernible from past historical patterns. Although one of the strengths of direct access interactive models lies in the ease with which such assumptions can be changed, it is recognized that unforeseen changes in the economy or demographic processes would have serious implications for the accuracy of projections from the model.

More specifically, the present model utilizes several critical assumptions in various components of the model. In the input-output module, it is assumed that input requirements of the respective sectors will not change significantly in the projection period and that recent trends will continue for the output for the basic sectors and for the ratios of gross business volume to employment.

In the demographic module, past mortality trends are assumed to continue and fertility rates are set at various predetermined levels. A particularly critical assumption for the interactive component is that rates of migration will continue to reflect employment opportunities in the predicted manner.

In the gravity module, the patterns of settlement are determined on the basis of present city populations and so the module contains the assumption that future growth will be in proportion to the cities' present populations.

In the fiscal impact module, it is assumed that past relationships will continue for public revenues and costs and the variables from which these estimates were made.

Finally, because of the interactive and interdependent nature of the model, each component (as shown in Figure 2) is dependent on all assumptions made for preceding components. Thus the interface component is dependent on the assumptions of the input-output and cohort-survival modules, the gravity module is affected by assumptions underlying the input-output, the cohort-survival, and the interface components; and the fiscal impact module is affected by the assumptions underlying all of the other components. Clearly, changes in the factors upon which these assumptions are based will have consequences for the model's accuracy.

Limitations

Although particular limitations for specific components of the model might be identified, perhaps the most important limitations of the model are those resulting from the data bases available. In the demographic module, for example, data by age and sex were derived from the 1970 census and data on demographic processes were in most cases based on trends for the period 1960 to 1970. Thus, those patterns which may have emerged since 1970 may not be accurately reflected in the data. In like manner the basic assessments of state interdependence coefficients are based on data collected in State Region 8 (Dickinson trade area) several years previously. In other areas, data were not only dated, but also not reported at the desired level of geographic specificity. Thus data on occupational groupings within industries for counties and age structure and employment data for municipalities could not be readily obtained. It should be recognized that some aspects and components of the model are based on extrapolations from available data that may be several years old.

It should also be evident that the present model is limited geographically to the 15-county area of North Dakota specified in Figure I-2. As such it does not provide for either statewide totals or provide information for areas of the state that may differ in their basic economics from that of the western part of the state.

It should be pointed out that the model has employed a variety of allocation procedures, such as a procedure for allocating regional employment to counties and of county employment to municipalities, and that such procedures clearly limit the types of generalizations that can be made for smaller units. In general, greatest care should be taken in interpreting model results for the smallest geographic units.

It is not possible for the model to take account of all the project-related cost and revenue changes that might be unique to the particular situation in a given community. For example, in some cases there will be significant county road costs during plant construction, but in other cases this will not be true. Also, some communities may have recently completed additions to their public service facilities, such as schools, water systems, etc., while other communities may soon have had to make these additions, even though coal resource development did not occur.

In summary, though highly flexible, the model should be used with full recognition of its limitations and of the assumptions on which it is based.

Ongoing Model Development

Throughout the process of developing the current version, the RED-1 model, the need for future elaboration of the model has been recognized. This version is based on existing available data, while data for possible future versions are being collected under a socioeconomic monitoring project. The model is presently being extended to include the entire state in order to maximize its utility.

The socioeconomic monitoring project, currently in progress, is designed to provide current North Dakota based data by which to validate and update the input-output technical coefficients. The same

project will afford an opportunity to utilize current data on demographic characteristics, social characteristics, and other relationships employed in the model. As indicated in the previous section on limitations, the assumptions of the current version are based on historical data and past trends. The data from the socioeconomic monitoring project will permit examination of the assumptions of continuing trends and to update as necessary the coefficients.

As is the case in any modeling effort, the assumptions of the model and the currency of its data base are the keys to its success or failure. A monitoring process is required to maintain a model in a current and useful state. Given the dynamic nature of social and economic phenomena, model development is regarded as an ongoing effort.

Summary

The REAP Economic-Demographic Model-1 provides a wide variety of projections for key aspects of the state's economy and population and does so in a form that is readily accessible and flexible. As such, it is designed to help serve the informational needs of state and local decision makers and other residents in the state; and it is only in such use that the model's utility will finally be established.

Chapter II

Case Study Results

NORTH DAKOTA

The study area for North Dakota consisted of seven counties located in State Regions 7 and 8 (Burleigh, Dunn, Mercer, McLean, Morton, Oliver, and Stark) (Figure II-1). Major trade centers in the study area are Bismarck-Mandan in Burleigh and Morton counties, and Dickinson in Stark County. The seven-county area is agriculturally oriented and sparsely populated.

Projection of the effects of coal development in North Dakota is presented in three phases: (1) a baseline projection of economic activity without energy development beyond that now in progress, (2) a Level I projection including (in addition to baseline) those projects that appear to be imminent, and (3) a Level II projection including (in addition to baseline and Level I) those projects that are in the early stages of planning and are tentative in nature.

Level I Projects

Natural Gas Pipeline Company of America plans to begin construction in 1980, of a 250 mmcf plant with a 14.0 mmtpy supporting mine having 1,072 operating employees and a peak construction work force of 4,200 during a six-year construction period. The project location is near Dunn Center in Dunn County.

American Natural Gas Company plans to begin construction in 1978 of a 250 mmcf plant with a 12.0 mmtpy supporting mine. The facility will be built in two distinct phases so that each phase will include all facilities necessary to produce an average of 125 mmcf of substitute natural gas.

Basin Electric Power Cooperative plans to begin construction in 1978 of two 450 megawatt electric generating units (Antelope Valley Station) with a supportive mine producing 5.2 mmtpy. The project location is near Beulah in Mercer County.

American Natural Gas and Basin Electric Power Cooperative presently intend that the above two projects will be a joint venture with co-location of facilities. This would reduce the manpower requirements of the two projects, primarily from the standpoint of using one mine versus two. In addition, a joint project would reduce the total number of tons of coal required since Basin Electric could use approximately 2.6 mmtpy of coal fines produced as a result of lignite crushing and screening for the gasification process which cannot be physically gasified in the Lurgi gasifiers. This would reduce the total tonnage required to 14.6 mmtpy. The total operating work force will be 1,314 with a peak construction work force of 3,240.

A consortium of electric power producers (the Coyote Station #1 Consortium) began construction in 1977 of a 440 megawatt electric generating unit with a supportive mine producing 2.3 mmtpy. The total operating work force will be 70, with a peak construction work force of 1,000 during a five-year construction period. The project location is near Beulah in Mercer County.

Level II Projects

The Coyote Consortium is beginning to make plans for a second unit (Coyote Station #2) tentatively to be located at the site of the first unit (near Beulah in Mercer County) and to be similar in size and design to Unit 1. Construction of Unit 2 would start in 1981 with a peak construction work force of 852 during a five-year construction period. The second unit would require an additional 40 operating employees; however, the present Beulah Plant with its 25 employees would be retired in 1985, resulting in a net increase of 15 employees.

Nokota Company plans to begin construction in 1982 of two lignite mines, each to produce 3.3 mmtpy with the first mine to begin production in 1984 and the second in 1986. The total operating work force will be 225 employees when both mines are in operation with a peak construction work force of 270 during the combined five-year construction period. The project location is near Garrison in McLean County.

Consolidation Coal Company plans to open four new mines at some time in the early to mid-1980's to meet estimated demand for North Dakota power production, as well as export. The four mines are described as:

The Dakota Star Mine, to be located near Hazen in Mercer County, will produce four mmtpy. The mine will require an operating work force of 176 with a peak construction work force of 75.

The Washburn Mine, to be located near Washburn in McLean County, will produce five mmtpy. The mine will require an operating work force of 202 with a peak construction work force of 90.

The Renners Cove Mine, to be located near Beulah in Mercer County, will produce three mmtpy. The mine will require an operating work force of 120 with a peak construction work force of 65.

The Underwood Mine, to be located near Underwood in McLean County, will produce 1.5 mmtpy. The mine will require an operating work force of 59 with a peak construction work force of 45.

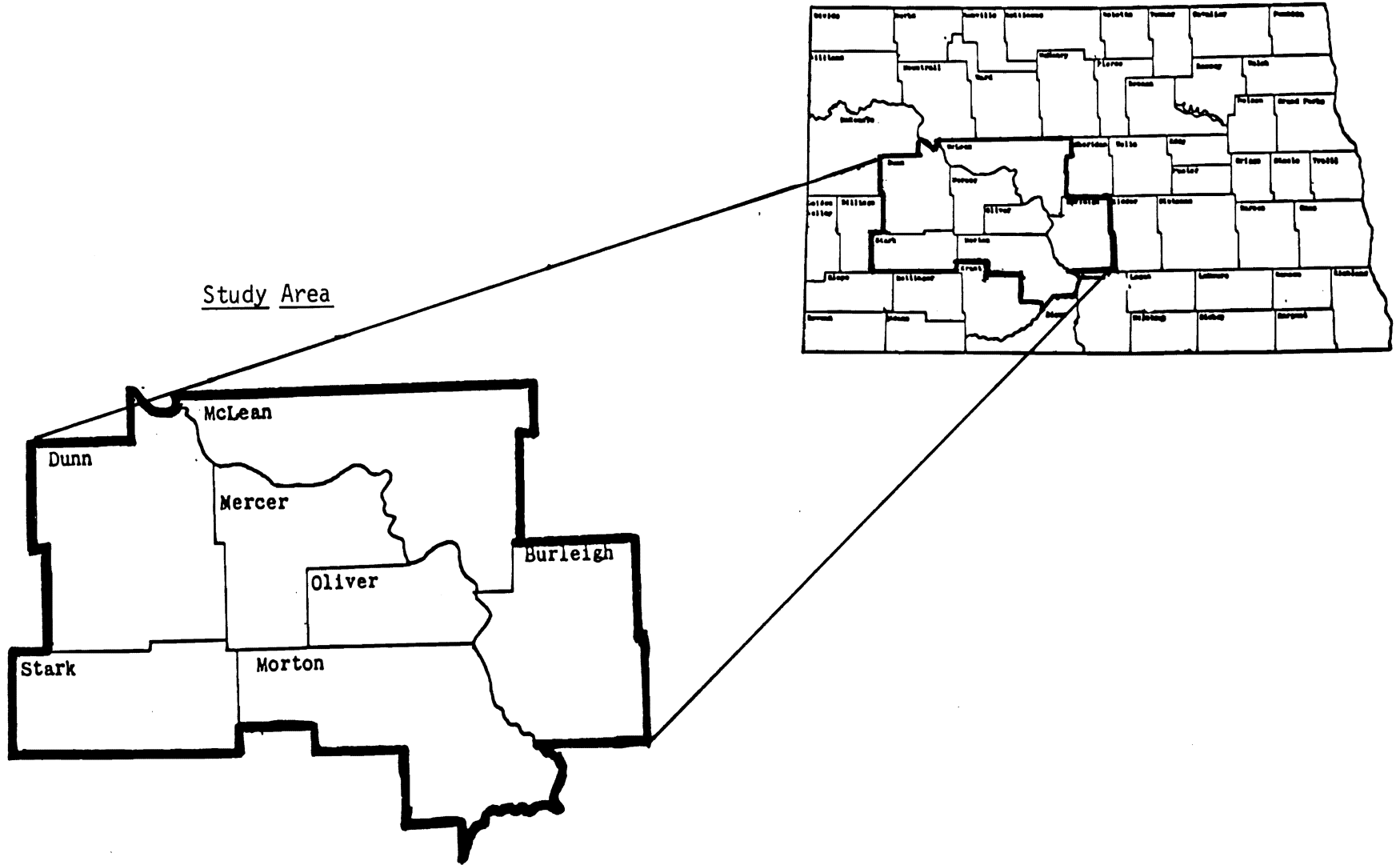


Figure II-1. Seven-County Multiple Impact Study Area.

Business Activity

Business activity (gross business volume) was projected for a 15-county region, encompassing the 7-county study area and contiguous counties. Business activity without further development was projected to increase from \$0.9 billion in 1975 to more than \$1.6 billion in 1999 (Table II-1).

Increased business activity resulting from Level I development was projected to increase by about \$18,000,000 during the first year of construction and to more than \$208,000,000 in 1981 (Table II-1). By 1989 a stable increase of about \$98,000,000 would be attained.

Population Projections, Baseline

The estimated population projections for the seven-county area without additional energy development show that only Burleigh and Stark counties would have significant increases in population (Table II-5). Oliver County was projected to have a very slight increase (nine people). The other counties (Dunn, McLean, Mercer, and Morton) were projected to experience rather noteworthy declines in population. The total projected population of the seven-county area was 113,524 in 1975, but increased by slightly over 32 percent to a projected

Table II-1. Business activity^a in 15-county E-D model area with and without Level I Projects, 1975-1999

Year	Business Activity Without Projects—Baseline ^b (\$000)	Business Activity With Projects ^c (\$000)	Difference (\$000)
1975	923,755	923,755	0
1976	998,550	998,550	0
1977	1,019,273	1,037,489	18,216
1978	1,030,454	1,068,755	38,301
1979	1,048,214	1,124,631	76,417
1980	1,055,322	1,234,522	179,200
1981	1,091,436	1,300,123	208,647
1982	1,123,579	1,315,497	191,918
1983	1,155,721	1,247,267	91,546
1984	1,187,861	1,307,291	199,430
1989	1,348,566	1,446,890	98,324
1994	1,509,269	1,607,593	98,324
1999	1,669,974	1,768,298	98,324

^aBusiness Activity is defined as the gross business volume (gross receipts) of sectors 3-11 (Table I-1).

^bSOURCE: E-D Model Master Run No. 657.

^cSOURCE: E-D Model Master Run No. 810.

Under Level II activity, business activity would increase by more than \$265,000,000 in 1983, during the peak of construction activity (Table II-2). By 1999, the stable increased gross business volume would be approximately \$126,000.

Personal Income

Personal income was also projected for a 15-county region. Under the baseline scenario, personal income was projected to increase from about \$0.6 billion in 1975 to more than \$1.1 billion in 1999 (Table II-3).

Level I development would generate an increase in personal income during construction activity varying from about \$13,000,000 in 1977 to more than \$146,000,000 in 1981 (Table II-3). By 1989, increased personal income would stabilize at almost \$83,000,000.

Under the Level II scenario, increased personal income would reach more than \$246,000,000 at the height of construction activity and stabilize at about \$104,000,000 by 1989 (Table II-4).

150,404 by 1999. The decline in population for four counties was offset by Burleigh County (71 percent increase) and Stark County (26 percent increase).

Projected population throughout selected municipalities in the seven-county area without additional energy development is presented in Table II-6. Bismarck-Mandan (actually in Burleigh and Morton counties) is considered to be in Burleigh County for this municipality breakdown. The Bismarck-Mandan trade center showed a projected population increase from 46,318 in 1975 to a 1999 projection of 85,524 (85 percent). Dickinson, the other trade center in the area, was projected to have a population increase from 12,435 to 19,132 between 1975 and 1999, a 54 percent increase. Larger municipalities which showed projected population increases were Underwood, Washburn, Beulah, Hazen, Hebron, Glen Ullin, Center, Belfield, and Richardton. Population projections indicated Garrison, Max, Butte, Ruso, and Turtle Lake will experience declines in population from 1975 to 1990.

Table II-2. Business activity^a in 15-county E-D model area with and without Level II Projects, 1975-1999.

Year	Business Activity Without Projects—Baseline ^b (\$000)	Business Activity With Level I and Level II Projects ^c (\$000)	Difference (\$000)
1975	923,755	923,755	0
1976	998,550	998,550	0
1977	1,019,272	1,037,489	18,216
1978	1,030,454	1,068,755	38,301
1979	1,048,214	1,124,631	76,417
1980	1,055,322	1,234,522	179,200
1981	1,091,436	1,318,339	226,903
1982	1,123,579	1,338,108	214,529
1983	1,155,721	1,421,563	265,842
1984	1,187,861	1,349,795	161,934
1989	1,348,566	1,474,236	125,670
1994	1,509,269	1,667,079	157,810
1999	1,669,974	1,795,644	125,670

^aBusiness Activity is defined as the gross business volume (gross receipts) of sectors 3-11 (Table I-1).

^bSOURCE: E-D Model Master Run No. 657.

^cSOURCE: E-D Model Master Run No. 580.

Table II-3. Personal income in 15-county E-D model area with and without Level I Projects, 1975-1999.

Year	Personal Income Without Projects ^a (\$000)	Personal Income With Projects ^b (\$000)	Difference (\$000)
1975	626,090	626,090	0
1976	677,268	677,268	0
1977	690,097	703,536	13,439
1978	697,512	724,230	26,718
1979	712,476	765,297	52,821
1980	719,326	844,952	125,626
1981	745,704	892,436	146,732
1982	768,121	904,068	135,947
1983	790,537	857,371	66,834
1984	812,954	905,631	92,677
1989	925,036	1,008,007	82,971
1994	1,037,118	1,120,089	82,971
1999	1,149,200	1,232,171	82,971

^aSOURCE: E-D Model Master Run No. 657.

^bSOURCE: E-D Model Master Run No. 810.

Table II-4. Personal income in 15-county E-D model area with and without Level II Projects, 1975-1999.

Year	Personal Income Without Projects ^a (\$000)	Personal Income With Projects ^b (\$000)	Difference (\$000)
1975	626,090	626,090	0
1976	677,268	677,268	0
1977	690,097	703,539	13,442
1978	697,512	724,230	26,718
1979	712,476	765,297	52,821
1980	719,326	844,952	125,626
1981	745,704	905,878	160,174
1982	768,121	920,692	152,571
1983	790,537	1,037,290	246,753
1984	812,954	936,824	123,870
1989	925,036	1,029,251	104,215
1994	1,037,118	1,141,333	104,215
1999	1,149,200	1,253,415	104,215

^aSOURCE: E-D Model Master Run No. 657.

^bSOURCE: E-D Model Master Run No. 580.

Table II-5. Population projections without further energy development for Burleigh, Dunn, McLean, Mercer, Morton, Oliver, and Stark counties, 1975-1999.

Year	Burleigh	Dunn	McLean	Mercer	Morton	Oliver	Stark
1975	49,291	4,326	9,785	6,213	19,561	2,515	21,833
1976	49,956	4,257	9,666	6,212	19,406	2,513	22,022
1977	51,325	4,194	9,790	6,153	19,308	2,509	22,350
1978	52,731	4,136	9,903	6,126	19,226	2,506	22,654
1979	54,163	4,070	9,835	6,107	19,151	2,489	22,925
1980	55,520	4,021	9,808	6,036	19,048	2,488	23,174
1981	57,025	3,966	9,802	6,024	19,024	2,490	23,432
1982	58,513	3,921	9,711	6,020	19,003	2,483	23,674
1983	60,028	3,886	9,626	6,012	18,991	2,489	23,909
1984	61,564	3,844	9,530	6,000	18,987	2,479	24,145
1989	69,375	3,712	9,193	5,966	19,031	2,511	25,324
1994	76,988	3,616	8,883	5,977	18,958	2,541	26,382
1999	84,076	3,551	8,481	5,948	18,635	2,526	27,187

SOURCE: E-D Model Master Run No. 657.

Population Projections, Level I

Projected population changes indicate there will be 13,845 more people in the area by 1999 with Level I projects than without (Table II-7). The majority of the increase is in the seven-county area. Mercer County population would increase by 5,959 people followed by increases of 4,066 in Dunn County; 1,412 in Stark County; 1,059 in Burleigh County; 719 in Morton County; 188 in McLean County; 50 in Oliver County; and 392 in other counties in the area.

The population projections for the study area due to both Level I development and baseline trends show that Burleigh, Dunn, Mercer, and Stark counties have substantial population increases from 1975 to 1999 (Table II-8). McLean County was projected to

have a decrease in population, while Morton and Oliver counties are expected to remain virtually unchanged. Population of the seven-county area increased by 44 percent from 1975 to 1999, increasing from 133,524 to 163,857. Mercer County had the largest percentage increase from 1975 to 1999, almost 92 percent, with population projected to increase from 6,213 to 11,907. Dunn County had the second largest percentage increase, 76 percent, during the same period. Burleigh, with the largest projected population, increased from 49,291 in 1975 to 85,135 in 1999, a 73 percent increase. The second most populated county, Stark, increased by only 31 percent during the same period increasing from 21,833 to 28,599.

Table II-6. Population projections without further development for selected municipalities within the study area, 1975-1999.

Year	Bismarck-								
	Mandan	Killdeer	Halliday	Underwood	Washburn	Beulah	Hazen	Center	Dickinson
1975	46,318	634	427	918	1,000	1,489	1,548	862	12,435
1976	47,155	638	432	901	1,101	1,547	1,521	895	12,723
1977	48,724	647	433	978	1,261	1,532	1,501	919	13,122
1978	50,326	647	445	1,057	1,416	1,514	1,501	945	13,492
1979	51,969	661	435	1,102	1,469	1,511	1,508	967	13,840
1980	53,503	645	455	1,130	1,556	1,489	1,498	990	14,164
1981	55,245	674	442	1,150	1,631	1,494	1,508	1,020	14,492
1982	56,950	661	454	1,150	1,636	1,496	1,514	1,036	14,806
1983	58,668	678	452	1,142	1,638	1,500	1,523	1,058	15,115
1984	60,412	665	472	1,134	1,635	1,499	1,521	1,070	15,409
1989	69,258	717	469	1,120	1,655	1,512	1,550	1,201	16,849
1994	77,758	736	502	1,108	1,673	1,520	1,598	1,336	18,116
1999	85,524	775	520	1,109	1,695	1,524	1,628	1,420	19,132

SOURCE: E-D Model Master Run No. 657.

Table II-7. Population increase of selected counties associated with development of Level I Projects, 1975-1999*.

Year	Burleigh County	Dunn County	McLean County	Mercer County	Morton County	Oliver County	Stark County	Seven-County Total	Other Counties	15-County Total
1975	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0
1977	31	0	13	744	13	0	16	817	0	817
1978	244	16	82	2,685	129	0	121	3,277	36	3,313
1979	597	56	190	5,649	356	27	284	7,162	75	7,237
1980	1,127	1,093	208	7,364	707	29	1,410	11,938	351	12,289
1981	1,241	1,515	252	8,084	783	44	1,477	13,396	400	13,796
1982	1,253	2,325	245	6,042	784	42	1,546	12,237	419	12,656
1983	1,124	2,413	192	6,788	669	34	1,609	12,829	324	13,153
1984	1,237	3,542	119	7,115	745	49	1,388	14,196	385	14,581
1989	1,244	3,951	84	5,836	804	47	1,599	13,565	394	13,959
1994	1,161	4,024	104	5,915	776	50	1,521	13,551	414	13,965
1999	1,059	4,066	188	5,959	719	50	1,412	13,453	392	13,845

*SOURCE: E-D Model Master Run Nos. 657 and 810.

The population projections for selected municipalities in the seven-county area with Level I development are presented in Table II-9. Bismarck-Mandan, with 46,318 people in 1975, increased 87,198 by 1999, an 88 percent change. Dickinson, the other major trade center in the area, had a projected population increase from 12,435 to 20,366 (64 percent). The majority (26 out of 34) of the selected municipalities showed an increase in projected population associated with Level I development. Killdeer, Washburn, Beulah, Hazen, and Center were projected to have significant population increases between 1975 and 1999, in addition to Bismarck-Mandan and Dickinson.

Population Projections, Level II

Population increases due to Level II projects show an increase of 17,842 for the 15-county area by 1999 (Table II-10). The increase was concentrated in the seven-county area with only slight population changes in the other counties during the projection period. Mercer County had the largest stable population increase with 7,568 new people by 1999; while Dunn County population increased by 4,069; McLean County by 1,706; Burleigh County by 1,543; Stark County by 1,512; Morton County by 933; Oliver County by 115; and other counties in the area by 396.

The population projections for the study area due to both Level II development and baseline trends

Table II-8. Population projections with Level I Development for Burleigh, Dunn, McLean, Mercer, Morton, Oliver, and Stark counties, 1975-1999.

Year	Burleigh	Dunn	McLean	Mercer	Morton	Oliver	Stark	Total
1975	49,291	4,326	9,785	6,213	19,561	2,515	21,833	113,524
1976	49,956	4,257	9,666	6,212	19,406	2,513	22,022	114,032
1977	51,356	4,194	9,803	6,897	19,321	2,509	22,366	116,446
1978	52,975	4,152	9,985	8,811	19,355	2,506	22,775	120,559
1979	54,760	4,126	10,025	11,756	19,507	2,516	23,209	125,899
1980	56,647	5,114	10,016	13,400	19,755	2,517	25,584	133,033
1981	58,266	5,481	10,054	14,108	19,807	2,534	24,909	135,159
1982	59,766	6,246	9,956	12,062	19,787	2,525	25,220	135,562
1983	61,152	6,299	9,816	12,800	19,660	2,523	25,518	137,768
1984	62,801	7,386	9,649	13,115	19,732	2,528	25,533	140,744
1989	70,619	7,663	9,277	11,802	19,835	2,558	26,923	148,677
1994	78,149	7,640	8,987	11,892	19,734	2,591	17,903	156,896
1999	85,135	7,617	8,669	11,907	19,354	2,576	28,599	163,857

SOURCE: E-D Model Master Run No. 810.

Table II-9. Population projections with Level I Development for selected municipalities within the study area, 1975-1999.

Year	Bismarck-Mandan	Killdeer	Halliday	Underwood	Washburn	Beulah	Hazen	Center	Dickinson
1975	46,318	634	427	918	1,000	1,489	1,543	862	12,435
1976	47,155	638	432	901	1,101	1,547	1,521	895	12,723
1977	48,761	647	438	984	1,266	1,904	1,835	921	13,141
1978	50,647	657	463	1,078	1,424	2,912	2,540	955	13,591
1979	52,753	679	471	1,086	1,510	4,523	3,679	994	14,069
1980	54,993	1,529	514	1,126	1,518	5,453	4,292	1,023	15,362
1981	56,824	2,178	595	1,152	1,603	5,959	4,493	1,066	15,744
1982	58,577	2,513	944	1,152	1,622	5,034	3,799	1,081	16,107
1983	60,123	2,680	918	1,144	1,626	5,479	4,119	1,100	16,487
1984	62,082	3,927	848	1,137	1,621	5,773	4,283	1,120	16,641
1989	70,980	4,337	855	1,130	1,646	5,637	4,032	1,288	18,249
1994	79,446	4,502	811	1,129	1,673	5,900	4,174	1,444	19,432
1999	87,198	4,755	770	1,120	1,697	6,171	4,314	1,545	20,366

SOURCE: E-D Model Master Run No. 810.

show that Burleigh, Dunn, Mercer, and Stark counties have substantial population increases from 1975 to 1999 (Table II-11). McLean County had a slight increase in population while Morton and Oliver counties remained virtually unchanged. Population of the seven-county area increased from 1975 to 1999 by 48 percent, increasing from 113,524 to 167,850 people. Mercer County had the largest percentage change from 1975 to 1999, increasing 118 percent, with population projected to increase from 6,213 to 13,516. Dunn County had the second largest increase, 76 percent, during the same period. Burleigh, with the largest projected population, increased from 49,291 in 1975 to 85,619 in 1999, a 74 percent increase. The second most populated county, Stark, increased by only 31 percent during

the same period, increasing from 21,833 to 28,699.

The population projections for selected municipalities in the seven-county area with Level II development are presented in Table II-12. Bismarck-Mandan, with 46,318 people in 1975, increased to 87,828 by 1999, a 90 percent change. Dickinson, the other major trade center in the area, had a projected population increase from 12,435 to 20,446 (64 percent). The majority (29 out of 34) of the selected municipalities showed an increase in projected population associated with Level II development. Killdeer, Washburn, Beulah, Hazen, and Center were projected to have significant population increases between 1975 and 1999, in addition to Bismarck-Mandan and Dickinson.

Table II-10. Population increase of selected counties attributable to development of Level II Projects, 1975-1999.

Year	Burleigh County	Dunn County	McLean County	Mercer County	Morton County	Oliver County	Stark County	7 County Total	Other Counties	15 County Total
1975	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0
1977	31	0	13	744	13	0	16	817	0	817
1978	244	16	82	2,685	89	0	111	3,227	86	3,313
1979	597	44	190	5,649	356	27	284	7,147	90	7,237
1980	1,127	1,093	208	7,364	707	29	1,410	11,938	351	12,289
1981	1,262	1,524	254	9,033	796	44	1,475	14,388	400	14,788
1982	1,341	2,334	504	7,779	818	42	1,635	14,453	424	14,877
1983	1,397	2,447	665	8,640	825	36	1,764	15,774	330	16,104
1984	1,649	3,525	750	9,025	948	55	1,449	17,401	411	17,812
1989	1,800	3,956	1,543	7,379	1,061	114	1,695	17,548	439	17,987
1994	1,676	4,014	1,610	7,470	1,017	120	1,597	17,504	338	17,958
1999	1,543	4,069	1,706	7,568	933	115	1,512	17,446	396	17,842

SOURCE: E-D Model Master Run Nos. 657 and 580.

Table II-11. Population projections with Level II energy development for Burleigh, Dunn, McLean, Mercer, Morton, Oliver, and Stark counties, 1975-1999.

Year	Burleigh	Dunn	McLean	Mercer	Morton	Oliver	Stark	Total
1975	49,291	4,326	9,785	6,213	19,561	2,515	21,833	113,524
1976	49,956	4,257	9,666	6,212	19,406	2,513	22,022	114,032
1977	51,356	4,194	9,803	6,897	19,321	2,509	22,366	116,446
1978	52,975	4,152	9,985	8,811	19,355	2,506	22,775	120,559
1979	54,760	4,126	10,025	11,756	19,507	2,516	23,209	125,899
1980	56,647	5,114	10,016	13,400	19,755	2,517	24,584	132,033
1981	58,287	5,490	10,056	15,057	19,820	2,534	24,907	136,151
1982	59,854	6,255	10,215	13,799	19,821	2,525	25,309	137,778
1983	61,425	6,333	10,291	14,652	19,816	2,525	25,673	140,715
1984	63,213	7,369	10,280	15,052	19,935	2,534	25,594	143,977
1989	71,175	7,668	10,736	13,345	20,092	2,625	27,019	152,660
1994	78,664	7,630	10,493	13,447	19,975	2,661	27,979	160,849
1999	85,619	7,620	10,187	13,516	19,568	2,641	28,699	167,850

SOURCE: E-D Model Master Run No. 580.

Energy Related Employment

An example of the direct and indirect employment requirements for North Dakota energy development projects recently completed (since 1975), currently under construction or proposed is indicated in Table II-13. After all projects listed in Table II-13 have reached the operation phase (by 1988), development of coal resources in North Dakota will have generated more than 8,000 new jobs.

Indirect Employment

Total employment generated by coal-energy development consists of both direct employment and indirect or induced employment. Direct employment is primarily the work force (including managerial and administrative personnel) involved directly in the construction and operation of an energy com-

plex or facility. Indirect or induced employment results from the additional sales volume in the particular region or area. The indirect work force is the people in the service and trade sectors which are needed to meet the needs for goods and services of the direct work force. Examples of indirect workers include retail personnel, school teachers, police, and so on.

Given accurate estimates of gross business volume (sales in dollars) of each sector, the dollar estimates of gross business volume can be translated into estimates of employment for each sector. Estimated gross business volumes for each sector were divided by the ratio of gross business volume to employment to obtain estimates of the employment in each sector associated with that set of final demands and gross business volumes.

Table II-12. Population projections with Level II energy development for selected municipalities within the study area, 1975-1999.

Year	Bismarck-Mandan	Killdeer	Halliday	Underwood	Washburn	Beulah	Hazen	Center	Dickinson
1975	46,318	634	427	918	1,000	1,489	1,548	862	12,435
1976	47,155	638	432	901	1,101	1,547	1,521	895	12,723
1977	48,761	647	438	984	1,266	1,904	1,835	921	13,141
1978	50,647	657	463	1,078	1,424	2,912	2,540	955	13,591
1979	52,753	679	471	1,086	1,510	4,523	3,679	994	14,069
1980	54,993	1,529	541	1,126	1,518	5,453	4,292	1,023	15,362
1981	56,852	2,180	599	1,157	1,599	6,470	4,880	1,066	15,738
1982	58,696	2,518	951	1,155	1,626	5,921	4,461	1,082	16,179
1983	60,493	2,684	929	1,153	1,634	6,367	4,850	1,110	16,612
1984	62,638	3,913	844	1,145	1,617	6,678	5,022	1,138	16,699
1989	71,707	4,344	853	1,252	1,953	6,421	4,811	1,337	18,345
1994	80,093	4,506	809	1,255	2,002	6,718	4,993	1,468	19,499
1999	87,828	4,763	768	1,265	2,066	7,034	5,190	1,550	20,446

SOURCE: E-D Model Master Run No. 580.

Table II-13. Direct and indirect employment for current and proposed North Dakota energy development projects.

Project	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Gascoyne (expansion):															
Direct	40	40	40	40	40	40	40	40	40	40	40	40	40	40	40
Indirect	97	97	97	97	97	97	97	97	97	97	97	97	97	97	97
Basin:															
Direct	400	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Indirect	143	143	143	143	143	143	143	143	143	143	143	143	143	143	143
Minnkota:															
Direct	510	610	210	110	110	110	110	110	110	110	110	110	110	110	110
Indirect	51	112	133	143	143	143	143	143	143	143	143	143	143	143	143
UPA-CPA:															
Direct	260	830	1,115	1,270	943	498	485	485	485	485	485	485	485	485	485
Indirect	23	98	198	313	313	313	313	313	313	313	313	313	313	313	313
Subtotal (Baseline):															
Direct	1,210	1,580	1,465	1,520	1,193	748	735	735	735	735	735	735	735	735	735
Indirect	314	450	571	696	696	696	696	696	696	696	696	696	696	696	696
Total	1,524	2,030	2,036	22,16	1,889	1,444	1,431	1,431	1,431	1,431	1,431	1,431	1,431	1,431	1,431
Coyote 1:															
Direct			632	677	921	1,000	615	70	70	70	70	70	70	70	70
Indirect			17	35	60	86	86	86	86	86	86	86	86	86	86
AMG-Basin:															
Direct				1,103	2,610	3,240	3,081	1,754	2,245	2,775	2,617	2,343	1,627	1,314	1,314
Indirect				159	536	1,004	1,449	1,449	1,449	1,449	1,449	1,449	1,449	1,449	1,449
NGPL:															
Direct						700	2,800	3,980	4,200	1,486	1,195	1,237	1,120	1,072	1,072
Indirect						68	340	727	1,135	1,135	1,135	1,135	1,135	1,135	1,135
Subtotal (Level 1):															
Direct	1,210	1,580	2,097	3,300	4,724	5,688	7,231	6,539	7,250	5,066	4,617	4,385	3,552	3,191	3,191
Indirect	314	450	588	890	1,292	1,854	2,571	2,958	3,366	3,366	3,366	3,366	3,366	3,366	3,366
Total	1,524	2,030	2,685	4,190	6,016	7,542	9,802	9,497	10,616	8,432	7,983	7,751	6,918	6,557	6,557
Coyote 2:															
Direct							57	609	784	852	485	15	15	15	15
Indirect							15	34	59	86	86	86	86	86	86
Nokota:															
Direct								163	153	270	235	225	225	225	225
Indirect								39	75	139	194	194	194	194	194
Dakota Star:															
Direct									75	30	176	176	176	176	176
Indirect									21	29	78	128	128	128	128
Washburn:															
Direct									90	36	202	202	202	202	202
Indirect									27	38	99	161	161	161	161
Renners Cove:															
Direct									65	26	120	120	120	120	120
Indirect									19	27	62	97	97	97	97
Underwood:															
Direct									45	18	59	59	59	59	59
Indirect									12	17	33	48	48	48	48
Total (Level 2):															
Direct	1,210	1,580	2,097	3,300	4,724	5,688	7,688	7,311	8,462	6,295	5,894	5,182	4,349	3,988	3,988
Indirect	314	450	588	890	1,292	1,854	2,586	3,031	3,579	3,702	3,918	4,080	4,080	4,080	4,080
Total	1,524	2,030	2,685	4,190	6,016	7,542	10,274	10,342	12,041	9,997	9,812	9,262	8,429	8,068	8,068

Local expenditures for construction and for operation were assigned to the sectors from which inputs are purchased to estimate gross business volume. Interdependence coefficients were applied to these expenditures to obtain estimates of the gross business volume generated in the respective sectors. In the case of construction expenditures, three sectors were involved. They were the construction, retail trade, and household sectors. The basic expenditures included in the construction sector would be those resulting from local subcontractor's wage and salary payments and local purchases of construction materials. Expenditures to the retail trade sector include any local purchases of supplies, materials, and equipment. Items purchased locally might include tools, office supplies, vehicles, spare parts, and other related items.

Expenditures to the household sector include payments for wages and salaries, site acquisition, and royalties. Site acquisition payments are applicable to the electrical generation or gasification facility and associated facilities; whereas, royalty payments are applicable to mine operation.

Local expenditures for plant operation are introduced into the local economy via the retail trade and household sectors. Local expenditures to the retail trade sector are for such items as supplies, maintenance materials, fuel, and lubricants. Expenditures to the household sector consist principally of wages, salaries, and royalty payments.

Indirect employment requirements are estimated by comparing increased gross business volume to historical trends of each sector's gross business volume to worker ratio.

The estimation of indirect workers in the construction phase is particularly difficult. Factors affecting these estimates include excess capacity of the existing business infrastructure of the area; tastes and preferences of the direct workers (i.e., settlement patterns, worker characteristics); and the dynamic nature, length, and magnitude of the construction phase. The nature and size of the construction project will influence the build-up of the construction work force, availability of local labor, and availability and feasibility of local wholesale and retail firms to supply various construction materials, supplies, and equipment. It is difficult to estimate the speed with which the local economy will react to the economic stimulus. It is possible that area businesses and firms may react quickly to meet the increased demand for goods and services. However, it is likely that a number of years will be required for the economic injections to stimulate the support and service sectors to expand sufficiently to fully adjust to the increased demand. The short-term nature of the construction phase is probably the greatest deterrent to expansion of existing businesses and establishment of new businesses and firms.

It would seem reasonable that the indirect and induced employment will not reach peak levels until sometime after the energy related project becomes operational. It is during the operational phase that affected businessmen, investors, community leaders, and others can assess the stability of the area's business volume, the industrial project, and the associated permanent work force. As a point of stability is reached (i.e., regarding employment, population, and business volume—sales receipts), the business community will no doubt react more positively to the economic situation.

The expansion of the trade and service sectors related to energy development will involve substantial "lags" in the short run. Likewise, the increases in indirect employment also will be affected. The indirect employment may not reach peak levels until sometime after the project becomes operational; but, for purposes of analysis, the total associated indirect employment was assumed to peak in the last year of construction. One critical problem exists in this approach. If energy development (the scheduling of energy facilities) becomes a continuous process of several facilities being built one after another, then the construction work force could become a permanent work force—thus resulting in a more rapid build-up of the indirect work force.

An example of estimated indirect employment generated by the construction and operation of a large electric generation facility and associated mine is presented in Table II-14.¹ During the construction phase, the sectors generating the greatest numbers of indirect workers are the construction sector (almost 31 percent), retail trade (about 15 percent), professional and social services (about 10 percent), and the government sector (about 26 percent). Operation phase expenditures would concentrate more than 70 percent of the indirect employment in three sectors—retail trade (about 25 percent), professional and social services (about 13 percent), and government (about 34 percent).

Employment Projections, Baseline

Employment projections without further development indicate that only Burleigh and Stark counties will have increased employment in the seven-county area between 1975 and 1999 (Table II-15). Burleigh County projected employment increased from 18,247 to 30,049 between 1975 and 1999, a 65 percent increase; while Stark County increased from 7,790 to 10,005, a 28 percent increase, during the same time period. A decrease in employment would occur in Dunn, McLean, Mercer, Morton, and Oliver

¹ The example presented is that of the United Power Association/Cooperative Power Association (UPA/CPA) Complex which began construction in North Dakota in 1975. Local expenditure data were provided by officials of UPA/CPA.

Table II-14. Number and percent of indirect jobs generated by construction and operation of a 972 megawatt electric generating plant and associated mine by industrial sector *

Sector	Indirect Jobs			
	Construction Phase		Operation Phase	
	Number	Percent	Number	Percent
Construction	383	30.9	12	3.8
Transportation	25	2.0	6	1.9
Communication and Utilities	43	3.5	14	4.5
Wholesaling	20	1.6	8	2.6
Retail Trade	184	14.8	78	24.9
Finance, Insurance, and Real Estate	42	3.4	13	4.2
Business and Personal Services	66	5.3	22	7.0
Professional and Social Services	123	9.9	42	13.4
Government	325	26.2	107	34.2
Other	30	2.4	11	3.5
Total	1,241	100.0	313	100.0

*Construction phase jobs are based on the local expenditures for construction during the year of peak construction activity. Operation phase jobs are based on the average annual cost of facilities operation.

counties between 1975 and 1999. The seven-county area projections showed 1975 employment at 42,873 and 1999 employment at 54,823, a 28 percent increase during that time period.

Employment projections for municipalities in the seven-county area are presented in Table II-16. The Bismarck-Mandan trade center had a projected employment increase from 23,662 in 1975 to 35,169 in 1999, a 49 percent increase. Dickinson, the other trade center in the area, increased from 6,567 to 8,433 during the time period, a 28 percent increase. The majority of municipalities in the seven-county area were projected to have a decline in employment

between 1975 and 1999. Bismarck-Mandan, Dickinson, Garrison, Beulah, Hazen, and Center were projected to have significant employment increases during the projection period.

Projections of agricultural employment for the livestock and crops sectors indicate employment will decline from 1980 to 1999 for both State Regions 7 and 8 (Table II-17). Total projected agricultural employment in State Region 7 declined from 8,078 in 1980 to 7,404 in 1999, an 8 percent decrease. State Region 8 experienced an 11 percent decline in projected total agricultural employment during the same time period, declining from 4,528 to 4,048.

Table II-15. Employment projections without further energy development for Burleigh, McLean, Mercer, Morton, Oliver, and Stark counties, 1975-1999

Year	Burleigh	Dunn	McLean	Mercer	Morton	Oliver	Stark
1975	18,247	1,635	4,013	2,798	7,357	1,033	7,790
1976	18,864	1,647	4,133	2,777	7,452	1,049	7,930
1977	19,283	1,637	4,174	2,739	7,438	1,010	8,045
1978	19,770	1,626	4,208	2,735	7,463	1,003	8,168
1979	20,143	1,612	4,115	2,667	7,434	993	8,264
1980	20,444	1,599	3,919	2,560	7,370	973	8,357
1981	20,981	1,588	3,929	2,569	7,402	978	8,475
1982	21,484	1,578	3,872	2,561	7,419	977	8,587
1983	21,988	1,566	3,820	2,550	7,430	975	8,695
1984	22,492	1,553	3,765	2,537	7,435	974	8,799
1989	25,018	1,489	3,501	2,474	7,414	967	9,279
1994	27,546	1,422	3,241	2,404	7,318	954	9,681
1999	30,049	1,352	2,995	2,328	7,154	940	10,005

SOURCE: E-D Model Master Run No. 95.

Table II-16. Employment projections without further energy development for municipalities within the study area, by county, 1975-1999

Year	Bismarck-Mandan	Killdeer	Halliday	Underwood	Washburn	Beulah	Hazen	Center	Dickinson
1975	23,622	810	546	625	682	962	1,012	1,033	6,567
1976	24,309	806	543	664	758	965	993	1,049	6,685
1977	24,716	801	539	686	802	949	975	1,010	6,782
1978	25,218	795	536	703	844	944	971	1,003	6,883
1979	25,562	789	531	687	834	920	942	993	6,968
1980	25,806	782	527	644	777	886	895	973	7,045
1981	26,363	777	523	654	800	887	901	978	7,145
1982	26,875	772	520	645	791	884	898	977	7,239
1983	27,382	766	516	638	781	881	892	975	7,331
1984	27,886	760	512	629	772	876	888	974	7,419
1989	30,377	729	490	589	730	856	865	967	7,822
1994	32,810	696	468	549	688	831	840	954	8,161
1999	35,169	662	445	511	649	804	813	940	8,433

SOURCE: E-D Model Master Run No. 99.

Table II-17. Projected employment for agricultural sectors without further energy development in State Regions 7 and 8, selected years

Sector	State Region 7	State Region 8
		<u>1980</u>
1) Livestock	3,015	1,545
2) Crops	<u>5,063</u>	<u>2,983</u>
TOTAL AGRICULTURAL	8,078	4,528
		<u>1985</u>
1) Livestock	2,831	1,431
2) Crops	<u>4,937</u>	<u>2,882</u>
TOTAL AGRICULTURAL	7,768	4,313
		<u>1990</u>
1) Livestock	2,697	1,351
2) Crops	<u>4,846</u>	<u>2,812</u>
TOTAL AGRICULTURAL	7,543	4,163
		<u>1999</u>
1) Livestock	2,574	1,270
2) Crops	<u>4,830</u>	<u>2,778</u>
TOTAL AGRICULTURAL	7,404	4,048

Employment Projections, Level I

Employment projections with Level I development show that four of the seven counties are expected to experience increased employment from 1975 to 1999 (Table II-18). Burleigh County projected employment increased 67 percent during the projection period, increasing from 18,247 to 30,424. Stark County projected employment increased from 7,790 in 1975 to 10,555 in 1999 (35 percent). Dunn County projected employment increased by 57 percent, while Mercer County employment increased by 76 percent. McLean, Morton, and Oliver counties were projected to experience employment declines from 1975 to 1999. Total projected employment for the seven-county area increased from 42,893 to 59,637 (39 percent) between 1975 and 1999.

Employment projections for selected municipalities in the seven-county area are presented in Table II-19. The Bismarck-Mandan trade center had a projected employment increase of 51 percent from 1975-1999, increasing from 23,622 to 35,677. The Dickinson trade center had a projected employment increase from 6,567 to 8,908 (36 percent) during the same period. The majority (18 out of 34) of the municipalities in the seven-county area experienced an increase in employment from 1975 to 1999.

Employment Projections, Level II

Employment projections with Level II development show that five of the seven counties are expected to experience increased employment from 1975 to 1999 (Table II-20). Burleigh County projected employment increased 68 percent during the projection period, increasing from 18,247 to 30,627. Stark County projected employment increased from 7,790 in 1975 to 10,592 in 1999 (36 percent). Dunn County projected employment increased by 57 percent, while Mercer County employment increased by 101 percent. The employment projections for Morton County indicate modest increases associated with Level II development. McLean and Oliver counties were projected to experience employment declines from 1975 to 1999. Total projected employment for the seven-county area increased from 42,893 to 60,537 (43 percent) between 1975 and 1999.

Employment projections for selected municipalities in the seven-county area are presented in Table II-21. The Bismarck-Mandan trade center had a projected employment increase of 52 percent from 1975 to 1999, increasing from 23,622 to 35,957. The Dickinson trade center had a projected employment increase from 6,567 to 8,941 (36 percent) during the same period. The majority (23 out of 34) of the municipalities in the seven-county area experienced an increase in employment from 1975 to 1999.

Table II-18. Employment projections with Level I development for Burleigh, Dunn, McLean, Mercer, Morton, Oliver, and Stark counties, 1975-1999

Year	Burleigh	Dunn	McLean	Mercer	Morton	Oliver	Stark
1975	18,247	1,655	4,013	2,798	7,357	1,033	7,790
1976	18,864	1,647	4,133	2,777	7,452	1,049	7,930
1977	19,377	1,644	4,198	3,230	7,139	1,021	8,090
1978	20,090	1,651	4,290	4,496	7,170	1,040	8,317
1979	20,814	1,669	4,293	6,395	7,198	1,073	8,576
1980	21,504	2,220	4,192	7,123	7,222	1,080	9,327
1981	22,208	2,691	4,230	7,244	7,241	1,088	9,989
1982	22,646	2,941	4,147	6,173	7,258	1,069	10,333
1983	23,138	2,765	4,091	6,404	7,271	1,069	10,302
1984	23,263	2,897	3,958	6,458	7,279	1,052	9,691
1989	25,445	2,782	3,610	5,304	7,270	1,010	9,893
1994	27,945	2,687	3,341	5,132	7,181	994	10,261
1999	30,424	2,594	3,092	4,969	7,025	979	10,554

SOURCE: E-D Model Master Run No. 810.

Table II-19. Employment projections with Level I development for selected municipalities within the study area, 1975-1999

Year	Bismarck-Mandan	Killdeer	Halliday	Underwood	Washburn	Beulah	Hazen	Center	Dickinson
1975	23,622	810	546	625	682	962	1,012	1,033	6,567
1976	24,309	806	543	664	758	965	993	1,049	6,685
1977	24,844	803	543	690	806	1,213	1,168	1,021	6,818
1978	25,653	802	548	715	856	1,896	1,661	1,040	7,004
1979	26,473	805	557	712	859	2,938	2,401	1,073	7,223
1980	27,239	1,219	627	681	814	3,347	2,668	1,080	7,871
1981	28,019	1,578	685	694	841	3,432	2,683	1,088	8,446
1982	28,442	1,774	711	680	828	2,850	2,255	1,069	8,747
1983	28,934	1,641	689	673	816	2,982	2,348	1,069	8,717
1984	28,930	1,835	634	654	798	3,039	2,374	1,052	8,185
1989	30,955	1,789	589	604	744	2,453	1,910	1,010	8,352
1994	33,351	1,736	562	562	701	2,375	1,846	994	8,662
1999	35,677	1,684	537	524	661	2,301	1,786	979	8,908

SOURCE: E-D Model Master Run No. 810.

Table II-20. Employment projections with Level II energy development for Burleigh, Dunn, McLean, Mercer, Morton, Oliver, and Stark counties, 1975-1999

Year	Burleigh	Dunn	McLean	Mercer	Morton	Oliver	Stark
1975	18,247	1,655	4,013	2,798	7,357	1,033	7,790
1976	18,864	1,647	4,133	2,777	7,452	1,049	7,930
1977	19,377	1,644	4,198	3,230	7,495	1,021	8,090
1978	20,090	1,651	4,290	4,496	7,658	1,040	8,317
1979	20,814	1,669	4,293	6,395	7,843	1,073	8,576
1980	21,504	2,220	4,192	7,123	8,017	1,080	9,327
1981	22,279	2,695	4,246	7,617	8,189	1,097	10,022
1982	22,783	2,947	4,301	6,688	8,203	1,084	10,389
1983	23,480	2,776	4,388	7,369	8,303	1,107	10,397
1984	23,568	2,909	4,335	7,371	8,072	1,083	9,786
1989	25,672	2,785	4,149	5,999	7,792	1,043	9,935
1994	28,158	2,689	3,862	5,802	7,674	1,025	10,303
1999	30,627	2,596	3,603	5,620	7,490	1,009	10,592

SOURCE: E-D Model Master Run No. 580.

Table II-21. Employment projections with Level II energy development for selected municipalities within the study area, 1975-1999

Year	Bismarck-Mandan	Killdeer	Halliday	Underwood	Washburn	Beulah	Hazen	Center	Dickinson
1975	23,622	810	546	625	682	962	1,012	1,033	6,567
1976	24,309	806	543	664	758	965	993	1,049	6,685
1977	24,844	803	543	690	806	1,213	1,168	1,021	6,818
1978	25,653	802	548	715	856	1,896	1,661	1,040	7,004
1979	26,473	805	557	712	859	2,938	2,401	1,073	7,223
1980	27,239	1,219	627	681	814	3,347	2,668	1,080	7,871
1981	28,116	1,579	687	696	843	3,632	2,830	1,097	8,473
1982	28,629	1,776	714	687	833	3,121	2,460	1,084	8,793
1983	29,403	1,643	695	702	857	3,466	2,753	1,107	8,799
1984	29,347	1,839	639	679	826	3,501	2,749	1,083	8,267
1989	31,268	1,790	591	659	855	2,772	2,225	1,043	8,388
1994	33,647	1,737	563	614	808	2,683	2,150	1,025	8,698
1999	35,957	1,685	538	576	766	2,600	2,081	1,009	8,941

SOURCE: E-D Model Master Run No. 580.

FISCAL REPORTS

Aggregate Income

Aggregate income is the increase in state government revenues associated with energy development. The sales and use tax, personal income, corporate income, and business and corporate privilege tax accounts are estimated based on increased gross business volume (business activity); highway taxes, cigarette and tobacco taxes, and liquor and beer taxes are based on per capita amounts associated with increased population; the conversion and severance taxes are based on annual energy sold and annual tons of coal mined respectively;² and the county equalization fund is the portion of local property tax revenues by which foundation program payments to the school districts are reduced, treated as an income to the state.

In 1982, the portion of severance taxes allocated to the Coal Impact Office (35 percent of severance taxes from the additional projects of Level I) would be \$672,000, while in 1990 when all projects would be fully operational, the amount would be \$15,516,000 annually. It should be noted that the amount of severance taxes allocated to the North Dakota Coal Impact Office has been retained in the state level income. Since the distribution of these funds is not bound by a fixed formula, no attempt was made to estimate distributions to local governments.

Federal royalty payments, while not included in the computerized project data, would add substantially to annual state revenues. The majority of federally owned mineral rights involved in the present proposed energy projects is associated with only the Dunn County project (Natural Gas Pipeline

Company of America). Of this project's total annual requirement of 14 million tons, approximately 40 percent (5,590,000 tons) is estimated to be federally owned. Federal royalties are paid on the basis of 12.5 percent of the value of the coal mined with the state's share of these royalties set at 50 percent. At an average 1976 value of \$6 per ton, annual state revenue from 5,590,000 tons of federally owned coal would be \$3,854,000 in 1985 prices.³

Although aggregate income is that associated with a 15-county area, the majority of the increased revenue could be attributed to economic activity within the seven-county study area. A comparison of the projected 1990 population increases due to Level I energy development between the 15-county total and the seven-county study area indicated that 97.5 percent of that increase was within the seven-county study area.

Level I

During the years prior to plant and mine operation, increased sales and use tax collections are the majority of increased total income (about 39 percent), followed by highway taxes (about 25 percent),

² The severance and conversion tax estimates derived in this section are based on the 1975-1977 tax laws and formulas. These laws and formulae were revised by the 1977 legislature and the results of these changes are described in the conclusion section.

³ The estimated \$6 per ton as a value for coal was provided by company officials of Natural Gas Pipeline Company of America. The \$3,854,000 for 1985 was derived by applying a 7 percent inflation factor per year to the value obtained in 1976.

personal income taxes (about 23 percent), corporate income taxes (about 3 percent), business and corporate privilege taxes (about 2 percent), cigarette/tobacco and liquor/beer taxes (about 5 percent), and county equalization (about 3 percent) (Table II-22).

In 1982, production of energy will begin. However, coal severance and conversion taxes do not begin to add substantially to increased total income until 1984, when they contribute about 66 percent of the total. In 1990, when all projects are operational, coal severance taxes are the primary contributor to total increased income (about 56 percent), followed by coal conversion tax (about 26 percent), sales and use tax (about 7 percent), highway tax (about 5 per-

cent), personal income tax (about 3 percent), corporate income taxes, county equalization, business and corporate privilege taxes, and cigarette and tobacco taxes (all about 1 percent).

Level II

During the years prior to plant and mine operation, increased sales and use tax collections are the primary contributor to increased total income (about 39 percent), followed by highway taxes (about 25 percent), personal income taxes (about 6 percent), cigarette tobacco and liquor beer taxes (about 5 percent), county equalization (about 3 percent), corporate income taxes (about 3 percent), and business and corporate privilege taxes (about 2 percent) (Table II-23).

Table II-22. Aggregate increased state level revenue associated with Level II development (\$000)

Year	Sales & Use Tax	Personal Income	Corporate Income	Corporate Privilege Tax	Highway Tax	Tobacco & Liquor Taxes	County Equalization	Coal Conversion Tax	Severance Tax	Total Revenue
1977	0	0	0	0	0	0	6	0	0	6
1978	309	195	25	17	101	23	32	0	0	702
1979	704	413	57	39	433	98	71	0	0	1,815
1980	1,582	874	120	83	1,010	228	116	0	0	4,013
1981	4,654	2,225	301	207	1,808	407	152	0	0	9,754
1982	6,004	2,781	375	259	2,169	489	255	800	1,921	15,053
1983	6,063	2,757	369	254	2,067	466	358	800	2,035	15,169
1984	2,897	1,450	189	130	2,325	524	464	6,150	9,177	23,306
1985	4,317	2,151	263	180	2,760	622	535	6,150	9,820	26,798
1986	5,068	2,465	301	207	3,008	678	629	15,250	25,831	53,437
1987	5,690	2,708	325	223	3,285	741	842	15,250	27,638	56,702
1988	6,088	2,899	347	239	3,257	734	986	15,250	29,574	59,374
1989	5,420	2,625	308	211	3,441	776	1,141	20,600	41,432	75,954
1990	5,386	2,701	304	209	3,697	833	1,299	20,600	44,332	79,361
1995	7,555	3,789	427	293	5,149	1,161	2,719	20,600	62,178	103,871
1999	9,902	4,966	558	385	6,667	1,502	4,640	20,600	81,502	130,722

Table II-23. Aggregate increased state level income associated with Level II development (\$000)

Year	Sales & Use Tax	Personal Income	Corporate Income	Corporate Privilege Tax	Highway Tax	Tobacco & Liquor Taxes	County Equalization	Coal Conversion Tax	Severance Tax	Total Income
1977	0	0	0	0	0	0	6	0	0	6
1978	309	195	25	17	101	23	32	0	0	702
1979	704	413	57	39	433	98	75	0	0	1,819
1980	1,582	874	120	83	1,010	228	127	0	0	4,024
1981	4,654	2,225	301	207	1,808	407	171	0	0	9,773
1982	6,409	3,035	408	281	2,329	525	280	800	1,921	15,988
1983	6,617	3,094	413	284	2,449	553	406	800	2,055	16,671
1984	8,144	5,353	548	376	2,870	647	550	6,150	9,177	33,815
1985	5,608	2,875	357	245	3,399	766	690	6,150	9,820	29,910
1986	6,546	3,215	395	272	3,931	886	817	15,250	40,607	71,919
1987	6,950	3,273	394	271	4,154	936	1,149	16,050	53,872	87,049
1988	7,436	3,503	421	290	4,189	945	1,373	16,050	57,643	91,850
1989	7,863	3,271	387	266	4,467	1,007	1,584	21,400	71,466	111,711
1990	6,930	3,393	388	267	4,805	1,083	1,886	21,400	76,469	116,621
1995	9,720	4,759	545	374	6,693	1,509	3,706	21,400	107,252	155,958
1999	12,740	6,238	714	491	8,668	1,953	6,326	21,400	140,585	199,115

In 1982, production of energy will begin. However, coal severance and conversion taxes do not begin to add substantially to increased total income until 1984, when they contribute about 45 percent of the total. In 1990, when all projects are operational, coal severance taxes are the primary contributor to total income (about 66 percent), followed by conversion taxes (about 18 percent), sales and use tax (about 6 percent), highway taxes (about 4 percent), personal income tax (about 3 percent), corporate income taxes, county equalization, business corporate and privilege taxes, and cigarette and tobacco taxes (all about 1 percent).

In 1982, the portion of severance taxes allocated to the Coal Impact Office would be \$672,000; while in 1990, when all projects would be fully operational, the amount would be \$26,764,000 annually.

Aggregate Expenditures

Aggregate expenditures are increased state government level expenditures associated with energy development. The distribution of highway funds, cigarette and tobacco taxes, conversion taxes, and severance taxes represent transfers to local units of government of their share of increased revenues collected at the state level. Education transfers to local governments, highway construction costs, and general government functions are increased costs to state government associated with increased population.

Level I

General government functions are the primary contributor to increased total state expenditures

throughout most of the projection period. During the years prior to plant and mine operation, increased general government functions are about 80 percent of total increased expenditures, followed by education transfers (about 11 percent), highway construction (about 5 percent), highway fund transfers (about 3 percent), and cigarette tobacco tax transfers (about 1 percent) (Table II-24). In 1982 when production of energy begins, the distribution of the local government's share of severance and conversion taxes begins to add to state government costs. In 1990 after all projects are operational, increased general government functions make up about 41 percent of total increased expenditures, followed by highway construction (about 31 percent), education transfers (about 12 percent), conversion tax transfers (about 7 percent), severance tax transfers (about 5 percent), highway fund transfers (about 3 percent), and cigarette/tobacco tax transfers (less than 1 percent).

Level II

General government functions are the majority of increased total state expenditures throughout most of the projection period (Table II-25). During the years prior to plant and mine operation, increased general government functions are about 80 percent of the total increased expenditures, followed by education transfers (about 11 percent), highway construction costs (about 5 percent), highway fund distributions (about 3 percent), and cigarette and tobacco tax distributions (about 1 percent). In 1990, after all projects are operational, increased general government functions make up about 40 percent of

Table II-24. Aggregate increased state level expenditures associated with Level I development (\$000)

Year	Education Transfers	Highway Fund	Cigarette and Tobacco	Conversion Tax	Severance Tax	Highway Construction	General Government Functions	Total Expenditures	Net Balance
1977	0	0	0	0	0	1	351	352	-346
1978	101	26	3	0	0	106	1,574	1,810	-1,108
1979	481	117	16	0	0	261	3,704	4,579	-2,764
1980	1,169	276	37	0	0	567	6,961	9,010	-4,997
1981	2,221	519	71	0	0	1,979	8,092	12,882	-3,128
1982	2,629	604	81	270	96	2,242	7,874	13,796	-1,257
1983	2,523	587	80	270	103	2,687	8,778	15,028	141
1984	2,875	655	89	1,005	459	6,199	10,991	22,273	1,033
1985	3,707	819	111	1,005	491	7,852	12,199	26,184	614
1986	4,131	909	124	2,115	1,292	9,167	13,517	31,255	22,182
1987	4,539	1,008	137	2,115	1,381	10,702	14,023	33,905	22,797
1988	4,522	1,045	142	2,115	1,479	11,619	15,170	36,092	23,282
1989	4,782	1,131	154	2,850	2,072	12,653	16,480	40,122	35,832
1990	5,164	1,228	167	2,850	2,217	13,661	17,846	43,133	36,228
1995	7,579	1,837	250	2,850	3,109	20,032	26,717	62,374	41,497
1999	10,254	2,540	345	2,850	4,075	27,246	36,864	84,174	46,548

Table II-25. Aggregate increased state level expenditures associated with Level II development (\$000)

Year	Education Transfers	Highway Fund	Cigarette and Tobacco	Conversion Tax	Severance Tax	Highway Construction	General Government Functions	Total Expenditures	Net Balance
1977	0	0	0	0	0	1	351	352	-346
1978	101	26	3	0	0	106	1,574	1,810	-1,108
1979	481	117	16	0	0	261	3,704	4,579	-2,760
1980	1,169	276	37	0	0	567	6,961	9,010	-4,986
1981	2,221	519	71	0	0	2,215	8,643	13,669	-3,896
1982	2,838	645	87	270	96	2,602	9,190	15,728	260
1983	3,005	685	93	270	103	3,194	10,711	18,061	-1,390
1984	3,554	799	109	1,005	459	6,854	13,280	26,060	7,755
1985	4,512	990	134	1,005	491	10,477	15,576	33,185	-3,275
1986	5,375	1,161	158	2,115	2,031	12,263	16,862	39,965	31,954
1987	5,723	1,257	171	2,385	2,693	14,157	17,668	44,054	42,995
1988	5,786	1,317	179	2,385	2,882	15,427	19,202	47,178	44,672
1989	6,177	1,431	195	3,120	3,573	16,779	20,885	52,160	59,551
1990	6,677	1,557	211	3,120	3,824	18,106	22,589	56,084	60,537
1995	9,763	2,315	315	3,120	5,362	26,454	33,674	81,003	74,955
1999	13,161	3,198	435	3,120	7,029	35,975	46,499	109,417	89,698

total increased expenditures, followed by highway construction costs (about 32 percent), education transfers (about 12 percent), severance tax distribution (about 7 percent), conversion tax distribution (about 6 percent), highway fund distributions (about 3 percent), and cigarette/tobacco tax distribution (less than 1 percent).

State Net Fiscal Balance

The state's annual net fiscal balance for both Level I and Level II is negative during construction activities and positive during operation of the energy facilities (Figures II-2 and II-3). Under the Level I scenario the first positive fiscal balance (\$141,000) is noted in 1983 and increases to \$46,548,000 annually by 1999, while under Level II the annual balance is positive by \$89,698,000 by 1999.

County Fiscal Impact Reports

Summaries of the fiscal reports for each of the seven counties in the study area under Levels I and II are presented in Tables II-26 and II-27. Detailed reports indicating separate revenue and expenditure accounts for each county are presented in Appendix Tables 1-7 for Level I and in Appendix Tables 8-14 for Level II.

Revenue Accounts

Income accounts for each county include the county's share of local property taxes based on new

businesses, residences, and for counties hosting a new mine, taxes from the value of the mine; federal revenue sharing based on a per capita amount for increased population; highway fund transfers from the state, also based on a per capita amount; for counties hosting a new mine, a share of the severance tax collected by the state; and for counties hosting conversion facilities, a share of the conversion taxes collected by the state.

Dunn and Mercer counties under Level I and Dunn, Mercer, and McLean counties under Level II contain all of the conversion facilities and mines addressed in the study. These counties, as hosts for energy facilities and mines, receive a direct share of severance and conversion tax revenues while the remaining counties do not.

During the years of construction activity, sources of increased revenue for both site and nonsite counties consist of property taxes and highway fund distributions. Federal revenue sharing payments do not increase until after a decennial census has been completed.

For the site counties, severance and conversion taxes become major contributors to total increased income when energy production begins. It should be noted that conversion taxes, as a fixed amount per unit of output, will not be subject to inflation and will, therefore, make up a decreasing portion of total increased revenues each year.

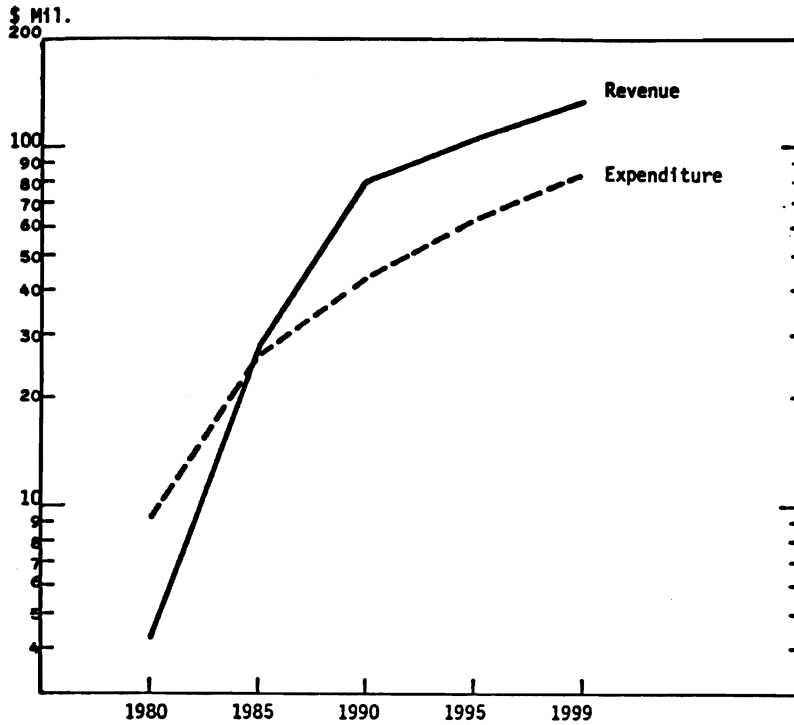


Figure II-2. Aggregate Increased State Level Revenue and Expenditures Associated with Level I Development

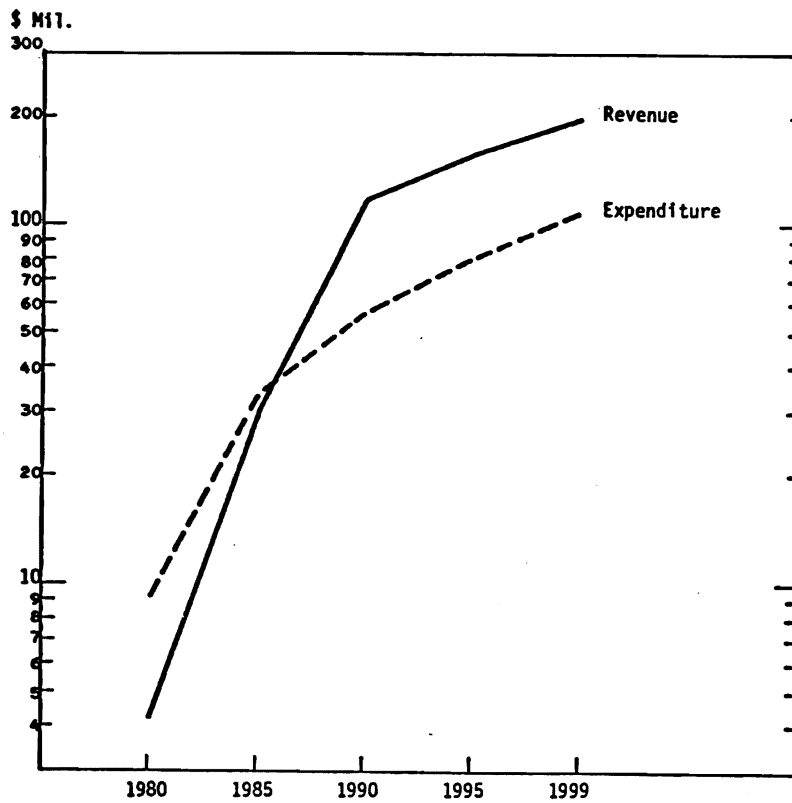


Figure II-3. Aggregate Increased State Level Revenue and Expenditures Associated with Level II Development

Table II-26. Fiscal Report Summaries for Burleigh, Dunn, McLean, Mercer, Morton, Oliver, and Stark Counties Associated with Level I Development (\$000)

Year	Burleigh County			Dunn County			McLean County			
	Revenue	Expenditure	Net Fiscal Balance	Revenue	Expenditure	Net Fiscal Balance	Revenue	Expenditure	Net Fiscal Balance	
1980	44	173	-129	30	171	-141	9	30	-21	
1985	129	293	-164	284	638	-354	17	14	3	
1990	190	440	-250	1,977	1,006	971	22	13	9	
1995	291	653	-362	2,740	1,511	1,229	23	29	-6	
1999	386	885	-499	3,471	2,098	1,373	31	29	2	
<hr/>										
Mercer County			Morton County			Oliver County				
1980	173	902	-729	27	111	-84	0	5	-5	
1985	1,551	1,330	221	78	181	-103	4	10	-6	
1990	2,938	1,820	1,118	119	283	-164	7	27	-20	
1995	3,889	2,753	1,136	184	414	-230	15	46	-31	
1999	4,920	3,853	1,067	245	574	-329	20	68	-48	
<hr/>										
Stark County										
1980	44	220	-176							
1985	157	354	-197							
1990	242	526	-284							
1995	360	745	-385							
1999	474	990	-516							

Table II-27. Fiscal Report Summaries for Burleigh, Dunn, McLean, Mercer, Morton, Oliver, and Stark Counties Associated with Level II Development (\$000)

Year	Burleigh County			Dunn County			McLean County			
	Revenue	Expenditure	Net Fiscal Balance	Revenue	Expenditure	Net Fiscal Balance	Revenue	Expenditure	Net Fiscal Balance	
1980	44	173	-129	30	171	-141	10	30	-20	
1985	170	408	-238	283	638	-355	87	236	-149	
1990	249	605	-356	1,976	1,008	968	1,186	390	796	
1995	406	882	-476	2,739	1,513	1,226	1,733	600	1,133	
1999	539	1,188	-649	3,475	2,112	1,363	2,275	829	1,446	
<hr/>										
Mercer County			Morton County			Oliver County				
1980	186	902	-716	27	111	-84	0	5	-5	
1985	1,669	1,688	-19	99	233	-134	6	23	-17	
1990	3,937	2,252	1,685	147	359	-212	12	48	-36	
1995	5,330	3,439	1,891	237	508	-271	22	57	-35	
1999	6,796	4,790	2,006	314	707	-393	29	77	-48	
<hr/>										
Stark County										
1980	44	220	-176							
1985	163	382	-219							
1990	256	560	-304							
1995	383	793	-410							
1999	505	1,053	-548							

Expenditure Accounts

Expenditure accounts for each county include law enforcement, social services, and other government functions. All three accounts are based on cost functions yielding per capita costs for increased population.

The primary increased expenditure for both site and nonsite counties is the cost of other government functions, followed by social services and law enforcement. Total expenditures increase in proportion to population increases throughout the projection period.

Table II-28. Fiscal Report Summaries for Selected Cities Within the Study Area Associated with Level I Development (\$000)

Year	Revenue	Expenditure	Net Fiscal Balance	Revenue	Expenditure	Net Fiscal Balance	Revenue	Expenditure	Net Fiscal Balance
Bismarck				Killdeer			Halliday		
1980	504	1,337	-833	82	1,093	-1,011	31	113	-82
1985	1,297	2,067	-770	2,819	4,387	-1,568	155	237	-82
1990	1,765	2,786	-1,021	4,414	6,108	-1,694	325	343	-18
1995	2,232	3,751	-1,519	5,906	8,528	-2,622	376	433	-57
1999	2,708	4,406	-1,698	7,927	11,342	-3,415	422	519	-97
Beulah				Hazen			Mandan		
1980	1,788	3,869	-2,081	1,296	2,802	-1,506	173	490	-317
1985	4,242	5,847	-1,605	2,774	3,943	-1,169	463	757	-294
1990	5,586	7,176	-1,590	3,434	4,680	-1,246	651	1,076	-425
1995	7,352	9,969	-2,617	4,435	6,425	-1,990	861	1,432	-571
1999	8,914	11,957	-3,043	5,262	7,529	-2,267	1,025	1,743	-718
Center				Dickinson					
1980	22	43	-21	271	1,501	-1,230			
1985	55	84	-29	1,261	2,232	-971			
1990	106	193	-87	1,871	2,922	-1,051			
1995	167	297	-130	2,371	3,767	-1,396			
1999	214	391	-177	2,897	4,623	-1,726			

Table II-29. Fiscal Report Summaries for Selected Cities within the Study Area Associated with Level II Development (\$000)

Year	Revenue	Expenditure	Net Fiscal Balance	Revenue	Expenditure	Net Fiscal Balance	Revenue	Expenditure	Net Fiscal Balance
Bismarck				Killdeer			Halliday		
1980	504	1,337	-833	82	1,093	-1,011	31	113	-82
1985	1,710	2,912	-1,202	2,801	4,391	-1,590	152	227	-75
1990	2,422	3,864	-1,442	4,434	6,146	-1,712	321	333	-12
1995	3,133	5,092	-1,959	5,919	8,562	-2,643	369	417	-48
1999	3,763	6,082	-2,319	7,592	11,420	-3,828	420	502	-82
Underwood				Washburn			Beulah		
1980	0	0	0	22	0	22	1,812	3,869	-2,057
1985	62	271	-209	126	482	-356	4,920	7,127	-2,207
1990	267	390	-123	626	831	-205	6,638	8,586	-1,948
1995	388	554	-166	911	1,212	-301	8,799	11,926	-3,127
1999	517	769	-252	1,186	1,574	-388	10,786	14,590	-3,804
Hazen				Mandan			Center		
1980	1,314	2,802	-1,488	173	490	-317	22	43	-21
1985	3,340	5,030	-1,690	620	1,064	-444	70	186	-116
1990	4,439	6,002	-1,563	868	1,414	-546	164	284	-120
1995	5,812	8,296	-2,484	1,127	1,854	-727	226	382	-156
1999	7,018	10,038	-3,020	1,374	2,307	-933	254	451	-197
Dickinson									
1980	323	1,501	-1,178						
1985	1,329	2,384	-1,055						
1990	2,000	3,093	-1,093						
1995	2,519	3,982	-1,463						
1999	3,054	4,919	-1,865						

County Net Fiscal Balances

Deficit fiscal balances are projected for each of the counties in the study area during the years that construction activity is taking place in or near that county (Appendix Figures 1 through 14).

Fiscal balances are positive for each of the site counties (Dunn, McLean, and Mercer) once full operation of facilities begins and severance and conversion taxes are distributed to these counties. Conversion taxes, which are a significant portion of total increased revenues for the site counties, are a fixed amount per unit of output. Hence, while all costs are subject to inflation, a substantial amount of revenue is not.

Municipal Fiscal Impact Reports

Summaries of municipal fiscal reports for selected cities within the study area are presented in Table II-28 for Level I and in Table II-29 for Level II. A detailed breakdown of the municipal revenue and expenditure accounts for both levels of development can be found in Appendix Tables 15 through 32.

Revenue Accounts

Revenue accounts for each city include the city's share of local property taxes based on new businesses, residences, and for cities within a county hosting a new mine, taxes from the value of the mine; education transfers from the state (included in municipal revenues since there is no separate report for school districts) based on a per pupil payment; federal revenue sharing based on a per capita amount for increased population; user's fees based on a per household amount; special assessments resulting from capital investment in streets, water distribution and treatment systems, and waste water treatment and disposal systems; highway fund and cigarette and tobacco tax transfers from the state based on per capita amounts for each; and for cities within a county hosting a new conversion facility, a share of the county's conversion taxes.

The primary increased revenue for most municipalities is the special assessments. Special assessments are a substantial part of increased revenue through most of the projection period as a result of capital investment in streets, water distribution and treatment systems, and waste water treatment and disposal systems made during peak construction activity.

Expenditure Accounts

Increased municipal expenditures include schools, streets, police, fire, other city government, and debt service. School expenditures represent a cost per pupil for new students; street expenditures are the cost of maintaining the number of new miles of street required for an increased population; police, fire, and other city government expenditures

are based on cost functions yielding per capita costs for increased population; and debt service is the annual payment of amortized capital investment in streets, water distribution and treatment systems, and waste water treatment and disposal systems.

Throughout most of the projection period, the primary contributor to total increased expenditures is debt service, followed by other city government costs, school costs, police and fire costs, and street maintenance. During the later years of the projection period, other city government costs become the primary contributor to increased expenditures. Debt service, representing amortization of capital investment, is not affected by inflation in the same manner as the other accounts and, as a result, makes up a decreasing percent of total expenditures.

Municipal Fiscal Balances

Net fiscal balances for most cities affected by energy development were projected to be negative (Appendix Figures 15 through 32). Debt service costs, incurred at the peak of construction activity, remain relatively high throughout the projection period, while revenues reflect correspondingly reduced population.

Effects on Agricultural Land Use

Productivity

Changes in land use resulting from energy development include land taken from agricultural use for residential and associated uses, land taken for plant and mine sites, and the acreage to be mined (mined land can be held out of production for five years)⁴. The reduction in acreage was converted to a reduction in sales to final demand to derive reduction in gross business volume (Table II-30). Reduced gross business volume in 1990 resulting from Level I development totaled \$121,000 in the livestock sector and \$237,000 in the crops sector. These figures represent about four-hundredths of 1 percent of the projected 1990 gross business volume in each of the livestock and crops sectors. Under Level II development, reduced gross business volume in 1990 reached \$231,000 in the livestock sector and \$443,000 in the crops sector (Table II-31). These figures represent about eight-hundredths of 1 percent of projected 1990 gross business volume in each of the livestock and crops sectors.

⁴The effects on agricultural land use are incorporated in the model and therefore are included in the model's projections. The effects are presented here as an indication of their magnitude.

Table II-30. Reduction in Gross Business Volume for all Sectors Resulting from Land Use Changes Associated with Level I Development in State Regions 7 and 8, with 100 Percent Productivity through Reclamation, 1990 (1972 Prices) (Thousand Dollars)

Sector	State Region 7	State Region 8
1. Livestock	86	35
2. Crops	161	76
3. Mining	0	0
4. Construction	13	5
5. Transportation	1	0
6. Comm. & Utilities	15	7
7. Whls. & Ag. Proc.	57	24
8. Retail	146	67
9. Fin., Ins., R.E.	29	13
10. Bus. & Pers. Serv.	11	5
11. Prof. & Soc. Serv.	12	4
12. Households	187	85
13. Governments	17	7
Total	735	328

Table II-31. Reduction in Gross Business Volume for all Sectors Resulting from Land Use Changes Associated with Level II Development in State Regions 7 and 8, with 100 Percent Productivity through Reclamation, 1990 (1972 Prices) (Thousand Dollars)

Sector	State Region 7	State Region 8
1. Livestock	190	41
2. Crops	355	88
3. Mining	2	0
4. Construction	30	7
5. Transportation	5	0
6. Comm. & Util.	34	7
7. Whls. & Ag. Proc.	126	28
8. Retail	322	78
9. Fin., Ins., R.E.	67	15
10. Bus. & Pers. Serv.	25	5
11. Prof. & Soc. Serv.	26	6
12. Households	411	99
13. Governments	39	8
Total	1,632	382

Effect on State Revenues, Level I

Application of interdependence coefficients to the decreased expenditures in the livestock and crops sectors in 1990 results in a decrease in gross business volume of \$215,174 to the retail trade sector, \$273,826 to the household sector, and \$429,477 to the business sectors (Table II-32). The resulting loss in annual state taxes in 1976 price totals \$13,928, consisting of \$8,392 in sales and use taxes, \$4,425 in personal income taxes, \$659 in corporate income taxes, and \$452 in business and corporate privilege taxes (Table II-33).

The loss of \$276,000 in local expenditures (Table II-32) results in a decreased employment of 17 workers. Based on a family size of 3.5, a total of 60 residents would be displaced. This results in a decreased total annual revenue in 1976 prices of \$7,821, consisting of \$6,463 in highway taxes, \$847 in cigarette and tobacco taxes, and \$511 in liquor and beer taxes (Table II-34).

Table II-32. Decrease in Annual Gross Business Volume Due to Level I Projects, 1990 (1972 Prices)^a

	Livestock Sector	Crops Sector	Total
Decrease in Expenditure	\$ 90,000	\$186,000	\$276,000
Interdependence Coefficients:			
Retail Trade	0.7098	0.8134	
Households	1.0490	0.9646	
All Businesses	1.7598	1.4575	
Gross Business Volume Lost:			
Retail Trade	\$ 63,882	\$151,292	\$215,174
Households	94,410	179,416	273,826
All Businesses	158,382	271,095	429,477

^aDecrease in annual gross business volume is a result of decreased expenditures in the livestock and crop sectors due to farmland displaced by energy facilities, mining, and housing and businesses.

Table II-33. Estimated State Tax Revenues Lost Annually by Sector and Type of Tax Due to Level I Projects

Sector	Type of Tax	Gross Business Volume	Tax Estimator	Tax Revenue (1972\$)	Tax Revenue (1976\$) ^a
Retail Trade	Sales and Use	\$215,174	.03	\$ 6,455	\$ 8,392
Household	Personal Income	273,826	.0118	3,231	4,425
All Businesses	Corporate Income	429,477	.00112	481	659
All Businesses	Business and Corporate Privilege	429,477	.00077	331	452
Total				\$10,498	\$13,928

^aGross business volume is in constant dollars with a 1972 base; therefore, revenues estimated on the basis of gross business volume were inflated to current year dollars.

Table II-34. Estimated Decreases in State Tax Revenues by Type of Tax Associated with Loss of Residents Due to Farmland Displaced by Level I Projects, 1990

Type of Tax	Per Capita Estimator ^a	Number of Residents Displaced ^b	Tax Revenues (1976\$)
Highway Taxes ^c	\$107.72	60	\$6,463
Cigarette and Tobacco Tax	14.11	60	847
Liquor and Beer Tax	10.18	60	511
Total	\$132.01		\$7,821

^aBased on 1972 estimators and inflated to 1976 prices.

^bBased on 17 workers displaced due to farmland displaced and a family size of 3.50.

^cIncludes revenues from the motor vehicle excise and use tax, motor vehicle fuel and special fuel tax, and the motor vehicle registration tax.

Effect on State Revenues, Level II

Application of interdependence coefficients to the decreased expenditures in the livestock and crops sectors in 1990 results in a decrease in gross business volume of \$402,012 to the retail trade sector, \$512,082 to the household sector, and

\$803,461 to the business sectors (Table II-35). The resulting loss in annual state taxes in 1976 prices totals \$25,513, consisting of \$15,682 in sales and use taxes, \$7,856 in personal income taxes, \$1,170 in corporate income taxes, and \$805 in business and corporate privilege taxes (Table II-36).

Table II-35. Decrease in Annual Gross Business Volume Due to Level II Projects, 1990 (1972 Prices)^a

	Livestock Sector	Crops Sector	Total
Decrease in Expenditure	\$170,000	\$346,000	\$516,000
Interdependence Coefficients:			
Retail Trade	0.7098	0.8134	
Households	1.0490	0.9646	
All Businesses	1.7598	1.4575	
Gross Business Volume Lost:			
Retail Trade	\$120,666	\$281,436	\$402,102
Households	178,330	333,752	412,082
All Businesses	299,166	504,295	803,461

^aDecrease in annual gross business volume is a result of decreased expenditures in the livestock and crop sectors due to farmland displaced by energy facilities, mining, and housing and businesses.

Table II-36. Estimated State Tax Revenues Lost Annually by Sector and Type of Tax Due to Level II Projects

Sector	Type of Tax	Gross Business Volume	Tax Estimator	Tax Revenue (1972\$)	Tax Revenue (1976\$) ^a
Retail Trade	Sales and Use	\$402,102	.03	\$12,063	\$15,682
Household	Personal Income	512,082	.0118	6,043	7,856
All Businesses	Corporate Income	803,461	.00112	900	1,170
All Businesses	Business and Corporate Privilege	803,461	.00077	619	805
Total				\$19,625	\$25,513

^aGross business volume is in constant dollars with a 1972 base; therefore, revenues estimated on the basis of gross business volume were inflated to current year dollars.

The loss of \$516,000 in local expenditures (Table II-35) results in a decreased employment of 37 workers. Based on a family size of 3.5, a total of 130 residents would be displaced. This results in a decreased total annual revenue in 1976 prices of \$17,161, consisting of \$14,004 in highway taxes, \$1,834 in cigarette and tobacco taxes, and \$1,323 in liquor and beer taxes (Table II-37).

Effect on Local Property Tax Revenues, Level I

Farm property tax revenues lost in the study area due to strip mining of farmland were based on 350 acres mined annually in Dunn County and 570 acres

mined annually in Mercer County. In 1990, this would result in a total loss of property tax revenues annually of \$9,800 in 1976 prices (Table II-38).

Effect on Local Property Tax Revenue, Level II

Farm property tax revenues lost in the study area due to strip mining of farmland were based on annual mining of 350 acres in Dunn County, 1,220 acres in McLean County, and 1,060 acres in Mercer County. In 1990, this would result in a total loss of property tax revenues annually of \$28,000 in 1976 prices (Table II-39).

Table II-37. Estimated Decreases in State Tax Revenues by Type of Tax Associated with Loss of Residents Due to Farmland Displaced by Level II Projects, 1990

Type of Tax	Per Capita Estimator ^a	Number of Residents Displaced ^b	Tax Revenues (1976\$)
Highway Taxes ^c	\$107.72	130	\$14,004
Cigarette and Tobacco Tax	14.11	130	1,834
Liquor and Beer Tax	10.18	130	1,323
Total	\$132.01		\$17,161

^aBased on 1972 estimators and inflated to 1976 prices.

^bBased on 37 workers displaced due to farmland displaced and a family size of 3.50.

^cIncludes revenues from the motor vehicle excise and use tax, motor vehicle fuel and special fuel tax, and the motor vehicle registration tax.

Table II-38. Estimated Decrease in Farm Property Tax Revenues Resulting From Level I Energy Development, 1990

County	Total Number of Acres Mined Annually	Total Number of Acres Unreclaimed ^a	Property Tax Loss (1976 Prices) ^b
Dunn	350	1,750	\$3,700
Mercer	570	2,850	6,100
Total	920	4,600	\$9,800

^aState law stipulates mined land can be held out of production for a maximum of six years, excluding the year it is mined.

^bBased on a \$105 per acre land value in 1972 prices and inflated to a 1976 value of \$144. The value per acre was used in conjunction with a revenue estimator of 1.48 percent to derive property tax revenue lost.

Table II-39. Estimated Decrease in Farm Property Tax Revenues Resulting From Level II Energy Development, 1990

County	Total Number of Acres Mined Annually	Total Number of Acres Unreclaimed ^a	Property Tax Loss (1976 Prices) ^b
McLean	1,220	6,100	\$13,000
Mercer	1,060	5,300	11,300
Dunn	350	1,750	3,700
Total	2,630	13,150	\$28,000

^aState law stipulates mined land can be held out of production for a maximum of six years, excluding the year it is mined.

^bBased on a \$105 per acre land value in 1972 prices and inflated to a 1976 value of \$144. The value per acre was used in conjunction with a revenue estimator of 1.48 percent to derive property tax revenue lost.

Changes in Severance and Conversion Tax Formulas

The 1977 North Dakota Legislative Assembly acted to substantially increase the revenue from severance taxes and to increase the local governments' shares of both taxes. Most of the increased local revenue results from the changes pertaining to the severance tax. As of July, 1977, the severance tax rate became \$0.65 per ton, increasing \$0.01 per ton for each one-point rise in the U.S. Department of Commerce's Wholesale Price Index (WPI). (It had been \$0.50 per ton beginning in January 1975, and adjusted for inflation by \$0.01 per ton for each three-point rise in the WPI). In addition, distribution to the site county was increased from 5 percent to 20 percent, with cities and school districts, as well as the county general fund, sharing receipts. (Previously the county retained the entire 5 percent.) Loans from the state's trust fund (financed by 15 percent of severance tax receipts) were also made available to local governments.

The effects of the changes in severance and conversion taxes were tested by REAP using the economic-demographic model. REAP's scenario included two electric generating plants of 440 megawatts each, one electric generating plant of two 486 megawatt units, one electric generating plant of two 450 megawatt units and a gasification plant. A total of 29.7 million tons of coal would be mined annually under this scenario (Schaible and Leistritz).

Fiscal balances for the state, county, and municipal governments are presented in Appendix Tables 33 through 51. At the state and county levels, the nature of the fiscal effects of development remain similar to those noted under the 1975 laws. After fiscal deficits in the early years of development, the state and counties hosting development are projected to experience revenue surpluses. Counties not hosting development, yet receiving impact from development, tend to experience fiscal deficits throughout the projection period. However, while the nature of fiscal effects at these levels may remain unchanged by the new laws, the magnitudes do not. Fiscal deficits are greatly reduced while revenue surpluses are greatly increased.

The severance and conversion tax law changes have the greatest effect at the municipal level. Whereas previously, virtually all cities affected by development were projected to experience financial difficulties throughout the projection period, projections using the new laws present a substantially different picture. Site county cities would still have fiscal deficits during the early years of development but would have surpluses during the later years. This is particularly notable in the Mercer County cities of Beulah and Hazen, which represent the heart of projected development. Under the former law, both cities were projected to experience substantial deficits throughout the period, but now are project-

ed to have substantial surpluses once plant and mine operation begin.

It should be noted that the fiscal deficits projected under this scenario would likely be substantially reduced by grants made from the state's coal impact fund. For example, in 1979, aggregate deficits for the seven counties and principally impacted cities would total \$4,567,000. The revenue received by the coal impact office in 1979 from all operational projects would be about \$1,375,000 or about 30 percent of the total local deficit. Another \$589,000 (15 percent) would have been received by the state's trust fund in 1979 and would be available for local government loans.

CONCLUSIONS

The effects of energy development on the socio-economic environment will depend on many factors including the state and local tax structure, tax concessions (if any) offered to new industries, the extent of excess capacity in public facilities, and the success of preplanning. Many of the factors involved must be assessed to some extent on a case-by-case basis, but this study has some general implications that may be useful to planners and decision makers at both state and local levels.

Considerable emphasis has been directed to the effect that energy development may have on public sector costs and revenues. At the local level, cash flow problems can be expected in the early years of development as the new population requires additional services (and public expenditures) immediately; whereas, much of the projected added tax revenues begin to accrue only after new residential, business, and industrial property have been constructed. For counties hosting development and for the cities in host counties, fiscal balances are expected to be positive when production of energy begins and coal severance and/or conversion taxes begin to accrue. Units of government experiencing revenue shortfalls would be forced to either increase tax rates or reduce governmental services or both to balance their budgets.

MONTANA

Projections of fiscal impact resulting from coal development in Montana were summarized from a research study by Krutilla and Fisher. This study considered four alternative coal development scenarios (Table II-40):

Scenario I: Current (1975) level of coal development, approximately 20 million tons annually. Only the energy conversion facilities in the Colstrip area were included in Scenario I.

Scenario II: An additional 22 million tons to be reached by 1980.

Scenario III: An additional 60 million tons (over Scenario II) to be reached by 1985—40 million tons in Rosebud County and 20 million tons in Big Horn County.

Table II-40. Projected Montana Coal Production, Big Horn and Rosebud Counties, Scenarios I-III

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Thousands of Tons											
Scenario I											
Big Horn	12,250	12,250	12,250	12,250	12,250	12,250	12,250	12,250	12,250	12,250	12,250
Rosebud	8,230	8,230	8,230	8,230	8,230	8,230	8,230	8,230	8,230	8,230	8,230
Total	20,480	20,480	20,480	20,480	20,480	20,480	20,480	20,480	20,480	20,480	20,480
Scenario II											
Big Horn	12,250	14,900	17,400	21,000	18,600	20,400	21,000	21,000	21,000	21,000	21,480
Rosebud	8,230	13,430	16,500	17,900	20,700	22,100	22,100	22,100	22,100	22,100	22,100
Total	20,480	28,330	33,900	38,900	39,300	42,500	43,100	43,100	43,100	43,100	43,100
Scenario III											
Big Horn	12,250	14,900	17,490	22,600	23,590	28,400	35,900	37,400	41,000	41,000	41,000
Rosebud	8,230	13,520	18,190	24,490	33,600	43,490	50,100	57,000	58,500	62,100	62,100
Total	20,480	28,420	35,680	47,090	57,190	71,890	86,000	94,400	99,500	103,100	103,100

SOURCE: Krutilla, John V. and Anthony C. Fisher, The Regional Economic and Fiscal Impacts of Energy Resource Development: A Case Study of Northern Great Plains Coal, Resources for the Future, Inc., Washington, D.C., August, 1976.

Scenario IV: Coal production reached under Scenario III plus two electric generating plants of 2,600 megawatts each in Rosebud County and a 250 million cubic foot per day gasification plant in Big Horn County.

Infrastructure projections were made using an econometric forecasting model. Changes in indirect employment were based on changes in industry output. Population projections were based on a cohort-survival technique whereby population by age and region is determined by births, deaths, and net migration. Net migration was adjusted by the average wage and measures of labor surplus in a region.

Increased revenues were estimated from increased coal extraction and related activities, increased economic activity, changes in local property tax bases, and other revenues as proportional to population increases. Debt service limits were assumed to be 5 percent of assessed valuation with an additional 10 percent limit for water and sewer facilities.

Costs were estimated on the basis of increased demand for public services and facilities created by increased population. Standard costs for both operating and capital expenditures for providing increased services were then applied to the new service and facility requirements.

Employment

Aggregate employment for Big Horn County was projected to stabilize at about 3,800 without development beyond 1975 (Scenario I). In Rosebud County, employment was projected to decline from about 4,500 in 1975 to a low of about 3,400 in 1978 following completion of the Colstrip projects. Secondary, or indirect growth would then result in increasing employment to about 4,300 by 1990.

Scenario II creates additional employment of about 500 for Big Horn County and about 1,000 for Rosebud County, while Scenario III would add another 800 employees to Big Horn and 1,800 to Rosebud.

Scenario IV presents the most drastic changes in employment for both counties. However, the fluctuation between construction and operation employment was not great in Big Horn County, increasing by 1,900 employees (over Scenario III) by 1983 with an increase of about 1,600 permanent employees beginning in 1985. For Rosebud County, employment during construction was projected to reach a peak increase of 5,100 by 1982 and decline to a permanent increase of 1,500 by 1990. A summary of projected total employment under the four alternative scenarios is presented in Figure II-4 for Big Horn County and Figure II-5 for Rosebud County.

Population

Population changes corresponding to changes in employment for the four levels of development are indicated in Figure II-6 for Big Horn County and in Figure II-7 for Rosebud County. The projected patterns of population change correspond to the patterns of employment change just described. Total projected stable population for Big Horn County varies from about 12,400 people in 1985 under Scenario I to about 21,000 people in 1985 for Scenario IV (with population under the four scenarios being relatively stable after 1985). Population projections for Rosebud County fluctuate in accordance with employment projections, generally indicating an increasing population under all four scenarios from about 1982. Population of Rosebud County for 1990 was projected to be about 9,800 under Scenario I compared to about 18,200 under Scenario IV.

Aggregate Employment (Thous.)

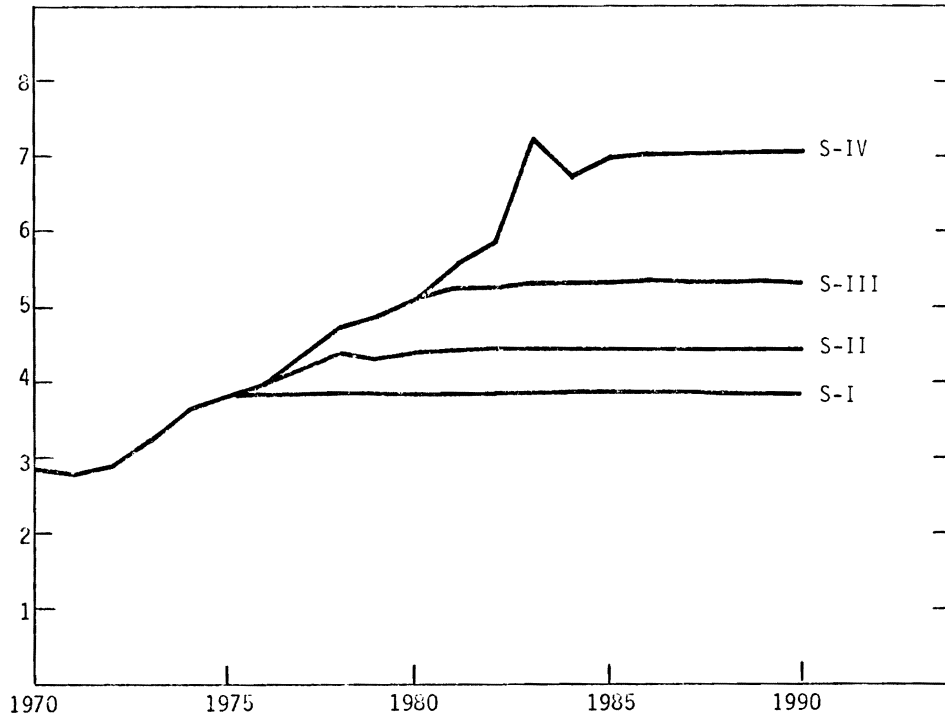


Figure II-4. Projected Aggregate Employment for Big Horn County, 1970-1999

Aggregate Employment (Thous.)

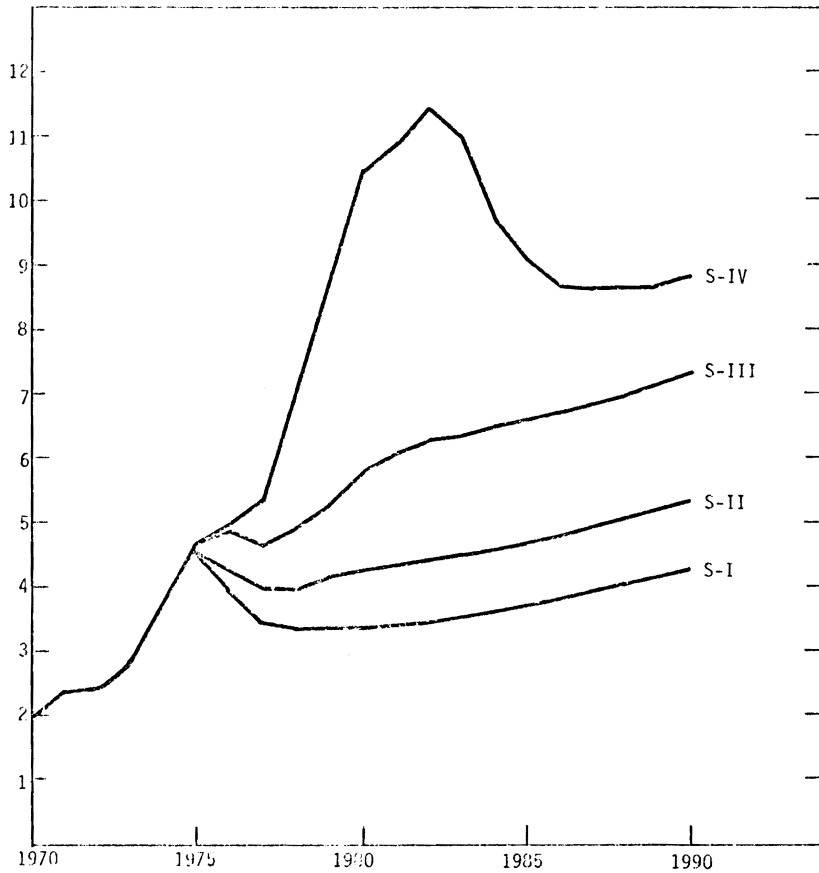


Figure II-5. Projected Aggregate Employment for Rosebud County, 1970-1999

Population (Thous.)

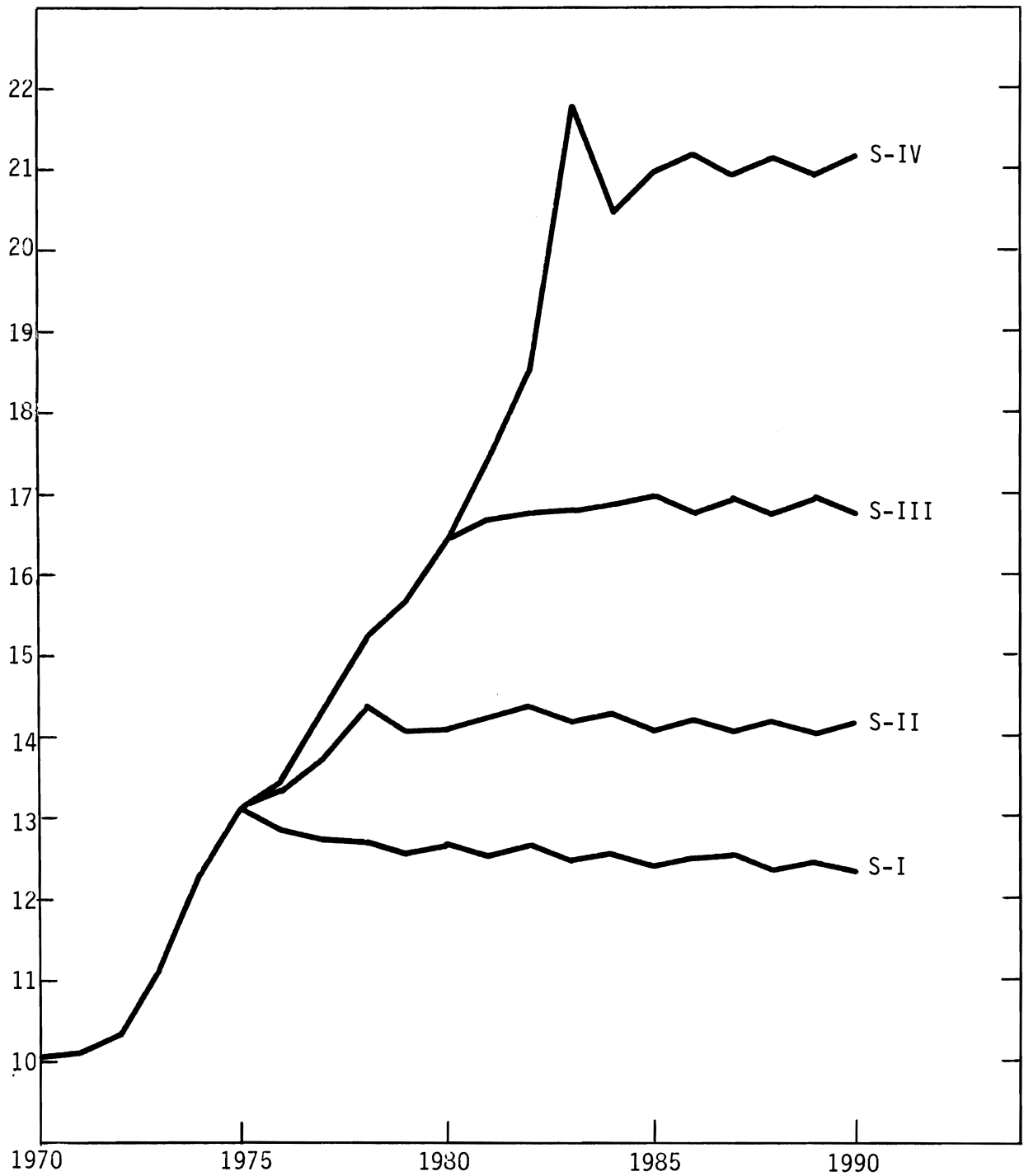


Figure II-6. Big Horn County Population Projections, 1970-1990

Population (Thous.)

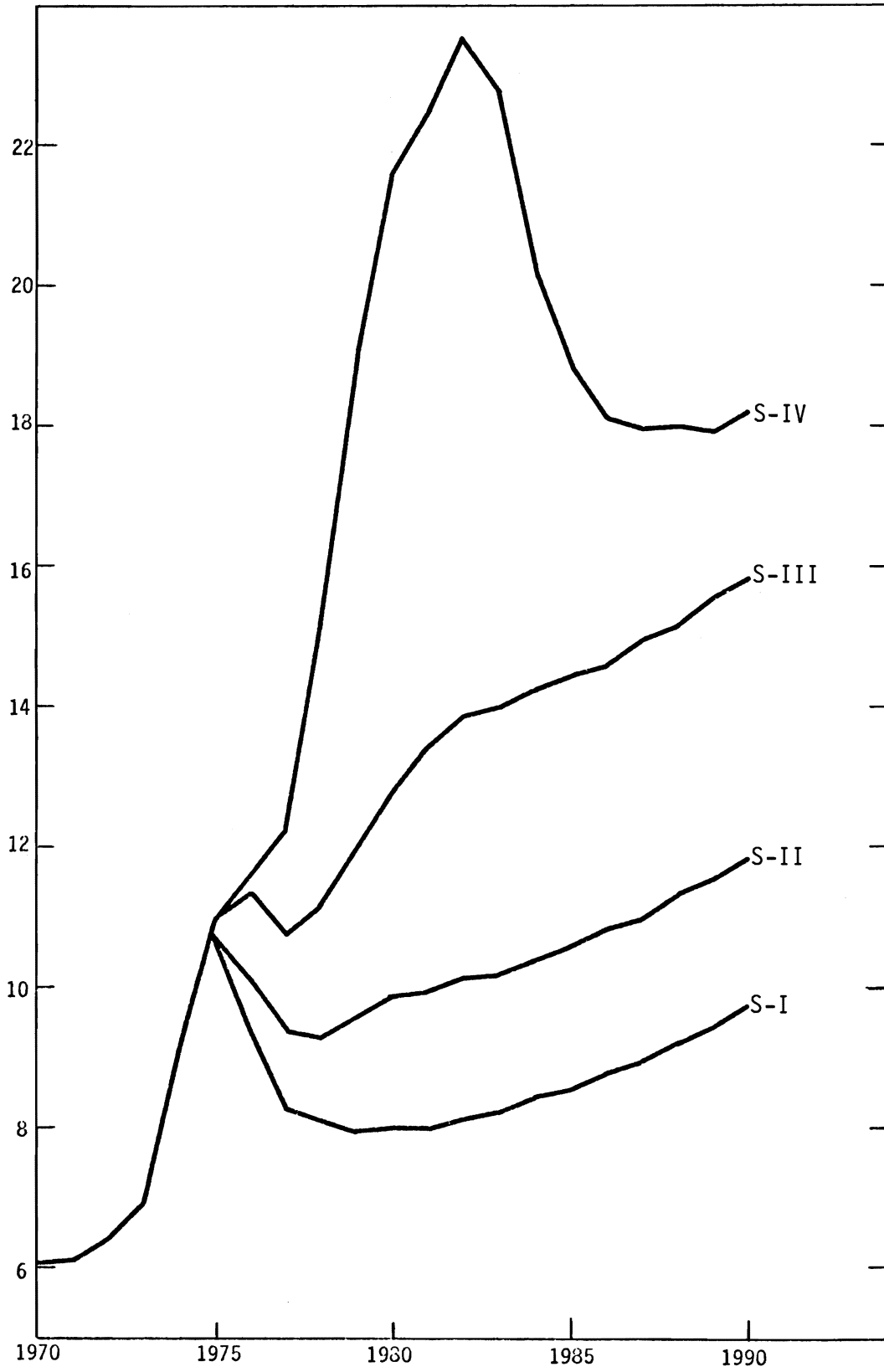


Figure II-7. Rosebud County Population Projections, 1970-1990

School Enrollment

School enrollment projections were indicated only for the upper bound case, Scenario IV. School enrollments in Big Horn County under Scenario IV were projected to increase from a total elementary enrollment of 2,389 in 1975 to a peak of 3,093 in 1983, and then decline to 2,090 by 1990. The corresponding changes for high school enrollment were from 795 in 1975 to a peak of 1,265 in 1983, and then a decline to 1,014 in 1990 (Table II-41).

In Rosebud County, total elementary enrollment under Scenario IV was projected to increase from approximately 1,943 in 1975 to a peak of 3,489 in 1982 and then decline to 2,056 by 1990. High school enrollment could be expected to increase from about 646 in 1975 to a peak of 1,379 in 1983, and then decline to about 976 by 1990.

Fiscal Projections

Schools

Appendix Figures 33 through 40 compare educational expenditures and receipts under the four different scenarios for both Big Horn and Rosebud counties. Except for 1975, all scenarios reflect revenue surpluses for both counties.

Counties

Estimated per capita county government expenditures under the four scenarios are presented in Table II-42 for Big Horn County and in Table II-43 for Rosebud County. Highest per capita expenditures are reached under Scenario IV for both counties. Under this scenario, county expenditures in Big Horn in-

crease from \$139 per capita in 1975 to \$249 in 1989 and then decline to \$247 in 1990; while in Rosebud, expenditures increase from \$143 to \$520 during the same period.

Per capita county revenues were also highest under Scenario IV (Tables II-44 and II-45). Revenues for Big Horn increased from \$154 per capita in 1975 to \$296 in 1989, then decreased to \$294 in 1990; and for Rosebud, from \$148 in 1975 to \$488 in 1990. Comparison of per capita revenues to per capita expenditures indicates that both counties could expect revenue surpluses for all years under Scenarios I, II, and III and Big Horn would also experience surpluses for each year under Scenario IV. Rosebud, however, could expect a fiscal deficit under Scenario IV for each year after 1984.

Rosebud's projection of fiscal deficit under Scenario IV (while experiencing surpluses under the other three scenarios) results from the tax structure for coal development. Coal mining (with the associated severance tax) provides for considerably greater revenue than that produced by coal conversion facilities. Scenario IV includes three large coal conversion facilities (one gasification plant and two electric generating plants) with correspondingly large work forces; while the other three scenarios consist only of export mines. Thus the population increases of Scenario IV do not reflect the relative magnitude of per capita revenues of the other scenarios. Rosebud, with two large electric generating plants, experiences considerably greater population increases than does Big Horn.

Table II-41. Total School Enrollment Projections Assuming 250 Students Per 1,000 Population for Big Horn and Rosebud Counties, Scenario IV

Year	Big Horn			Rosebud		
	Elementary	Secondary	Total	Elementary	Secondary	Total
1975	2,389	795	3,184	1,943	646	2,589
1976	2,376	814	3,190	2,049	699	2,748
1977	2,474	870	3,344	2,104	736	2,840
1978	2,535	921	3,456	2,547	914	3,461
1979	2,504	950	3,454	3,091	1,137	4,228
1980	2,510	993	3,503	3,410	1,286	4,696
1981	2,568	1,053	3,621	3,446	1,331	4,777
1982	2,624	1,104	3,728	3,489	1,379	4,868
1983	3,093	1,265	4,358	3,279	1,327	4,606
1984	2,630	1,140	3,770	2,812	1,166	3,978
1985	2,781	1,204	3,985	2,545	1,080	3,625
1986	2,625	1,166	3,791	2,356	1,022	3,378
1987	2,411	1,109	3,520	2,256	1,002	3,258
1988	2,324	1,094	3,418	2,184	991	3,175
1989	2,144	1,039	3,183	2,094	972	3,066
1990	2,090	1,014	3,104	2,056	976	3,032

Table II-42. Estimated Per Capita County Expenditures, Big Horn County, 1975-1990

Year	Scenario I	Scenario II	Scenario III	Scenario IV
1975	\$139.07	\$ 139.07	\$139.07	\$139.07
1976	142.20	151.55	151.07	151.07
1977	143.29	158.33	156.26	156.27
1978	144.34	170.31	174.65	174.65
1979	145.88	164.39	177.94	177.96
1980	145.79	172.07	191.65	191.67
1981	147.64	171.38	213.44	208.77
1982	147.14	170.68	218.61	206.87
1983	148.91	172.85	230.17	202.54
1984	148.66	172.42	230.22	208.00
1985	150.59	174.74	229.89	216.08
1986	150.22	1,174.15	232.26	215.29
1987	150.42	176.02	231.20	217.48
1988	151.98	175.42	233.53	246.38
1989	151.61	177.25	232.41	248.53
1990	153.15	176.60	234.64	247.17

Table II-44. Estimated Per Capita County Revenues, Big Horn County, 1975-1990

Year	Scenario I	Scenario II	Scenario III	Scenario IV
1975	\$153.92	\$153.92	\$153.92	\$153.92
1976	156.03	170.45	169.82	169.82
1977	156.96	180.20	177.42	177.42
1978	157.47	196.96	202.66	202.66
1979	158.54	187.67	207.45	207.46
1980	158.11	197.41	226.16	226.18
1981	159.53	196.44	253.65	248.08
1982	158.81	195.49	259.91	246.44
1983	160.14	197.47	273.14	240.64
1984	159.70	196.82	273.23	247.90
1985	161.19	198.96	275.85	257.82
1986	160.65	198.15	275.29	256.85
1987	160.61	199.83	274.14	259.13
1988	161.77	199.01	276.56	293.42
1989	161.22	200.63	275.34	295.73
1990	162.32	199.73	277.63	294.30

Municipalities

The fiscal situation for Forsyth in Rosebud County and Hardin in Big Horn County was assessed by comparing the cumulative investment for community facilities to the borrowing capacity of the cities. Borrowing capacity was limited to 5 percent of projected assessed valuation plus an additional 10 percent for water and sewer facilities.

Borrowing capacity problems were projected to be

virtually nonexistent under the conditions of Scenarios I and II. However, under Scenarios III and IV both cities would experience substantial deficiencies (Figures II-8 through II-11). Under Scenario III, Hardin was expected to have a cumulative deficiency of \$900,000 by 1985; while Forsyth's capital deficiency would be \$1.5 million by 1985 and more than \$2 million by 1989. Under scenario IV, capital deficiencies of more than \$4 million would occur for Hardin by 1983 and \$5.7 million for Forsyth by 1982.

Table II-43. Estimated Per Capita County Expenditures, Rosebud County, 1975-1990

Year	Scenario I	Scenario II	Scenario III	Scenario IV
1975	\$144.47	\$144.47	\$143.07	\$143.07
1976	190.72	204.53	204.53	192.87
1977	202.66	224.98	221.19	209.69
1978	206.69	233.89	252.92	218.30
1979	209.76	244.06	286.99	227.91
1980	209.74	245.72	318.21	240.47
1981	211.55	246.23	337.96	252.45
1982	210.50	244.26	359.69	339.25
1983	211.01	244.85	364.24	351.65
1984	209.13	242.64	373.88	387.19
1985	209.27	242.25	371.18	502.25
1986	207.23	239.56	370.16	518.36
1987	206.91	239.05	365.16	522.70
1988	204.68	236.26	362.93	523.37
1989	204.17	235.40	357.14	526.23
1990	201.68	232.34	354.16	520.00

Table II-45. Estimated Per Capita County Revenues, Rosebud County, 1975-1990

Year	Scenario I	Scenario II	Scenario III	Scenario IV
1975	\$149.92	\$149.92	\$148.24	\$148.24
1976	222.13	242.66	227.00	224.37
1977	238.86	270.47	265.51	248.12
1978	243.30	281.27	305.79	258.26
1979	246.26	293.72	345.62	271.63
1980	245.49	295.58	377.91	289.28
1981	246.92	295.74	396.05	305.95
1982	244.92	292.97	413.74	402.31
1983	244.41	293.10	417.50	413.46
1984	241.16	289.89	425.63	437.09
1985	240.08	288.61	424.42	473.29
1986	236.58	284.69	424.97	476.02
1987	234.87	283.26	421.81	479.72
1988	231.02	279.11	421.34	482.35
1989	228.93	277.11	417.20	486.41
1990	224.67	272.47	415.79	488.25

Millions of Dollars

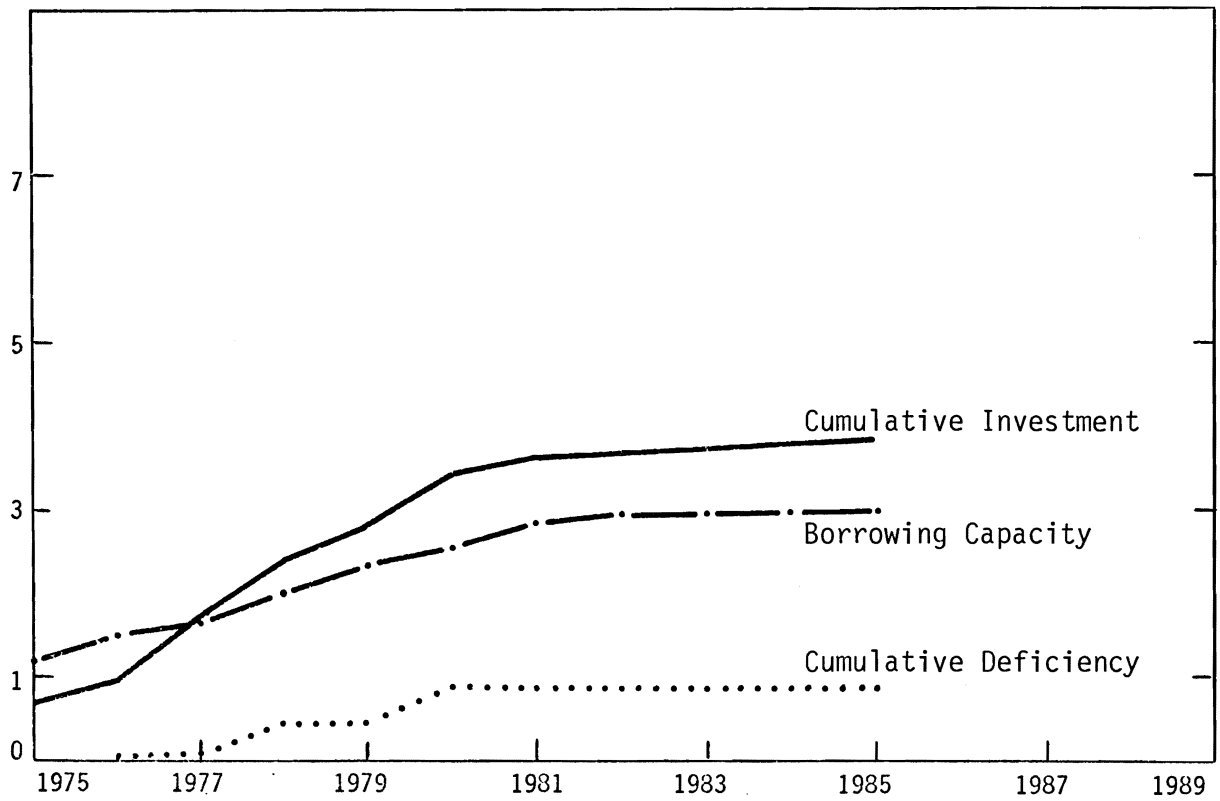


Figure II-8. Hardin Cumulative Investment and Borrowing Capacity, Scenario III

Millions of Dollars

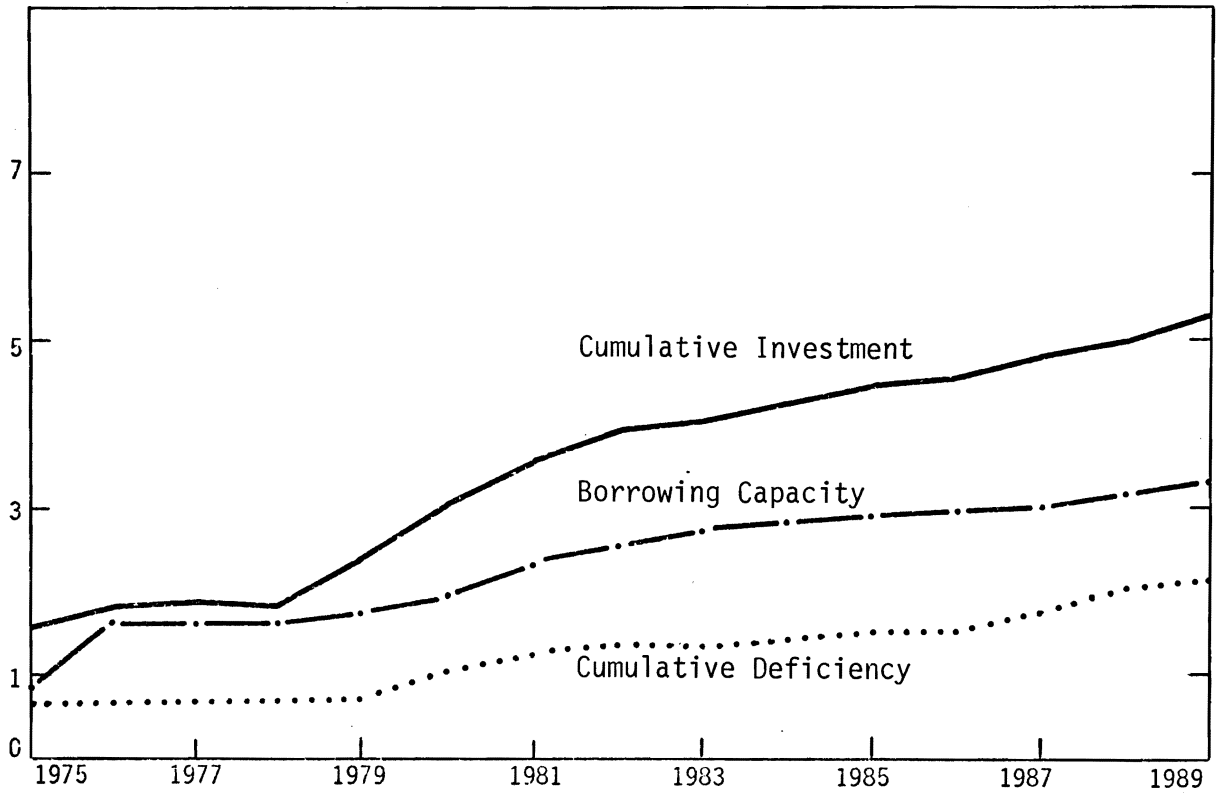


Figure II-9. Forsyth Cumulative Investment and Borrowing Capacity, Scenario III

Millions of Dollars

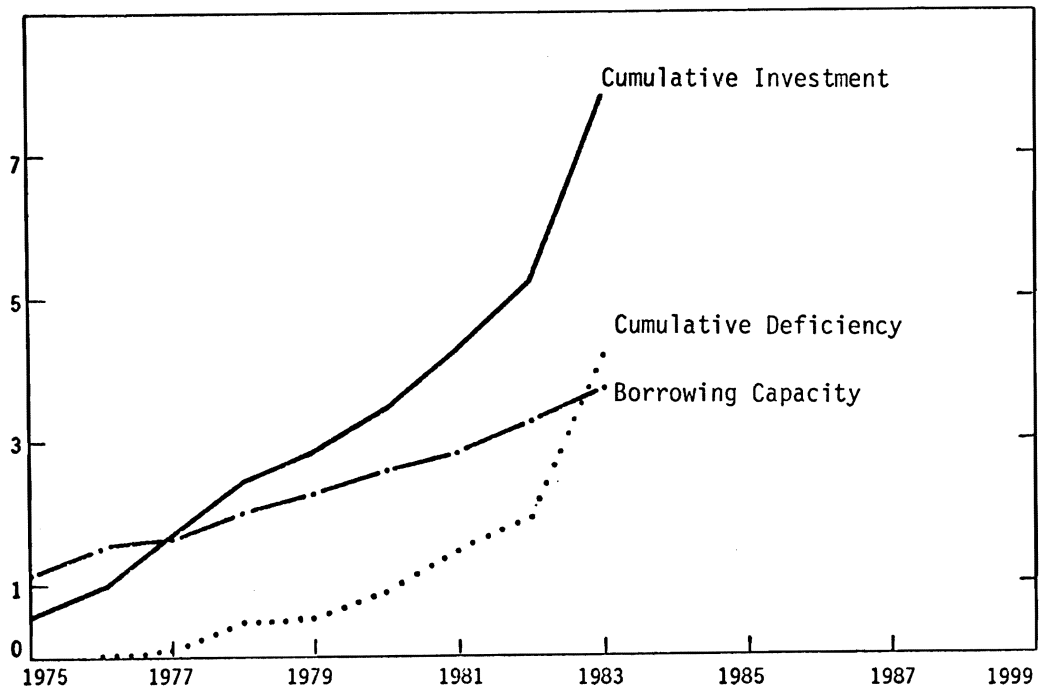


Figure II-10. Hardin Cumulative Investment and Borrowing Capacity, Scenario IV

Millions of Dollars

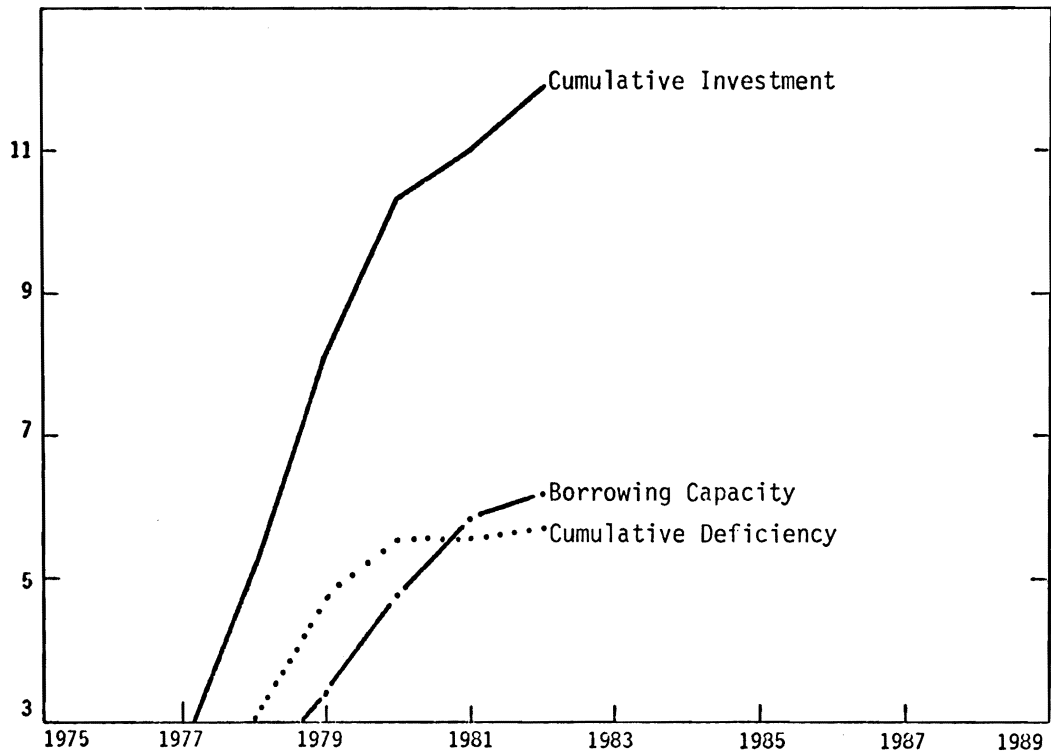


Figure II-11. Forsyth Cumulative Investment and Borrowing Capacity, Scenario IV

WYOMING

Fiscal impact projections resulting from coal development in Wyoming were summarized from a study by Hayen and Watts. The approach taken was based on a coal development scenario compiled by the Wyoming Geological Survey (Table II-46). From this table, three levels of coal production were computed—level 1, the lower range of estimated production; level 3, the high range of estimated production; and level 2, a mean or midpoint level of production between the low and high.

The mean or most likely scenario was used as the basis for fiscal analysis for Campbell County and for the city of Gillette. Under this scenario, total direct coal related employment was expected to reach 2,760 by 1980 and remain at about this level (Figure II-12). Total indirect coal related employment would reach 1,374 by 1980 and increase to 2,034 by 1985.

Infrastructure projections were made using a computer based planning model which translated employment increases into population and school enrollment increases. Each basic sector job was assumed to result in a population increase of 2.1 persons, increasing to 2.7 persons as the basic sector moves from construction of projects to operation. The ratio of direct workers to indirect workers was assumed to be 0.125 initially and rise to 0.25 over a period of five years.

School enrollments were projected on the basis of 0.9 school age children per household with an average household size of 3.4 persons.

Subsequent modules were then used to translate population increases into increased demand for public services and facilities. Standard costs for providing increased services (both operating and capital expenditures) were then applied to the new service and facility requirements.

Revenue projections were made for a 10-year planning period for the county, municipal, and school district levels of government. Sales and use tax and private property tax revenues were assumed to increase proportionally with population increases. Coal related property tax revenues were projected on the basis of estimated project construction costs. Coal production revenues were based on estimated coal production from the mines included in the analysis, using the 1974 state-wide average value of \$3.54 per ton.

The population in Campbell County was projected to increase from about 14,000 in 1975 to more than 27,000 by 1985; and the corresponding increase for Gillette was from 9,500 to 20,275, or more than double (Figure II-12) the present population.

School enrollments for Campbell County, which is served by one unified school district, were projected to increase from a total for all grades of 3,157 in 1975

Table II-46. Campbell County Coal Mining Operations*

Company	Mine	Planned Opening	Estimated Production (millions of tons)		Employment (number of employees)	
			1974	1980	1974	1980
Amax Coal Company	Belle Ayr South	In Operation	3	10-15	150	250-350
	Belle Ayr North	1978	--	10-20	--	250-350
Atlantic Richfield	Black Thunder	1977	--	7-10	--	225-250
Carter Mining Company (a subsidiary of Exxon)	North Rawhide	1977	--	5-12	--	300
Kerr-McGee Coal Corporation	Jacobs Ranch	1978	--	9-16	--	200-300
	East Gilletta	1979	--	5-11	--	200-300
Rochelle Coal Company (a subsidiary of Peabody Coal and Panhandle Eastern Pipe Line)	Rochelle	1978	--	11	--	290
Sunoco Energy Development Company (a subsidiary of Sun Oil)	Belle Fourche	1977	--	12	--	225-400
Wyodak Resources Development Corporation (a subsidiary of Black Hill Power and Light)	Wyodak North and South	In Operation	.7	2.2	30	190

*From "Directory of Wyoming Coal Companies and Contracts, Selected Other Industries, and State Agencies," Gary B. Glass, Wyoming Geological Survey, Laramie, Wyoming, January, 1975.

Thous. of People

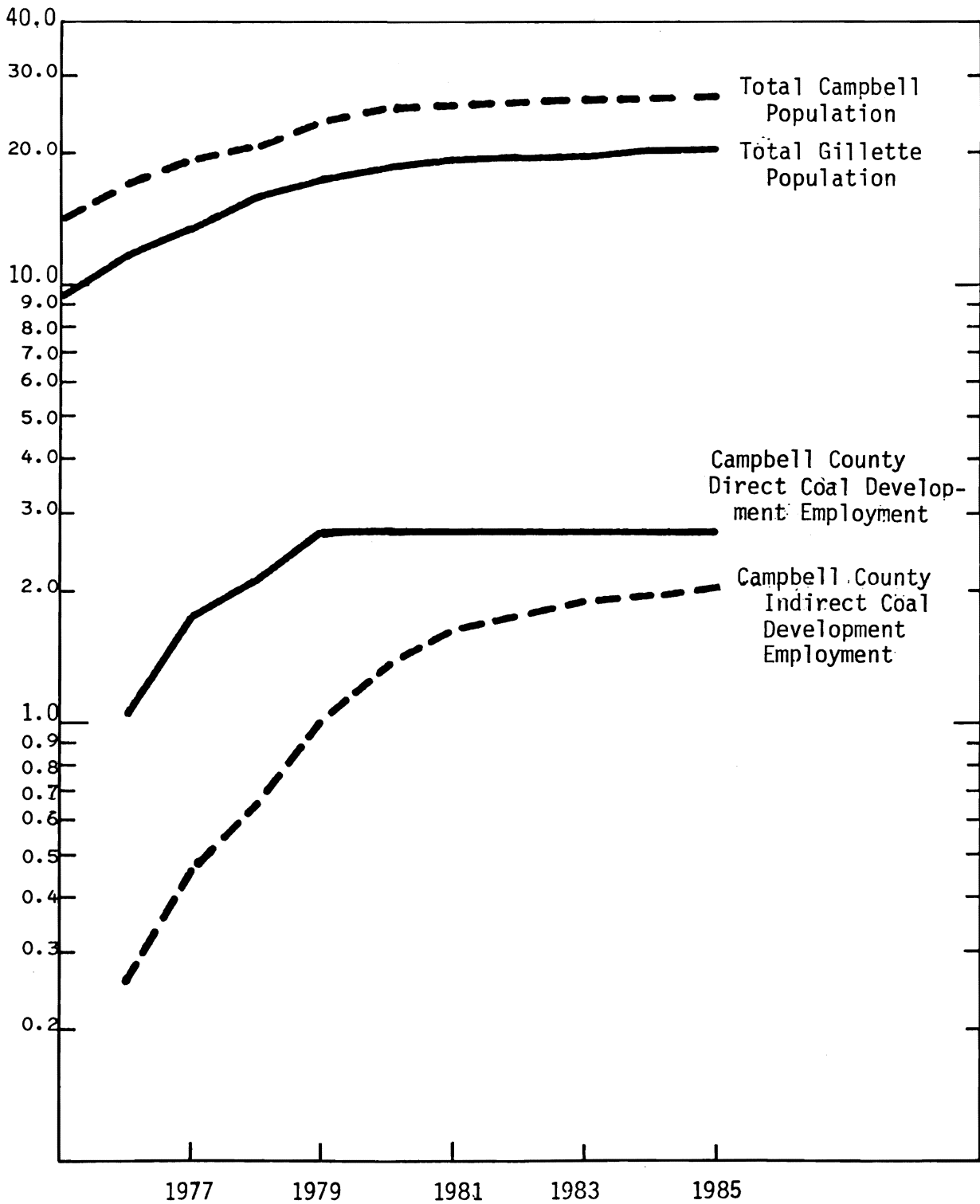


Figure II-12. Projected Population and Employment for Campbell County and Gillette, Wyoming, 1975-1985

to 7,158 by 1985. Projections were made for three categories of students—kindergarten through grade six, seventh through ninth grades, and tenth through twelfth grades (Table II-47).

Costs and revenues associated with the most likely level of development were based on 1975 dollars with no adjustment for inflation. Budget projections were made for Campbell County, the school district, and the city of Gillette for each year of the 10-year planning horizon.

Table II-47. Projected Campbell County School Enrollment, 1975-1985

Year	K Thru 6	7 Thru 9	10 Thru 12	Total
1975	1,705	800	681	3,157
1976	2,452	1,101	951	4,504
1977	2,771	1,244	1,074	5,089
1978	3,014	1,353	1,169	5,536
1979	3,417	1,534	1,325	6,277
1980	3,628	1,629	1,407	6,664
1981	3,723	1,672	1,444	6,838
1982	3,791	1,702	1,470	6,963
1983	3,838	1,723	1,488	7,050
1984	3,872	1,738	1,501	7,111
1985	3,896	1,749	1,511	7,156

The Campbell County school district was expected to experience a revenue surplus throughout the projection period (Figure II-13).⁵ Although total education expenditures are expected to more than double by 1979 (from \$7.1 million in 1975 to \$14.6

million in 1979), projected increases in assessed valuation will more than offset the increased expenditures.

The Campbell County government fiscal resources were expected to be adequate to meet the increased demand for services of an expanded population. Under current tax rates, the county's revenues were projected to exceed expenditures throughout the entire projection period, increasing to more than \$5 million annually by 1980 (Figure II-14). However, it should be noted that new road and highway construction costs were not estimated and are not included in the budget. A detailed breakdown of expenditures by category is included in Table II-48 with revenues shown in Table II-49.

While the county and school district appear to avoid substantial financial difficulties, the city of Gillette may encounter revenue shortfalls of about \$3 million annually by 1980 (Figure II-15). Projected increases in revenue were expected to be sufficient to offset increases in the city's operating budget. However, expansion of existing water, sewer, and electrical distribution systems would incur debt service requirements considerably beyond the city's share of revenue from increased property valuation, resulting in a revenue gap comparable to this debt service cost. A more detailed breakdown of expenditures for Gillette by category is included in Table II-50 with revenues in Table II-51.

⁵Assuming mill levies would be maintained at 1975 levels.

\$ Mil.

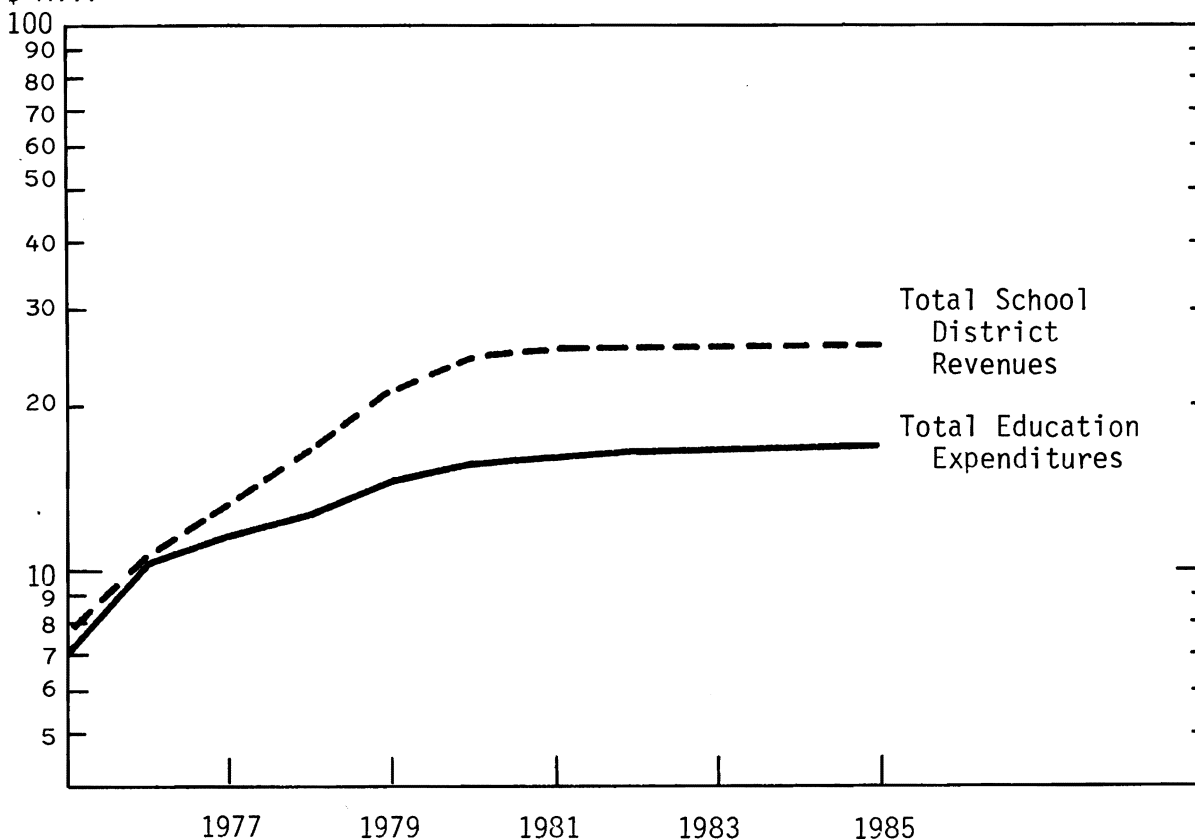


Figure II-13. Projected Campbell County Education Budget

\$ Mil.

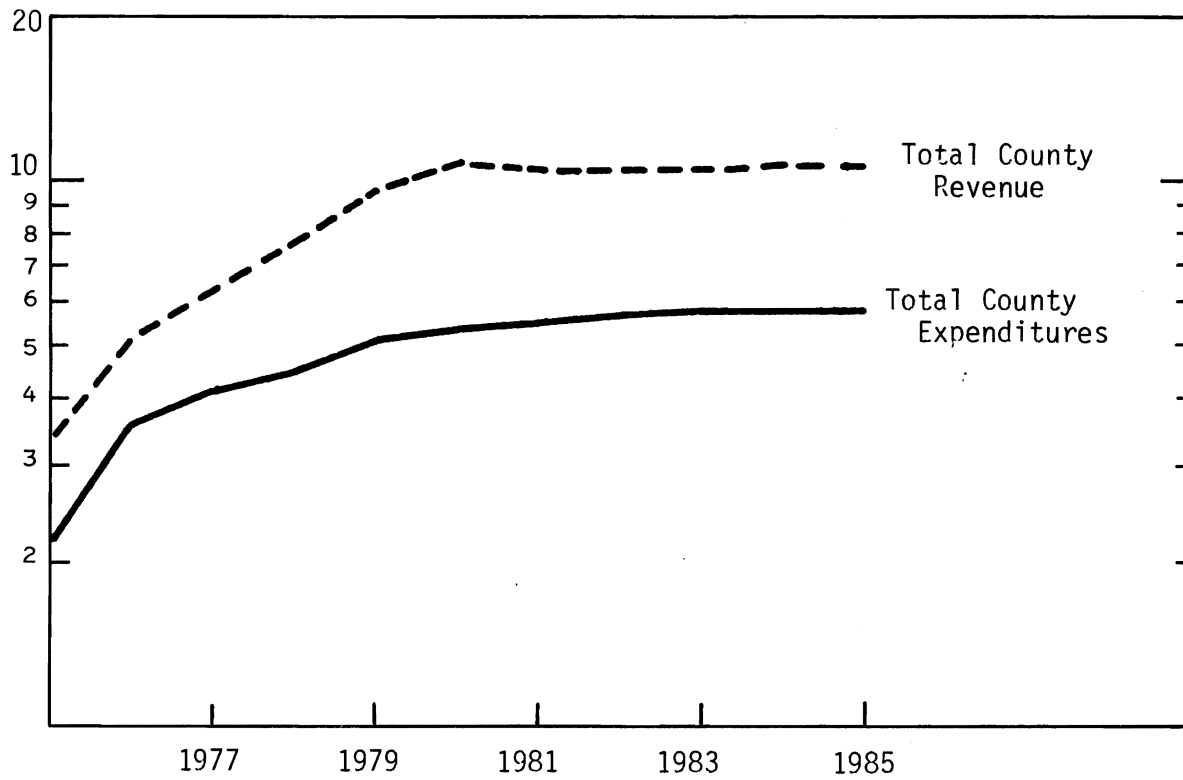


Figure II-14. Projected Campbell County Revenue and Expenditures, 1975-1985

\$ Mil.

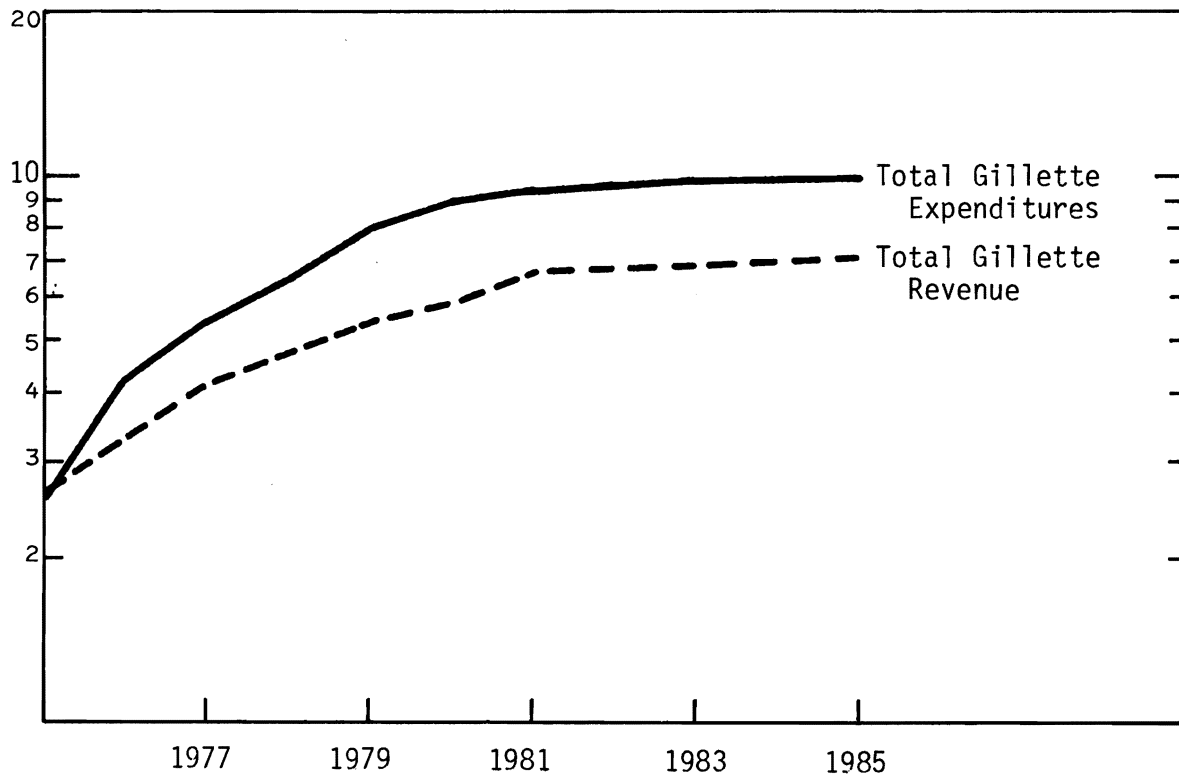


Figure II-15. Projected Revenues and Expenditures for Gillette, Wyoming, 1975-1985

Table II-48. Projected Campbell County Operating and Facilities Expenditures Detail, 1975-1985

Year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
	(\$000)										
General Government	513.0	596.7	651.4	689.6	746.3	772.5	783.6	791.2	796.4	800.0	802.6
Office Facility Debt Service Cost	--	.4	3.3	5.5	9.1	11.0	11.9	12.5	12.9	13.2	13.4
Law Enforcement	141.0	171.5	193.8	210.8	239.0	253.7	260.4	265.1	268.4	270.8	272.5
Fire Protection	34.0	41.7	47.1	51.3	58.1	61.7	63.3	64.5	65.3	65.8	66.3
Campbell Fire Protection Debt Service	4.7	4.7	5.5	6.0	6.8	7.1	7.3	7.5	7.6	7.8	7.8
Health	465.0	564.9	638.3	694.4	787.2	835.8	857.7	873.3	884.2	891.9	897.5
Hospital Facility Debt Service Cost	--	408.2	492.4	556.7	663.3	719.0	744.1	762.0	774.6	783.4	789.8
Roads and Airports	460.0	559.7	632.5	688.0	780.0	828.1	849.9	865.3	876.1	883.8	889.3
Water and Sewer	1.2	1.4	1.6	1.7	2.0	2.1	2.1	2.2	2.2	2.2	2.2
Library	19.9	24.1	27.3	29.7	33.6	35.7	36.6	37.3	37.8	38.1	38.3
Space Facility Debt Service Cost	--	6.2	12.9	18.1	26.7	31.2	33.2	34.6	35.6	36.4	36.9
Collection Facility Debt Service Cost	--	4.2	9.5	13.6	20.3	23.8	25.4	26.5	27.3	27.9	28.3
Agriculture	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0
Revenue Sharing Expend	303.0	365.9	413.5	449.8	509.9	541.4	555.6	565.7	572.7	577.7	581.4
Exist Bonds and Interest	193.0	193.0	193.0	193.0	193.0	193.0	193.0	193.0	193.0	193.0	193.0
New Facilities Debt Service	--	541.5	667.2	766.7	928.2	1,012.3	1,050.5	1,077.6	1,096.6	1,110.1	1,119.8
Total County Expenditure	2,196.0	3,550.1	4,057.3	4,440.9	5,069.5	5,394.4	5,540.6	5,644.4	5,716.8	5,768.1	5,805.1

Table II-49. Projected Campbell County Revenue Detail, 1975-1985

Year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
	(\$000)										
Current Property Tax	2,254.0	3,766.8	4,671.0	5,981.4	7,622.6	8,823.3	9,226.4	9,248.6	9,264.3	9,275.3	9,283.1
Campbell Sales Tax	690.0	931.3	1,079.2	1,219.7	1,400.2	1,485.2	842.6	855.0	863.6	869.8	874.2
Gasoline Tax	170.0	176.0	189.7	196.5	211.6	212.7	218.3	222.3	225.0	227.0	228.4
Cigarette Tax	2.6	2.7	2.9	3.0	3.2	3.3	3.3	3.4	3.4	3.5	3.5
License, Permits, and Fines	100.0	138.3	156.3	170.0	192.8	204.7	210.0	213.8	216.5	218.4	219.8
Interest and Rent	80.0	110.7	125.0	136.0	154.2	163.7	168.0	171.1	173.2	174.7	175.8
Miscellaneous	15.0	20.0	23.5	25.5	28.9	30.7	31.5	32.1	32.5	32.8	33.0
Current Total Co. Revenue	3,311.6	5,146.6	6,247.6	7,732.1	9,613.5	10,923.6	10,700.1	10,746.3	10,778.5	10,801.5	10,817.8

Table II-50. Projected Operating and Facilities Expenditures for Gillette, 1975-1985

Year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
	(\$000)										
General Government	405.0	504.3	581.3	644.9	745.3	806.3	827.5	842.5	853.0	860.0	865.9
Office Facility Debt Service	--	2.6	4.9	6.8	9.7	11.6	12.2	12.6	12.9	13.2	13.3
Law Enforcement	292.0	363.5	419.0	464.8	537.2	581.2	596.4	607.3	614.8	620.2	624.1
Office Facility Cost	--	.0	.0	.0	.0	.0	.0	.4	1.2	1.4	1.5
Fire Protection	24.0	30.0	34.5	38.3	44.3	47.9	49.2	50.0	50.7	51.1	51.4
Capital Equipment	--	10.6	13.3	15.5	19.1	21.2	22.0	22.6	23.0	23.2	23.4
Roads and Airports	23.1	28.7	33.1	36.7	42.4	45.9	47.1	48.0	48.6	49.0	49.3
Sanitation	346.0	430.7	496.4	550.7	636.5	688.5	706.6	719.5	728.5	734.8	739.4
Water and Sewer	404.0	502.4	579.2	642.5	742.6	803.3	824.4	839.4	849.9	857.3	862.7
Treatment Facility Cost	--	44.8	57.7	68.4	85.2	95.4	98.9	101.4	103.2	104.4	105.3
Distribution System Cost	--	126.3	224.9	306.3	434.9	513.1	540.2	559.5	572.9	582.5	589.4
Treat Facility Cost	--	69.5	102.4	129.5	172.4	199.5	207.5	213.9	218.4	221.6	223.9
Collection System Cost	--	212.1	377.8	514.6	730.7	862.0	907.5	939.9	962.5	978.6	990.2
Parks and Recreation	57.7	71.8	82.7	91.8	106.1	114.8	117.8	119.9	121.4	122.5	123.2
Parks Facility Cost	--	32.8	58.4	79.5	112.9	133.2	140.2	145.2	148.7	151.2	153.0
Cemetery	28.8	35.9	41.4	45.9	53.0	57.4	58.9	60.0	60.7	61.2	61.6
Electricity	668.0	831.5	958.4	1,063.2	1,228.8	1,329.4	1,364.3	1,389.1	1,406.4	1,418.7	1,427.6
Elect Distrib Sys Cost	--	2.3	4.1	5.6	8.0	9.4	9.9	10.2	10.5	10.6	10.8
Exist Bonds and Interest	265.0	265.0	265.0	265.0	265.0	265.0	265.0	265.0	265.0	265.0	265.0
New Facilities Debt Service	--	640.2	1,078.0	1,439.3	2,010.2	2,357.0	2,477.8	2,563.9	2,624.1	2,666.8	2,697.6
Total Gillette Expenditures	2,513.6	4,205.0	5,412.5	6,409.3	7,984.3	8,941.1	9,273.8	9,510.7	9,676.4	9,793.8	9,878.6

SUMMARY

Since fiscal comparisons are the end product of projected economic and demographic changes, considerable emphasis has been directed to the effect that energy development may have on public sector costs and revenues. Energy development taxes for all three states would appear to generate substantial revenues. However, distribution formulas may not

provide sufficient funds at the local levels to offset all of the rapid growth effects. Municipalities are likely to realize more substantial fiscal problems than either the county government or school districts. For most counties and school districts, lack of borrowing capacity is the most limiting factor in fiscal stability. Shortfalls of front-end financing would appear to be the most serious of the potential fiscal difficulties for all levels of government.

Table II-51. Projected Gillette Revenue Detail, 1975-1985

Year	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
	(\$000)										
Property Tax	72.8	105.1	130.6	150.6	167.1	193.1	208.9	214.4	218.3	221.0	222.9
Sales and Use Tax	843.0	1,138.3	1,319.0	1,490.7	1,711.4	1,815.3	2,527.7	2,564.9	2,590.9	2,609.4	2,622.7
Gasoline Tax	152.5	214.4	247.2	274.2	316.9	342.9	351.9	358.3	362.7	365.9	368.2
Cigarette Tax	95.9	134.8	155.4	172.4	199.2	215.6	221.2	225.2	228.0	230.0	231.5
License, Permits, and Fines	69.9	98.3	113.3	125.7	145.2	157.1	161.2	164.2	166.2	167.7	168.7
Interest and Rent	23.1	32.5	37.4	41.5	48.0	51.9	53.3	54.3	54.9	55.4	55.8
Water, Sewer, and Electric	1,314.0	1,848.4	2,130.7	2,363.7	2,731.7	2,955.4	3,032.9	3,088.1	3,126.6	3,153.9	3,172.6
Miscellaneous	32.3	45.5	52.4	58.2	67.2	72.7	74.6	76.0	76.9	77.6	78.1
Total Gillette Revenue	2,604.0	3,617.3	4,186.0	4,676.9	5,386.8	5,803.9	6,631.7	6,745.2	6,824.6	6,880.9	6,921.5

CHAPTER III

ALLEVIATION OF ADVERSE FISCAL EFFECTS

NORTH DAKOTA

Under the recent changes in severance and conversion tax collections and distribution, local units of government located in counties hosting development appear to be in relatively favorable fiscal positions once energy production begins. Until distribution of energy taxes begins, however, a shortage of front-end capital is apparent. Conversion taxes are in lieu of any ad valorem property taxes (except for the land occupied by the plant) and, therefore, no revenue is forthcoming during project construction when impact is at its peak. Some financial difficulties also may be experienced by units of government in counties adjacent to development as these communities may absorb considerable population growth without the benefit of a share in energy taxes.

North Dakota's coal development taxes consist of a severance tax on all coal mined and a production or conversion tax on the output of all large coal conversion facilities. As of July, 1977, severance taxes become \$0.55 per ton adjusted upwards quarterly by increases in the U.S. Wholesale Price Index. Conversion taxes are 0.25 mill per kilowatt hour of electricity produced and \$0.10 per thousand cubic feet of synthetic natural gas produced. Revenues from both taxes are shared with the county hosting the development and, in turn, the county shares its portion of these revenues with the school districts and municipalities. In addition to a direct share of energy taxes, local units of government affected by development are eligible for grants from the state's coal impact fund (financed by 35 percent of severance tax collections). Loan money is available from a special trust fund financed by 15 percent of severance tax collections. Another type of loan fund exists for school districts that have borrowed up to their constitutional limit. This is the state school construction revolving fund which can provide money under a rental contract basis up to \$600,000 and is not considered part of the school district's bonded debt. The fund is financed by an original appropriation of \$5 million, which has been sufficient to date.

MONTANA

Montana's energy development taxes provide a state and local revenue of about \$1.50 per ton of coal mined. During the 1977-1979 biennium, coal severance taxes alone are expected to generate about \$40 million a year. The newly created Coal Board, which has the power to make grants to local governments affected by energy development, receives a 17½ percent share of coal severance tax revenues. The state's annual share of federal mineral lease revenues, also available for energy development

impact alleviation, is estimated to increase from \$6 million to about \$11 million by 1979.

Counties hosting development have found that rising taxable property valuations resulting from an increase in taxable property of electric generating plants and increased valuations of coal mine operations provide a substantial source of revenue. These revenues, along with the county share of severance taxes and state assistance revenues, appear to be adequate for providing the facilities and services required by expanding populations. Some fiscal problems can develop, however, for counties adjacent to energy host counties since these counties can experience the rapid influx of population without the advantages of energy-increased tax bases.

School districts appear to share financial circumstances similar to that of the county governments. However, at the school district level, a mechanism to assist those districts bordering a development district is provided by the state's school foundation equalization formula. Under these formulae, some of the state revenue raised under the state's mandatory levies can be redistributed from districts having high valuations to those most in need of assistance.

Municipal governments would appear to experience more substantial fiscal problems than either the county or school districts. Although some cities have reduced their financial problems through increased sewer, water, and other user charges, fiscal difficulties are still apparent. Municipalities do not receive increased property tax revenue from energy developments nor do they receive a direct share of coal severance tax revenues as do other units of government.

Under existing policies, units of government adversely affected by energy development are eligible for grants from the coal impact alleviation fund. Revenues for this fund, which are distributed by the Coal Board, are projected to be nearly \$7 million a year during the 1977-1979 biennium. Funds are also available from the state's share of federal mineral lease revenues, which are projected to increase substantially during the next biennium. A third source, not so readily available, is the state trust fund. Revenues for this fund are derived from severance taxes (the fund receives 25 percent of severance tax collections presently and will receive 50 percent beginning in 1980) and may be appropriated by legislative action.

Changes in existing policies could enhance the financial situations of local governments. The state general fund presently receives 40 percent of coal severance tax collections. Since projected collec-

tions are sizable, it is possible changes in the distribution formula could provide a direct share to municipalities. Making the state trust fund revenue available for local government loans would provide another avenue for assistance.

WYOMING

By 1978, Wyoming's total severance tax on coal will be 10.5 percent of the value of gross products (taxable value of coal). Other severance or production taxes on the value of gross products include: Uranium and trona at 5.5 percent; petroleum, natural gas, and oil shale at 4 percent; and precious metals, soda, saline, bentonite or other valuable deposits at 2 percent. Although local governments do not receive a direct share of severance and production taxes, state revenue from these sources is available for construction of community facilities and schools.

County government finances would appear to meet the needs of an expanding population. Although operating budgets and debt service requirements would increase substantially, revenue increases, primarily from increased sales and use tax revenues and from increased assessed valuation, would also be substantial. However, some difficulties could be expected in the financing of capital facilities as current debt limitations are set at 2 percent of assessed valuation.

The financial ability of school districts in Wyoming varies widely. Although the state's equalization program removes some of the inequality, districts that are rich in minerals fare considerably better than those that are not, due to high per pupil valuations. School districts with low per pupil valuations would appear to find fiscal difficulties both in their operating budgets and in financing facility construction. Bonded indebtedness is limited to 10 percent of assessed valuation.

While counties and school districts experience increased taxable valuations as energy projects are completed, municipalities (due to a lack of taxing jurisdiction) do not. As a result, the most critical fiscal difficulties resulting from Wyoming energy development occur in the municipalities.

The state's coal impact tax, which is a part of total severance tax collections, is projected to reach \$10 million a year by the early 1980's. Grants from these

funds may be provided for water, sewer, highway, road, or street projects in areas affected by coal development.

An optional 1 percent sales tax, which provides revenue for counties and incorporated cities, has been established in several of the Wyoming counties experiencing energy development. This tax, where effected, has provided substantial operating revenue. However, since it has no effect on assessed valuations and hence, borrowing capacity, units of government experiencing problems funding capital facilities may still have revenue shortfalls.

Financing of school facilities has been assisted, in at least one instance, by the power project responsible for the impact. The Missouri Basin Power Project has guaranteed tax-exempt bonds being sold to finance new school facilities and has provided loans for operating revenues. This financial assistance was provided in response to Wyoming's Industrial Siting Act, which requires evidence that new large energy developments would be accompanied by adequate public services.

An often overlooked major source of revenue for municipalities is the utility hook-up charges. These can be increased (or, in some cases, instituted) with little effect on indigenous households, yet can provide substantial revenues during the construction phase of new projects when a city's tax base lags and much of the new housing is mobile homes. Problems with financing capital facilities could be alleviated to some extent by an increase in the bonded debt limit, currently at 4 percent of assessed valuation.

MODEL MINE REVENUE COMPARISONS

Bronder compared the productivity of tax systems of western states in relation to coal mining. The study was based on model mines from U.S. Bureau of Mines studies.

A summary of the total taxes by source of tax for a 9.2 million ton per year model surface mine is presented in Table III-1. Of the three states, Montana's tax structure would provide the greatest revenue, yielding more than \$13.5 million from annual coal production of 9.2 million tons. The comparable revenues for North Dakota and Wyoming would be about \$4.9 million and \$4.0 million, respectively. Severance taxes yield the majority of total coal taxes

Table III-1. Total Taxes by Source of Tax and Resulting Taxes per Ton Associated with a 9.2 Million Ton per Year Model Surface Mine in Montana, North Dakota, and Wyoming, 1975-76

State	Annual Tax, Source (in millions of dollars)					Taxes Per Ton (\$)
	Severance	Property	Income	Miscellaneous	Total	
Montana	9.556	3.599	0.240	0.184	13.581	1.48
North Dakota	4.784	0.042	0.150	0.002	4.979	0.54
Wyoming	1.659	2.344	none	0.001	4.004	0.43

SOURCE: Bronder, Leonard D., *Taxation of Surface and Underground Coal Mining in Western States*, Special Report to the Governors, Western Governors' Regional Energy Policy Office, Denver, Colorado, August, 1976.

in both Montana and North Dakota (70.4 percent and 96.1 percent, respectively), while in Wyoming the majority is property tax (58.5 percent) with severance taxes about 41.4 percent.

SUMMARY

Energy development taxes for all three states would appear to generate substantial revenues. However, distribution formulas may not provide sufficient funds at the local levels to offset all of the rapid growth effects. Municipalities are likely to realize more substantial fiscal problems than either the county government or school districts. For most

counties and school districts, lack of borrowing capacity is the most limiting factor in fiscal stability. Shortfall of front-end financing would appear to be the most serious of the potential fiscal difficulties for all levels of government.

The total fiscal resources and present and potential tax structures within each state are sufficient to provide for impact alleviation. Local units of government could be aided, in some cases, by changes in distribution formulas and by new avenues of loan funds and loan guarantees. Other options could include a local sales tax, increased utility hook-up and user charges, and increased debt limits.

CHAPTER IV PRESENT WORKER CHARACTERISTICS AND LOCAL LABOR SUPPLY

The prospect of extensive development of the Fort Union coal resources has created considerable interest regarding the employment opportunities that will be created and the potential for rapid population growth in rural communities. An understanding of the socioeconomic characteristics of the coal industry's work force may be valuable in helping state and local decision makers plan for expanded coal development. Therefore, the following includes a discussion of the characteristics of construction and operating work forces from North Dakota, Montana, and Wyoming.

NORTH DAKOTA

One of the objectives of this study was to determine the occupation, education, locational origin, housing preferences, commuting patterns, and other socioeconomic characteristics of the construction work forces building electric generating plants in North Dakota in 1975. A questionnaire was administered to workers at two plant construction sites in June of 1975, and 267 workers (24 percent of the work force) returned completed questionnaires.

North Dakota's Electric Generating Construction Work Force

One hundred and thirty-three of the 265 employees who answered the power plant construction work force survey were nonlocal workers.¹ Nonlocal workers were defined as employees who changed their location of residence to work on the construction sites. The average age of the workers was 34.8 years for local and 37.8 years for nonlocal employees. Nearly 80 percent of both local and nonlocal workers were married. However, there were substantial differences in family composition between the local and nonlocal employees. There were 1.43 children per local worker and 1.67 children per nonlocal worker. Only 49 percent of the nonlocal workers' children were living in the coal development communities with their construction worker fathers compared to over 70 percent for the local workers. More than 40 percent of the nonlocal construction workers did not bring their families to live with them in the coal development communities, whereas 89 percent of the local workers resided with their families while working on the construction sites.

The average household size of local workers was 2.50 compared to 2.20 for the nonlocal workers.² The average household size, for married workers only, was 3.58 for local and 3.83 for nonlocal workers. The married workers whose families lived with them in the community had an average family size of 3.69 for local and 4.05 for nonlocal workers.

The nonlocal workers had more children of pre-school age, but fewer children in grades 1-12 living with them in the community than did the local workers (Table IV-1).

North Dakota was the birthplace of 70 percent of the local workers and 26 percent of the nonlocal workers. Almost 67 percent of the nonlocal workers and 47.7 percent of the local workers lived in a city with a population of 1,000 to 2,500 people. Over 42 percent of the local workers and 26.3 percent of the nonlocal workers lived in a city with a population over 10,000 people. This would indicate that the nonlocals prefer to live in the smaller towns near the construction sites if housing is available.

The local workers had lived an average of 18.3 years in their present community while the nonlocal workers had lived an average of 1.6 years in their present community. The length of residence of the local workers may indicate that many of them had switched from other jobs in the area to work at the higher paying construction sites. The relatively short length of residence of the nonlocals would appear

Table IV-1. Number of Children per Worker by Education Category by Local and Nonlocal Category, North Dakota, 1975

Education Category	Number of Children Per Worker	
	Local	Nonlocal
Number of Preschool Children	.443	.385
Preschool Children Living in Community	.259	.239
Number of Children Grades 1-8	.669	.576
Grades 1-8 Children Living in Community	.388	.469
Number of Children Grades 9-12	.298	.356
Grades 9-12 Children Living in Community	.136	.261
Number of College Age Children	.124	.043
College Children Living in Community	.017	.026
Number of Other Children ^a	.132	.068
Other Children ^a Living in Community	.016	.026

^aChildren that for one reason or another did not attend school.

¹ Two workers could not be identified as local or nonlocal and were dropped from the analysis in this section.

² Household size refers to the number of dependents living with the worker in the coal development area.

logical as many of these workers move on to another construction project once their particular phase of construction is completed. With expanded coal development, the nonlocal workers may become more permanent residents, as they may be able to work at different sites in the area.

Over 46 percent of the local workers and 10.5 percent of the nonlocal workers owned a single family house; 69.3 percent of the nonlocal workers rented housing compared to 30.3 percent of the local workers (Table IV-2). Over 24 percent of the nonlocal workers were in the "rent other" category which consists primarily of sleeping rooms in boarding houses or rooms in hotels or motels.

Table IV-2. Present Housing of Power Plant Construction Employees by Local and Nonlocal Category, North Dakota, 1975

Present Housing	Local		Nonlocal	
	Number	Percent	Number	Percent ^a
Own House	61	46.2	14	10.5
Own Mobile Home	19	14.4	26	19.5
Own Apartment	0	0.0	0	0.0
Own Other	5	3.8	0	0.0
Rent Apartment	15	11.4	28	21.1
Rent House	15	11.4	17	12.8
Rent Mobile Home	4	3.0	15	11.3
Rent Other	6	4.5	32	24.1
No Answer	7	5.3	1	0.8
Total	132	100.0	133	100.0

^aTotal percent may not add to 100 due to rounding.

The nonlocal workers had more formal education than the local workers. Twenty-two percent of the local workers had formal education beyond high school compared to almost 40 percent of the nonlocal workers (Table IV-3).

While many jobs in the construction industry do not demand a high level of formal education, mechanical skills generally learned through vocational training are very important. Almost 36 percent of the local, and over 45 percent of the nonlocal workers had received some vocational training (Table IV-4). Over 18 percent of the local, and 29.3 percent of the nonlocal workers had received more than 12 months of vocational training. The vocational training of the workers averaged 21 months for the local workers and 22 months for the nonlocal workers. The three most common types of vocational training categories were mechanics and welding, plumbing and pipefitting, and electrical work. Over 30 percent of the local and 42.1 percent of the nonlocal workers were mechanics, welders, and carpenters prior to working on the two construction sites (Table IV-5). This would indicate that there is a strong relationship between a construction worker's last and present job descriptions. The local workers earned an average of \$5.44 per hour, and the nonlocals \$7.86 per hour at their previous jobs.

Table IV-3. Years of Formal Education of Power Plant Construction Employees by Local and Nonlocal Category, North Dakota, 1975

Years of Education	Local		Nonlocal	
	Number	Percent ^a	Number	Percent ^a
8 Years or Less	21	15.9	8	6.9
9-11 Years	16	12.1	3	2.3
12 Years	66	50.0	68	51.1
13-15 Years	22	16.7	30	22.6
16 or More Years	7	5.3	23	17.3
No Answer	0	0.0	1	0.8
Total	132	100.0	133	100.1

^aTotal percent may not add to 100 due to rounding.

Table IV-4. Months of Vocational Training of Local and Nonlocal Power Plant Construction Employees, North Dakota, 1975

Months of Training	Local		Nonlocal	
	Number	Percent	Number	Percent
6 Months or Less	14	10.6	12	9.0
7-12 Months	9	6.8	9	6.8
13-18 Months	7	5.3	8	6.0
19-24 Months	2	1.5	5	3.8
25 or More Months	15	11.4	26	19.5
No Vocational Training	81	61.4	61	45.9
No Answer	4	3.0	12	9.0
Total	132	100.0	133	100.0

Table IV-5. Previous Job Classification of Local and Nonlocal Power Plant Construction Employees, North Dakota, 1975

Previous Job Classification	Local		Nonlocal	
	Number	Percent ^a	Number	Percent ^a
General Laborers	27	20.5	10	7.5
Electricians and Engineers	13	9.8	22	16.5
Office and Management Personnel	12	9.1	22	16.5
Mechanics, Welders, and Carpenters	40	30.3	56	42.1
Equipment Operators	15	11.4	6	4.5
Miscellaneous	8	6.1	8	6.0
No Answer	17	12.9	9	6.8
Total	132	100.1	133	100.1

^aTotal percent may not add to 100 due to rounding.

The local construction workers had worked an average of 21.6 months and the nonlocal workers 28.9 months for their present company. This could indicate that many of the nonlocal workers move from job to job with their present company. The local workers had held an average of 1.6 positions, and the nonlocal workers 2.3 positions with their present employer.

The local workers traveled an average of 33.2 miles one way to work, while the nonlocals commuted 24.9 miles to work each day. Over 55 percent of the nonlocal workers, but less than 30 percent of the local workers, commuted less than 20 miles. The younger workers commuted greater distances than

the older workers for both the local and nonlocal categories. This would indicate that the younger workers are more willing to commute to work.

The local construction employees had been employed in the general construction site area an average of 62 months compared to 17 months for the nonlocal workers. The construction workers were asked how long they intended to work in the general construction site area. Local workers expressed a desire to work an average of 8.8 years compared to three years for the nonlocal workers. Over 70 percent of the locals, and nearly half of the nonlocals were very interested in working on another construction site in the area. Less than 4 percent of the locals and 15 percent of the nonlocals showed no interest in working on another construction site. This would indicate that if expanded coal development were to occur in North Dakota, many of the construction workers might move to another site and remain living in the area after finishing at one construction site.

The average hourly earnings of the local workers at their present job was \$6.98 compared to \$7.89 for the nonlocal workers. This is an increase over their previous employment wages of \$1.54 per hour for the local workers and \$0.03 for the nonlocal workers.

Job descriptions of the construction workers were condensed into six occupational categories. Information obtained from coal and construction industry officials and personal judgment were used in developing these categories. The categories were defined as follows:

1. Pipefitter—one who is skilled in pipefitting or welding and works in this capacity at the construction site.
2. Operating Engineer—one who performs engineering functions or is an equipment operator at the construction site.
3. Common Laborer—one who performs many combinations of tasks and is a general handyman at the construction site.
4. Electrician and Carpenter—one who is skilled in electronics, carpentry, or related fields and works in this capacity at the construction site.
5. Supervisor and Office Worker—one who performs a supervisory or managerial function and is responsible in various degrees for the overall construction of the electric generating plant.
6. Miscellaneous—this category includes workers who perform a wide variety of specialized tasks. Included in this category are iron workers, cement finishers, millwrights, and boiler-makers.

The nonlocal work force consisted of 46.6 percent pipefitters and 15.8 percent engineers, as compared to 28.8 percent pipefitters and 7.6 percent engineers for the local workers (Table IV-6). These are two of the skilled positions which pay wages higher than other job categories and may explain some of the

difference in wage levels between the local workers and the nonlocal workers.

Table IV-6. Present Job Classification of Local and Nonlocal Construction Employees, North Dakota, 1975

Present Job Classification	Local		Nonlocal	
	Number	Percent	Number	Percent
Pipefitters	38	28.8	62	46.6
Operating Engineers	10	7.6	21	15.8
Common Laborers	36	27.3	9	6.8
Carpenters and Electricians	21	15.9	20	15.0
Supervisors and Office Personnel	13	9.8	14	10.5
Miscellaneous	14	10.6	6	4.5
No Answer	0	0.0	1	.8
Total	132	100.0	133	100.0

North Dakota's Coal Mine and Electric Generating Plant Operating Work Force

Another objective of this study was to determine the socioeconomic characteristics of North Dakota's coal industry employees. An understanding of the characteristics of the current industry work force could provide insights that may help state and local decision makers plan most effectively for labor market and population impacts associated with expanded coal development.

A 58 percent return was obtained from a questionnaire that was administered in June, 1974, to the 416 employees working in four electric generating plants and four coal mines located in western North Dakota. Forty-three of the 241 employees who answered the operating work force coal mine and power plant survey questionnaire were nonlocal workers. Nonlocal workers were defined as employees who had moved into the community they were residing in at the time of the survey within the five previous years. The local workers were considerably older than the nonlocals with an average age of 38.6 years compared to 28.0 years of age, respectively. Almost 90 percent of the local and 81.4 percent of the nonlocal workers were married. Only 1 percent of the local workers and none of the nonlocal workers had been either widowed or divorced. The local workers had an average of 1.86 children per worker, while the nonlocal workers had 1.45 children.

North Dakota was the birthplace of over 90 percent of the local workers and 65.1 percent of the nonlocals. Forty-six percent of the local workers and 37.2 percent of the nonlocal workers lived in a city with a population of 1,000 to 2,500 people. The local workers had lived an average of 26.4 years in their present community and the nonlocal workers 1.8 years.

Over 70 percent of the local workers and almost 40 percent of the nonlocal workers owned a single family house, while 9.6 percent of the local workers and 37.2 percent of the nonlocal workers rented housing (Table IV-7).

Table IV-7. Present Housing of Local and Nonlocal Coal Industry Employees, North Dakota, 1975

Present Housing	Local		Nonlocal	
	Number	Percent ^a	Number	Percent
Own House	140	70.7	17	39.5
Own Mobile Home	27	13.6	7	16.3
Own Apartment	0	0.0	2	4.7
Own Other	3	1.5	1	2.3
Rent Apartment	4	2.0	7	16.3
Rent House	14	7.1	7	16.3
Rent Mobile Home	1	0.5	1	2.3
Rent Other	0	0.0	1	2.3
No Answer	9	4.5	0	0.0
Total	198	99.9	43	100.0

^a Total percent may not add to 100 due to rounding.

Over 60 percent of the nonlocal workers had formal education beyond high school compared to less than 20 percent for the local workers (Table IV-8). Almost 30 percent of the local and 37.2 percent of the nonlocal workers had received some vocational training; about 13 percent of the local and 16.3 percent of the nonlocal workers had received over 12 months of vocational training (Table IV-9). The most common types of vocational training were electrical, mechanical, and welding.

Table IV-8. Formal Education of Local and Nonlocal Coal Industry Employees, North Dakota, 1974

Years of Education	Local		Nonlocal	
	Number	Percent ^a	Number	Percent ^a
8 Years or Less	51	25.8	1	2.3
9-11 Years	19	9.6	2	4.7
12 Years	84	42.4	14	32.6
13-15 Years	31	15.7	11	25.6
16 or More Years	8	4.0	15	34.9
No Answer	5	2.5	0	0.0
Total	198	100.0	43	100.1

^a Total percent may not add to 100 due to rounding.

Table IV-9. Vocational Training of Local and Nonlocal Coal Industry Employees, North Dakota, 1974

Months of Training	Local		Nonlocal	
	Number	Percent	Number	Percent ^a
6 Months or Less	14	7.1	2	4.7
7-12 Months	14	7.1	5	11.6
13-18 Months	7	3.5	4	9.3
19-24 Months	8	4.0	0	0.0
25 or More Months	11	5.6	3	7.0
Time Unknown	5	2.5	2	4.7
No Vocational Training	102	51.5	17	39.5
No Answer	37	18.7	10	23.3
Total	198	100.0	43	100.1

^a Total percent may not add up to 100 due to rounding.

The previous job category of the coal industry local employees consisted of 37.3 percent general laborers and 23.6 percent equipment operators. Over 24 percent of the nonlocal employees were mechanics, welders, and carpenters (Table IV-10). Over 60 percent of the local workers were from a general laborer or equipment operator background. This would indicate a strong relationship between the operating workers' previous and present employment. Some of the nonlocals were apparently

brought in from managerial or other skilled positions to work at the operating sites. The local workers had been employed an average of 4.2 years and the nonlocal workers, 3.1 years with their previous company.

Over 72 percent of the local workers and 53.5 percent of the nonlocal workers commuted less than 10 miles to work. The local operating workers commuted an average of 8.1 miles to work daily (one way) while the nonlocal workers commuted an average of 14.4 miles.

The local operating workers had worked an average of 9.9 years and the nonlocals 3.1 years with their present company. The local workers had held an average of 1.8 jobs and the nonlocals 1.2 jobs with their present employer. Over 24 percent of the local workers and 30.2 percent of the nonlocal workers earned over \$13,000 with the median being \$12,000.

Table IV-10. Previous Job Classification of Local and Nonlocal Coal Industry Employees, North Dakota, 1974^a

Previous Job Classification	Local		Nonlocal	
	Number	Percent ^b	Number	Percent
General Laborer	60	42.6	4	16.7
Electricians and Engineers	6	4.3	6	25.0
Mechanics, Welders, and Carpenters	25	17.7	8	33.3
Equipment Operators	38	27.0	3	12.5
Farmers	7	5.0	0	0.0
Miscellaneous	5	3.5	3	12.5
Total	141	100.1	24	100.0

^a Forty-four employees had no previous employment and three employees failed to answer if they had previous employment.

^b Total percent may not add to 100 due to rounding.

Job descriptions for the coal industry were condensed into nine categories. Information obtained from coal industry personnel and personal judgment were used in developing these nine categories. The categories are defined as follows:

1. Yard Operator or Car Spotter—one who is employed at the tipple and lines up coal cars for loading and performs other miscellaneous tasks.
2. Dragline or Shovel Operator and Oiler—dragline operator is one who operates an electric dragline or shovel in the removal of overburden in strip mines. A dragline oiler provides maintenance to the dragline and assists the operator.
3. General Laborer—one who works at the mine or power plant performing any combination of tasks, such as cleaning working areas, painting, or general handyman.
4. Mechanics, Welders, and Carpenters—one who provides a maintenance function on coal mine or power plant equipment.
5. Electricians, Engineers, and Boiler Attendant—one who is skilled in electronics or en-

gineering and works in this capacity at either the coal mine or power plant.

6. Accountant and Office Persons—one who performs record keeping, accounting, and general office functions for the coal or power companies.
7. Manager and Foreman—one who performs a supervisory or managerial function and is responsible in various degrees for the overall operation of the coal mine or power plant.
8. Dozer Operator and Truck Driver—one who operates power equipment used in the removal of overburden and the reclamation process. One who drives a vehicle used in moving or replacing overburden, coal, or other material.
9. Miscellaneous—coal shooters (dynamiters), night watchmen, and other miscellaneous workers.

Over 22 percent of the local workers compared to 4.7 percent of the nonlocal workers were general laborers, while 27.9 percent of the nonlocal and only 4 percent of the local workers were in the electrician, engineer, and boiler attendant category (Table IV-11). Most workers entered the coal industry in the same category that they held in their previous job.

Table IV-11. Present Job Classification of Local and Nonlocal Coal Industry Employees, North Dakota, 1974

Present Job Classification	Local		Nonlocal	
	Number	Percent	Number	Percent ^a
Yard Operators or Car Spotters	13	6.6	2	4.7
Dragline or Shovel Operators, and Dragline Oilers	16	8.1	0	0.0
General Laborers	44	22.2	2	4.7
Mechanics, Welders, and Carpenters	24	12.1	5	11.6
Electricians, Engineers, and Boiler Attendants	8	4.0	12	27.9
Accountants and Office Personnel	9	4.5	6	14.0
Managers and Foreman	31	15.7	9	20.9
Dozer Operators and Truck Drivers	37	18.7	4	9.3
Miscellaneous	16	8.1	3	7.0
Total	198	100.0	43	100.1

^aTotal percent may not add to 100 due to rounding.

Comparison of the Characteristics of Coal Industry Construction and Operating Work Forces

Both work forces consisted primarily of male workers. Ninety-six percent of the construction workers and 93 percent of the operating workers were male. The ages of the workers were comparable, 36 years for the construction and 37 for the operating work force. Almost 80 percent of the construction and 87 percent of the operating workers were married. The construction workers had an average of 1.55 children per worker and the operating workers, 1.8 children per worker. However, only 73 percent of the construction workers had their family

living with them, resulting in a reduction in the average number of children to .92 per worker. About 56 percent of the construction workers and 86 percent of the operating workers were born in North Dakota. Over 37 percent of the construction workers lived in a community with a population of 500 to 1,000; whereas 44.4 percent of the operating workers lived in a community between 1,000 and 2,500 people. The construction workers had lived an average of 9.9 years and operating workers 22 years in their present community. About 50 percent of the construction workers and over 80 percent of the operating workers owned their housing at the time of the survey. The construction work force had more formal education than the operating work force, with over 80 percent as opposed to 69 percent having at least a high school degree. Over 40 percent of the construction workers and 31.1 percent of the operating workers had some type of vocational training. The type of vocational training was similar for both work forces with the emphasis on mechanical, welding, and electrical skills.

The construction workers commuted much farther to work (29 miles one way compared to 9.1 miles) than the operating work force. This may reflect a lack of housing close to the construction sites. Since construction work at a site is normally short term, the construction worker is generally more willing to commute longer distances for the added services of a larger town.

The construction workers received higher wages than the operating employees. The average wage of a North Dakota coal industry construction employee who worked an average of 10.1 months a year in 1975 was over \$14,500; the average income of an operating employee was approximately \$12,000 in 1974.

WYOMING

Workers at the Jim Bridger (Rock Springs, Wyoming) and Dave Johnson (Glenrock, Wyoming) sites were surveyed during the summer of 1976 by researchers at the University of Wyoming. A total of 396 or 59.5 percent of the 665 employees at the two sites responded to the questionnaire.

Rock Springs Coal Mine and Electric Generating Plant Operating Work Force

One hundred and twenty-eight, or 53.1 percent of the 241 employees at the Jim Bridger Power Plant and Mine were nonlocal workers. Nonlocal workers were again defined as those who changed residences to work at their job at the time of the survey. Local and nonlocal workers were approximately the same age; local workers averaged 32.0 years of age and nonlocal workers had an average age of 32.9 years. Seventy-seven percent of the local workers and 78.1 percent of the nonlocal workers were married. Only 1.8 percent of the local workers and

10.2 percent of the nonlocal workers were widowed or divorced.

Local workers had an average of 1.37 children per worker, while nonlocal workers had 1.59 children. Almost 97 percent of the local and 98.0 percent of the nonlocal workers had their families living with them. Married local workers who had their families living with them had an average family size of 3.85 and the nonlocal workers 4.08.³ Wyoming was the birth place of 29.2 percent of the local workers and 19.5 percent of the nonlocal workers were born in the adjoining states of Montana, South Dakota, Nebraska, Colorado, Utah, and Idaho. Over 82 percent of the local workers and 86.7 percent of the nonlocal workers lived in a community with a population of over 10,000 people. Local workers had lived an average of 11.1 years and nonlocal workers 3.2 years in their present community.

Over 38 percent of the local and 35.9 percent of the nonlocal workers owned a single family house; whereas, 20.4 percent of the local and 33.6 percent of the nonlocal workers rented some form of housing (Table IV-12). One reason for the low percentage of workers owning single family dwellings may have been the lack of available houses in the Rock Springs area.

The work force in the Rock Springs area had high levels of educational attainment with 85.9 percent of the local and 93.1 percent of the nonlocal workers having completed high school (Table IV-13). Non-

Table IV-12. Present Housing of Local and Nonlocal Coal Industry Employees, Rock Springs, Wyoming, 1976

Present Housing	Local		Nonlocal	
	Number	Percent	Number	Percent
Own House	43	38.1	46	35.9
Own Mobile Home	32	28.3	35	27.3
Own Other ^a	2	1.8	2	1.6
Rent Apartment	10	8.8	10	7.8
Rent House	14	12.4	7	5.5
Rent Mobile Home	7	6.2	26	20.3
Rent Other	2	1.8	0	0.0
No Answer	3	2.7	2	1.6
Total	113	100.0	128	100.0

^a"Own Other" category includes condominiums, duplexes, and fourplexes.

Table IV-13. Years of Formal Education of Local and Nonlocal Coal Industry Employees, Rock Springs, Wyoming, 1976

Years of Formal Education	Local		Nonlocal	
	Number	Percent	Number	Percent
8 Years or Less	2	1.8	0	0.0
9-11 Years	13	11.5	5	3.9
12 Years	52	46.0	56	44.1
13-15 Years	42	37.2	50	39.4
16 or More Years	3	2.7	13	10.2
No Answer	1	0.9	3	2.4
Total	113	110.0	127	100.0

³Family size consisted of married employees currently living with their families, spouse, and children.

local workers included a larger percent of college graduates with 10.2 percent of nonlocal workers but only 2.7 percent of local workers having obtained college degrees.

Previous job classification of local employees consisted of 24.8 percent equipment operators and 19.5 percent in each of office and management personnel, mechanics, welders, and carpenters (Table IV-14). Among nonlocal workers, 25.0 percent were equipment operators and 21.1 percent office and management personnel. Only 15.0 percent of the local and 11.7 percent of the nonlocal workers had been employed as general laborers prior to their employment at the time of the survey. This may indicate that many workers came from other coal-related employment or construction jobs where similar skills were required. This was obvious in the Rock Springs area as many workers who had entered the area to work on the construction phase of the Jim Bridger Power Plant accepted employment in either the operating phase of the plant or the local mining industry.

Table IV-14. Previous Job Classification of Local and Nonlocal Coal Industry Employees, Rock Springs, Wyoming, 1976

Previous Job Classification	Local		Nonlocal	
	Number	Percent	Number	Percent
General Laborers	17	15.0	15	11.7
Electricians and Engineers	12	10.6	8	6.3
Office and Management Personnel	22	19.5	27	21.1
Mechanics, Welders, and Carpenters	22	19.5	17	13.3
Equipment Operators	28	24.8	32	25.0
Operating Technicians	5	4.2	19	14.8
Miscellaneous	4	3.5	6	4.7
No Answer	3	2.7	4	3.1
Total	113	100.0	128	100.0

Local operating employees had worked an average of 45.8 months and nonlocal employees 44.0 months for their previous employer. Over 83 percent of the local and 49.2 percent of the nonlocal workers' previous job location was Wyoming.

Local operating workers had worked an average of 16.3 months and nonlocal workers 25.9 months with their present employer. Over 42 percent of the local and 46.1 percent of the nonlocal workers had held more than one position with their present company with the local workers having an average of 1.7 positions and the nonlocal workers 2.3 positions. Local operating workers earned an average of \$7.30 an hour, and nonlocal workers \$7.87 an hour. Over 51 percent of the local and 60.2 percent of the nonlocal workers earned between \$7.00 and \$8.99 an hour.

Local workers made up a higher percentage of the employees in the equipment operator and general laborer categories than did nonlocal workers, while the nonlocal workers included a higher percentage of control and auxiliary operators and managers and foremen than the local workers (Table IV-15). This may have been due to some of the employees in the management and operating classifications having transferred from similar jobs at different locations.

Over 81 percent of both the local and nonlocal workers commuted from 31 to 40 miles one way to work each day. The local workers commuted an average of 36.4 miles per day and the nonlocal workers 34.9 miles. Over 76 percent of the local workers and 75.0 percent of the nonlocal workers commuted in car pools and most of the rest commuted in private automobiles.

Table IV-15. Present Job Classification of Local and Nonlocal Coal Industry Employees, Rock Springs, Wyoming, 1976

Present Job Classification	Local		Nonlocal	
	Number	Percent	Number	Percent
Control and Auxiliary Operators	17	15.0	31	24.2
Dragline or Shovel Operators	13	11.5	7	5.5
General Laborers	11	9.7	8	6.3
Mechanics, Welders, and Carpenters	18	15.9	20	15.6
Electricians, Engineers, and Boiler Attendants	8	7.1	9	7.0
Managers and Foremen	5	4.4	11	8.6
Dozer Operators and Equipment Operators	29	25.7	27	21.1
Driller or Shooter	6	5.3	9	7.0
Miscellaneous	6	5.3	6	4.7
Total	113	100.0	128	100.0

Glenrock Coal Mine and Electric Generating Plant Operating Work Force

Sixty of the 155 employees at the Dave Johnson Power Plant and Mine at Glenrock were nonlocal workers. The local operating workers averaged 34.9 years of age and the nonlocal workers 35.1 years of age. Almost 79 percent of the local and 85.0 percent of the nonlocal workers were married.

The local workers had an average of 1.45 children per worker and the nonlocals 1.70 children per worker. All but one local and two nonlocal married workers had their families living with them in their community at the time of the survey. Married workers had an average family size of 3.86 for the local workers, compared to 4.04 for the nonlocal employees.⁴ Wyoming was the birthplace of 52.1 percent of the local and 30.0 percent of the nonlocal workers. Another 17 percent of the local and 26.7 percent of the nonlocal workers were born in one of the surrounding states. Over 55 percent of the local workers resided in a community of over 10,000 population, while only 20.0 percent of the nonlocal workers lived in a community of that size. Another 40.4 percent of the local workers lived in a community with a population of 1,000 to 2,500; while 71.7 percent of the nonlocal workers lived in a community of that size.

Over 69 percent of the local and 70.0 percent of the nonlocal workers owned a single family home, while 10.7 percent of the local and 13.4 percent of the nonlocal workers rented some type of housing (Table IV-16).

⁴Family size consisted of married employees currently living with their families, spouses, and children.

Both local and nonlocal employees showed high levels of educational attainment with 93.5 percent of the local and 93.3 percent of the nonlocal employees having completed high school (Table IV-17). Almost 40 percent of the local and 51.7 percent of the nonlocal workers had received formal education beyond high school.

Table IV-16. Present Housing of Local and Nonlocal Coal Industry Employees, Glenrock, Wyoming, 1976

Present Housing	Local		Nonlocal	
	Number	Percent	Number	Percent
Own House	65	69.1	42	70.0
Own Mobile Home	14	14.9	8	13.3
Own Other ^a	5	5.3	0	0.0
Rent Apartment	6	6.4	1	1.7
Rent House	3	3.2	7	11.7
Rent Mobile Home	1	1.1	0	0.0
Rent Other	0	0.0	0	0.0
No Answer	0	0.0	2	3.3
Total	94	100.0	60	100.0

^a"Own Other" category includes condominiums, duplexes, and four-plexes.

Table IV-17. Years of Formal Education of Local and Nonlocal Coal Industry Employees, Glenrock, Wyoming, 1976

Years of Formal Education	Local		Nonlocal	
	Number	Percent	Number	Percent
8 Years or Less	1	1.1	1	1.7
9-11 Years	4	4.3	1	1.7
12 Years	51	54.3	25	41.7
13-14 Years	34	36.2	24	40.0
16 or More Years	3	3.2	7	11.7
No Answer	1	1.1	2	3.3
Total	94	100.0	60	100.0

The previous job category of local employees consisted of 25.5 percent office and management personnel, 22.3 percent equipment operators, and 19.1 percent general laborers (Table IV-18). Of the nonlocal workers, 18.3 percent had previously been employed as office and management personnel; 18.3 percent as mechanics, welders, and carpenters; 16.7 percent as operating technicians; and 16.7 percent general laborers.

Table IV-18. Previous Job Classification of Local and Nonlocal Coal Industry Employees, Glenrock, Wyoming, 1976

Previous Job Classification	Local		Nonlocal	
	Number	Percent	Number	Percent
General Laborers	18	19.1	10	16.7
Electricians and Engineers	6	6.4	4	7.7
Office and Management Personnel	24	25.5	11	18.3
Mechanics, Welders, and Carpenters	18	19.1	11	18.3
Equipment Operators	21	22.3	9	15.0
Operating Technicians	3	3.2	10	16.7
Miscellaneous	3	3.2	3	5.0
No Answer	1	1.1	2	3.3
Total	94	100.0	60	100.0

The local operating employees had worked an average of 45.3 months and the nonlocal workers 41.0 months for their previous employer. Over 87 percent of the local workers and 55.0 percent of the

nonlocal employees' previous job location was Wyoming.

The local operating workers had worked an average of 62.4 months and the nonlocal workers 88.2 months for their present employer. Almost 64 percent of the local and 71.7 percent of the nonlocal workers had held more than one position with their present company. The local workers had averaged 2.8 positions and the nonlocal workers 2.9 positions with their present company. The local workers earned an average of \$7.31 per hour and the nonlocal workers \$8.18 per hour. The nonlocal workers were consistently in higher earning categories than local workers with 28.3 percent of the nonlocal workers earning over \$9.00 an hour.

Almost 28 percent of the local workers were dozer or equipment operators; 19.1 percent mechanics, welders, and carpenters; and 18.1 percent control and auxiliary operators (Table IV-19). Over 28 percent of the nonlocal workers were control and auxiliary operators, while 25 percent were mechanics, welders, and carpenters.

The local workers commuted considerably longer distances than the nonlocal workers. Almost 60 percent of the local workers commuted from 21 to 40 miles to work (one way), while only 31.6 percent of the nonlocal workers commuted within that range. The local workers commuted an average of 21.9 miles per day (one way) and the nonlocal workers 14.1 miles.

Table IV-19. Present Job Classification of Local and Nonlocal Coal Industry Employees, Glenrock, Wyoming, 1976

Present Job Classification	Local		Nonlocal	
	Number	Percent	Number	Percent
Control and Auxiliary Operators	17	18.1	17	28.3
Dragline or Shovel Operators	5	5.3	4	6.7
General Laborer	9	9.6	3	5.0
Mechanics, Welders, and Carpenters	18	19.1	15	25.0
Electricians, Engineers, and Boiler Attendants	5	5.3	9	15.0
Managers and Foremen	4	4.3	4	6.7
Dozer Operators and Equipment Operators	26	27.7	6	10.0
Driller or Shooter	3	3.2	0	0.0
Miscellaneous	7	7.4	2	3.3
Total	94	100.0	60	100.0

MONTANA

Workers at Decker Coal Company's Decker Mine were surveyed in 1975. Decker Coal Company is a subsidiary of Peter Kiewit and Sons. The questionnaire was designed and administered by Decker Coal Company officials and was substantially different from the instrument used at the other sites; but since many of the questions were the same, data from the Decker surveys were used in this analysis.

Decker Coal Mine Operating Work Force

Eighty-one of the 116 Decker employees who answered the questionnaire were local workers.

Almost 93 percent of the local and 97.1 percent of the nonlocal workers were male. Over 38 percent of the local and 48.6 percent of the nonlocal employees were between the ages of 26 and 35. Eighty-four percent of the local and 91.4 percent of the nonlocal workers were married. Average family size was 3.22 for local and 3.20 for nonlocal workers.

Nonlocal workers had been employed longer with Peter Kiewit and Sons than local workers. Almost 31 percent of the local workers and 17.1 percent of the nonlocal workers had been employed with the company from one to two years, while 21.0 percent of the local and 31.4 percent of the nonlocal workers had been employed with Peter Kiewit and Sons for over five years.

Two-thirds of the local workers, but only 25.7 percent of the nonlocal workers, were born in either Montana or Wyoming. Over 50 percent of the local and 31.4 percent of the nonlocal employees owned a home; another 16 percent of the local and 31.4 percent of the nonlocal workers owned a mobile home. Forty-two percent of the local workers and 31.4 percent of the nonlocal workers had 12 years of education, while 33.3 percent of the local and 40.0 percent of the nonlocal workers had 13 or more years of education. Over 17 percent of the local and 14.3 percent of the nonlocal workers had vocational or technical training. The local employees earned an average of \$317 a week while the nonlocal employees' weekly earnings were \$310.

SUMMARY AND COMPARISON OF THE COAL MINES AND ELECTRIC GENERATING PLANT OPERATING WORK FORCE

A total of 753 employees responded to the operating work force questionnaires. Of those, 94.6 percent of the workers at Glenrock, Wyoming having a high school degree, while only 69.3 percent of the local workers. A local worker was classified as an employee who did not change his location of residence to work at his job at the time of the surveys. Almost 83 percent of the employees were married. The employees had an average of 1.57 children per worker and 54.5 percent of the employees owned a house. The workers had lived an average of 168 months or 14 years at their present address. Almost 53 percent of the employees were born in the state in which they were working when interviewed.

The number of local workers hired at each site varied from 82.2 percent in North Dakota to 46.9 percent in Rock Springs, Wyoming. The educational level of employees varied substantially with 93.5 percent of the workers at Glenrock, Wyoming have a high school degree, while only 69.3 percent of the workers in North Dakota had a high school diploma. A comparison of various worker characteristics by region is included in Table IV-20.

Table IV-20. A Comparison of Various Worker Characteristics by Region and Each Individual Area

Item	All Employees	North Dakota	Glenrock (Wyoming)	Rock Springs (Wyoming)	Decker (Montana)
<u>General Worker Characteristics:</u>					
Total Number of Respondents	753	241	155	241	116
Percent Local Workers	64.5	82.2	60.6	46.9	69.8
Percent Males	94.6	92.9	94.2	96.7	94.0
Average Age	34.7	36.8	34.9	32.4	b
Percent High School Graduates	84.1	69.3	93.5	89.6	90.5
Percent Married	82.7	87.1	81.3	77.6	86.2
Number of Children Per Worker ^c	1.57	1.79	1.54	1.49	1.35
Percent Owning a House	54.5	67.2	69.0	36.9	44.8
Length of Residence (Months) ^d	168	264	150	83	b
Percent Born in Present State	52.7	86.3	43.9	24.1	54.3
<u>Present Employment Characteristics:</u>					
Months Employed	65	104	72	21	b
Number of Positions With Present Company	2.1	1.7	2.8	2.0	b
Average Distance Commuted (Miles)	21.5	9.2	18.8	35.6	21.6
<u>Previous Employment Characteristics:</u>					
Previous Length Employed (Months)	46	48	44	45	b
Percent Working Prior to Present Employment In Present State	73.0	79.6	74.8	65.1	b

^aBecause data were not available from the Decker Mine for certain worker characteristics, some averages were based on 637 employees.

^bData were not available from the Decker employees for these characteristics.

^cThis includes both married and unmarried employees.

^dThe length of residence refers to the number of months an individual has lived in his present community.

LOCAL LABOR SUPPLY MODEL

This section presents the conceptual framework of the local labor supply model developed in this study. The local labor supply model is designed to estimate the number of local workers that will be supplied by local communities to work on a given project. A local worker was defined as an employee who did not change his location of residence to work at the project site. It was hypothesized that many local workers would be willing to commute moderate distances to a project site because of the coal industry's high wages. The objective in developing the local labor supply model was to determine whether variation in the number of local workers from project to project could be explained by the characteristics of the projects and the communities surrounding them.

A review of studies on local labor markets indicated that the following variables may be important: community population, distance from residence to work, project size, number of employees at other projects in the area, population of an area, the number of underemployed workers, and the current wage level in the area (Dobbs and Kiner; Lonsdale; Clemente and Summers). Population is important as a measure of the size of the work force that would potentially be available for hire. The hypothesis is that the larger the population of a

community, the more local workers will be hired from the community to work on a project.

Review of previous studies indicated that most individuals consider commuting to be an undesirable task. This indicates an inverse relationship exists between the number of local workers and the distance they live from the project site. The farther a community is from a project site, the fewer local workers that community would be expected to supply to the project.

Project size is an important variable if the local labor supply model is to be applied to a variety of projects. This variable standardizes the model for both large and small projects. One would hypothesize a positive relationship between project size and number of local workers supplied by a community. The larger the project size the greater the number of local workers that a community will potentially supply because of increased job opportunities.

The number of workers employed at other energy related projects in the area will affect the number of local workers supplied by a community. The hypothesis is that the more projects there are in an area, the fewer workers a local community will supply to a given project because local workers will have more than one project site for possible employment. Therefore, a negative relationship is expected to exist between the number of workers

employed at area projects and the number of local workers each community will supply to a given project.

The population of other communities in a commuting region is hypothesized to have a negative relationship with the number of local workers supplied. The more people in the area available for employment, the fewer workers each community will supply because more competition exists for available jobs.

There is a substantial number of underemployed workers in many of the western coal development areas (Voelker). Many of these workers may have skills required for coal industry employment. However, the amount of underemployment in an area is difficult to measure. One potential measure is the number of weeks worked in the past year. However, these data are not available for the smaller communities in the coal development areas. Another potential measure, and the one used in this study, is the current area wage level. Current wage levels of coal industry employees are high relative to wage levels of employees in other occupations in coal development areas. The hypothesis is that the greater this difference in wages, the more underemployment that exists and the more workers each community will supply.

The following hypotheses were developed to indicate the relationships between variables:

- Hypothesis 1: There is a positive relationship between the number of local workers supplied by community i to project j (LW_{ij}) and the size of the community i (POP_i).
- Hypothesis 2: There is an inverse relationship between the number of local workers supplied by community i to project j and the distance between i and j (D_{ij}).
- Hypothesis 3: There is a positive relationship between the number of local workers supplied by community i to project j and the total number of workers on project j (EMP_j).
- Hypothesis 4: To the extent that workers from community i are already employed on energy-related projects other than j (ΣEMP), LW_{ij} will be diminished.
- Hypothesis 5: The larger the total population of other communities (ΣPOP) within the project's commuting region, the smaller will be LW_{ij} . This hypothesis takes into account the possibility that the number of jobs available to residents of a community may be limited if there are large competing sources of supply within the area.

Hypothesis 6: There is an inverse relationship between a community's wage level (WL_i) and the number of workers that will be supplied to a project (LW_{ij}).

In summary, the model and the hypothesized relationships are as follows: $LW_{ij} = a_0 + a_1 POP_i + a_2 D_{ij} + a_3 EMP_j + a_4 \Sigma EMP + a_5 \Sigma POP + a_6 WL_i$

Where: a_2 , a_4 , a_5 , and a_6 are expected to be negative; and a_1 , and a_3 are expected to be positive.

Where: LW_{ij} = the number of local workers supplied by community i to project j .
 POP_i = the population of community i
 D_{ij} = the distance between community i and project j
 EMP_j = the number of employees at project j
 ΣEMP = the total number of employees at other energy related projects in the area
 ΣPOP = the total population of all communities in the area
 WL_i = the wage level of community i

Observations for testing the model consisted of those communities with local workers working on a project or plant site. Special census data were available for only a few communities. Therefore, the 1970 census of population was used in measuring POP_i . The number of employees working on a project at the time it was surveyed provided the estimate of EMP_j . Distance (D_{ij}) was the calculated road mileage between the community and project sites, determined by using mileages from state highway maps. The population of other communities in the region (ΣPOP) consisted of the sum of the population of communities within the commuting region of a project or plant.⁵ The total number of workers employed at other projects (ΣEMP) consisted of the number of employees working at all energy-related project sites within the commuting region. Most communities had relatively small populations and data on current wage levels by community were not available. County estimates of wages and salaries in 1974 were divided by wage and salary employment which was available from the Bureau of Economic Analysis, U.S. Department of Commerce, to provide an estimate of wage levels for each county. Every community in a county was assigned the same wage level.

⁵ The commuting region includes all communities from which it would be reasonable to commute daily to the place of employment. For this study, the commuting region was confined to 40 miles.

Ordinary least squares was used to estimate coefficients of the North Dakota construction model, the regional operating model, and also for models for each of the areas, except the Decker area, where there were not sufficient data for computation.⁶

North Dakota Construction Work Force Model

Data from the North Dakota construction sites provided 32 observations on LW_{ij} .⁷ The results of the model are shown below with the t-values in parentheses.⁸

$$LW_{ij} = 17.1182 + .0016 POP_i + .0193 EMP_j - .3839 D_{ij} - .0001 \Sigma POP - .0080 \Sigma EMP + .0028 WL_i$$

(4.85) (1.27) (-2.13) (-.69) (-.61) (.94)

F Value = 8.04

The coefficient of determination (R^2) is the amount of total variation in LW_{ij} that can be explained by the equation. The coefficient of determination is .659. In other words, the equation accounted for 65.9 percent of the variation of LW_{ij} . The coefficients on POP_i and D_{ij} are significant at the .05 level. The hypothesized relationships exist for both POP_i and D_{ij} .

Regional Operating Work Force Model

Data from all operating sites provided 54 observations on LW_{ij} . The empirical results are shown below with the calculated t-ratios in parentheses.⁹

$$LW_{ij} = 1.2630 + .0020 POP_i + .1551 EMP_j - .6324 D_{ij} - .0007 \Sigma POP + .0028 EMP + .0010 WL_i$$

(4.93) (3.17) (-2.60) (-.93) (.40) (.38)

F Value = 6.24

The coefficient of determination is .443. The coefficients on POP_i , EMP_j , and D_{ij} are significant at the .05 level, while the other independent variables were not significant. The hypothesized relationships exist for the significant variables in the equation. The best equation including only significant variables was:

$$LW_{ij} = 7.2600 + .0018 POP_i + .1204 EMP_j - .5479 D_{ij}$$

(4.66) (2.87) (-2.57)

F Value = 11.21

This equation had an R^2 of .402 and explained almost as much of the variation in LW_{ij} as the total model.

North Dakota Operating Work Force Model

Data from the North Dakota operating sites provided 28 observations on LW_{ij} . The results of the North Dakota model are shown below with the

t-values in parentheses.¹⁰

$$LW_{ij} = -7.5142 + .0014 POP_i + .2401 EMP_j - .5835 D_{ij} - .0002 \Sigma POP - .0072 \Sigma EMP + .0019 WL_i$$

(1.01) (.86) (-2.48) (-.17) (-.29) (.98)

F Value = 2.15

The coefficient of determination is .380 for the equation. However, the only variable that is significant at the .05 level is D_{ij} . In order to obtain a better equation, the stepwise regression procedure was used. The best equation with all coefficients significant to the .80 level is as follows:

$$LW_{ij} = 2.6049 + .0014 POP_i + .2735 EMP_j - .6446 D_{ij}$$

(1.35) (1.67) (-3.02)

F Value = 4.26

This equation had a coefficient of determination of .348 and the hypothesized relationships exist for these three variables.

Glenrock Model

Data from the Dave Johnson Plant and Mine provided ten observations on LW_{ij} . Admittedly, this is a small number of observations; however, this is not a result of limited data but rather a result of few communities in the area. Two variables (EMP_j and ΣEMP) did not have any variation and were not included in the model because the plant and mine are located within a few miles. The results of the Glenrock model are shown below:¹¹

$$LW_{ij} = 183.5720 + .0014 POP_i - .6968 D_{ij} - .0012 \Sigma POP - .0111 WL_i$$

(4.06) (-1.75) (-.11) (-.50)

F Value = 5.61

The coefficient of determination is .818 for the equation. The hypothesized relationships hold for each of the variables. However, caution is advised in using the equation as only ten observations existed for estimating the model.

Rock Springs Operating Work Force Model

Data from the Jim Bridger Plant and Mine provided nine observations on LW_{ij} . Again, this was not a problem of limited data, but rather a result of only a few communities within the commuting area. Also, three variables (ΔEMP , ΔPOP , and WL_i) did not have any variation in the Rock Springs area and were not included in the model. The results of the Rock Springs model are shown below:¹²

$$LW_{ij} = 79.4188 + .0048 POP_i - .3876 EMP_j - .3640 D_{ij}$$

(6.46) (-1.07) (-1.51)

F Value = 14.91

The coefficient of determination is .899 for the equation. Again, the results are based on only nine observations and, therefore, caution is advised when interpreting them.

⁶ The Regional Operating Model consisted of data from all the operating sites surveyed.

⁷ Data from the UPA-CPA construction site were included in the local labor supply model. The data could not be used in the discussion of socioeconomic characteristics of the construction work force because of the nature of the questionnaire.

⁸ With 25 degrees of freedom, the null hypothesis that $b = 0$ can be rejected at the 95 percent level when $t > 2.060$.

⁹ With 47 degrees of freedom, the null hypothesis that $b = 0$ can be rejected at the 95 percent level when $t > 2.021$.

¹⁰ With 21 degrees of freedom, the null hypothesis that $b = 0$ can be rejected at the 95 percent level when $t < [2.080]$.

¹¹ With five degrees of freedom, the null hypothesis that $b = 0$ can be rejected at the 95 percent level when $t < [2.571]$.

¹² Ibid.

Summary of the Models

While it is obvious that much of the variance in the regional and North Dakota models is unexplained, the equations represent a start toward determining which variables are important in estimating the supply of local workers to a major operating site. The Glenrock and Rock Springs models explain much more of the variation in LW than the others, but the models are based on so few observations that caution is advised. The hypothesized relation-

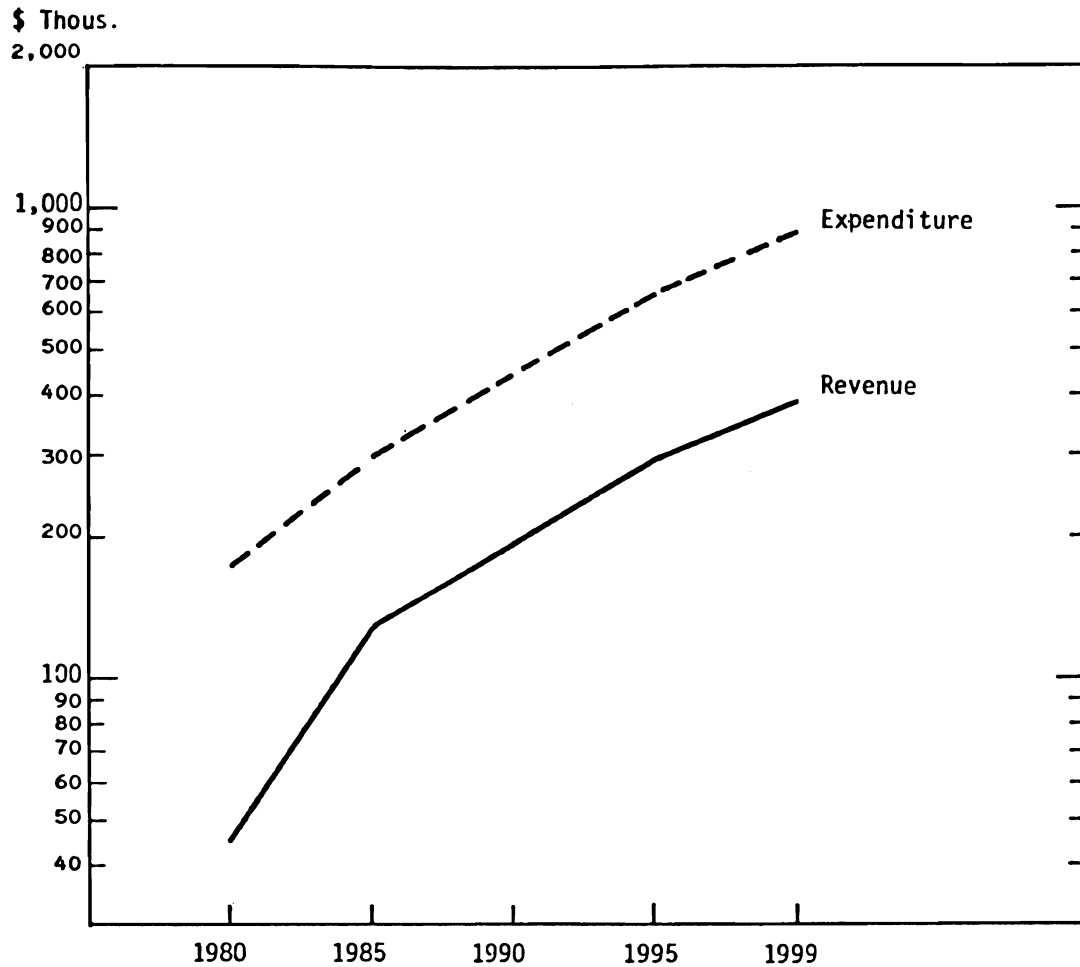
ships existed for all significant variables in each model. The differences in the magnitude of the regression coefficients indicate the importance of site specific information in estimating labor supplies. Only two variables (POP and D) played an important role in each of the equations. While these two variables seem most important in determining the number of local workers supplied by a community to a project, the remaining variables should not be overlooked in a regional labor supply model. A summary of the models is included in Table IV-21.

Table IV-21. Summary of Regression Coefficients for the Local Labor Supply Models

Area	Intercept	Variables						Observations	R ²
		POP _j	EMP _j	D _{ij}	ΣPOP	ΣEMP	WL		
North Dakota Construction	17.1182	.0016 (4.85)	.0193 (1.27)	-.3839 (-2.13)	-.0001 (-.69)	-.0080 (-.61)	.0028 (.94)	32	.659
North Dakota Operating	- 7.5142	.0014 (1.01)	.2401 (.86)	-.5835 (-2.48)	.0002 (-.17)	-.00072 (-.29)	.0019 (.98)	28	.380
Glenrock Operating	183.5720	.0014 (4.06)		-.6968 (-1.75)	-.0012 (-.11)		-.0111 (-.50)	10	.818
Rock Springs Operating	79.4188	.0048 (6.46)	.3876 (1.07)	.3640 (-1.51)				9	.899
Regional Operating Model	1.2630	.0020 (4.93)	.1551 (3.17)	-.6324 (-2.60)	.0007 (-.93)	.0028 (.40)	.0010 (.38)	54	.443

**APPENDIX
TABLES AND FIGURES**

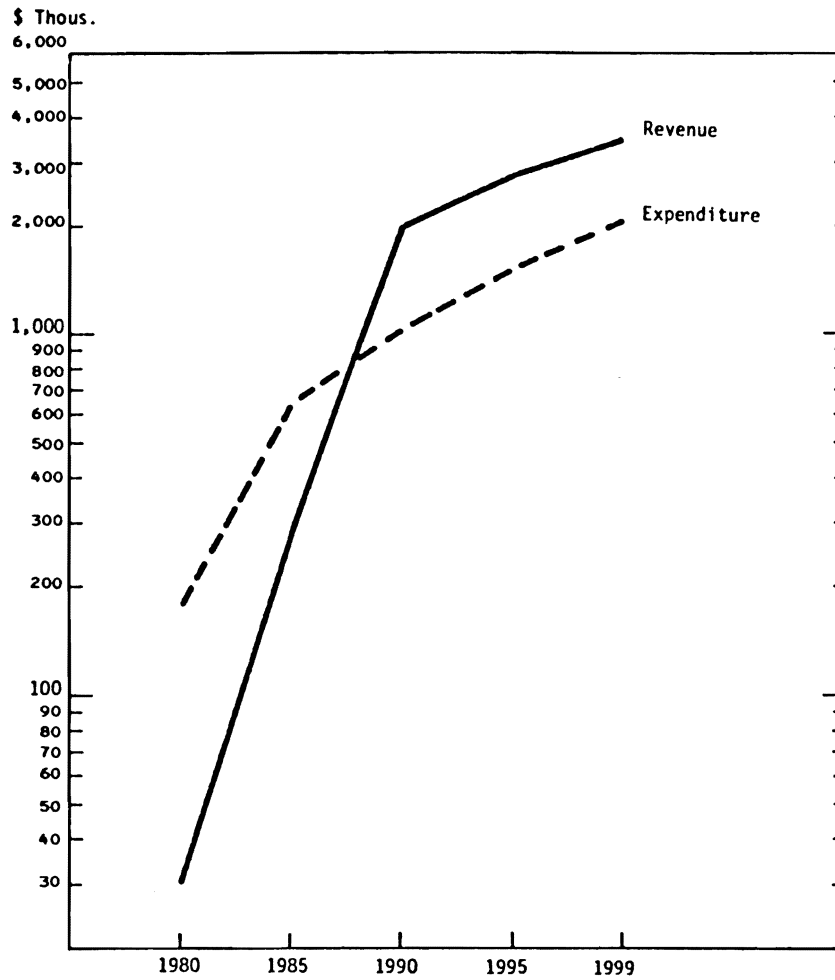
Appendix Figure 1. Burleigh County Revenues and Expenditures Associated with Level I Development



Appendix Table 1. Burleigh County Fiscal Report Associated with Level I Development (\$000)

Year	Revenue					Expenditures			Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government	
1977	3	0	0	0	0	1	0	3	-1
1978	11	0	1	0	0	1	2	29	-20
1979	20	0	6	0	0	5	5	75	-59
1980	27	0	17	0	0	9	11	153	-129
1981	30	0	34	0	0	10	13	178	-137
1982	40	27	39	0	0	10	13	194	-111
1983	46	29	43	0	0	11	14	191	-98
1984	50	31	42	0	0	13	16	234	-140
1985	44	33	52	0	0	15	17	261	-164
1986	46	35	58	0	0	15	19	285	-180
1987	49	38	63	0	0	17	22	315	-204
1988	53	41	70	0	0	19	24	341	-220
1989	57	44	75	0	0	20	26	367	-237
1990	61	48	81	0	0	21	27	392	-250
1995	86	86	119	0	0	32	40	581	-362
1999	112	112	162	0	0	42	55	788	-499

Appendix Figure 2. Dunn County Revenues and Expenditures Associated with Level I Development

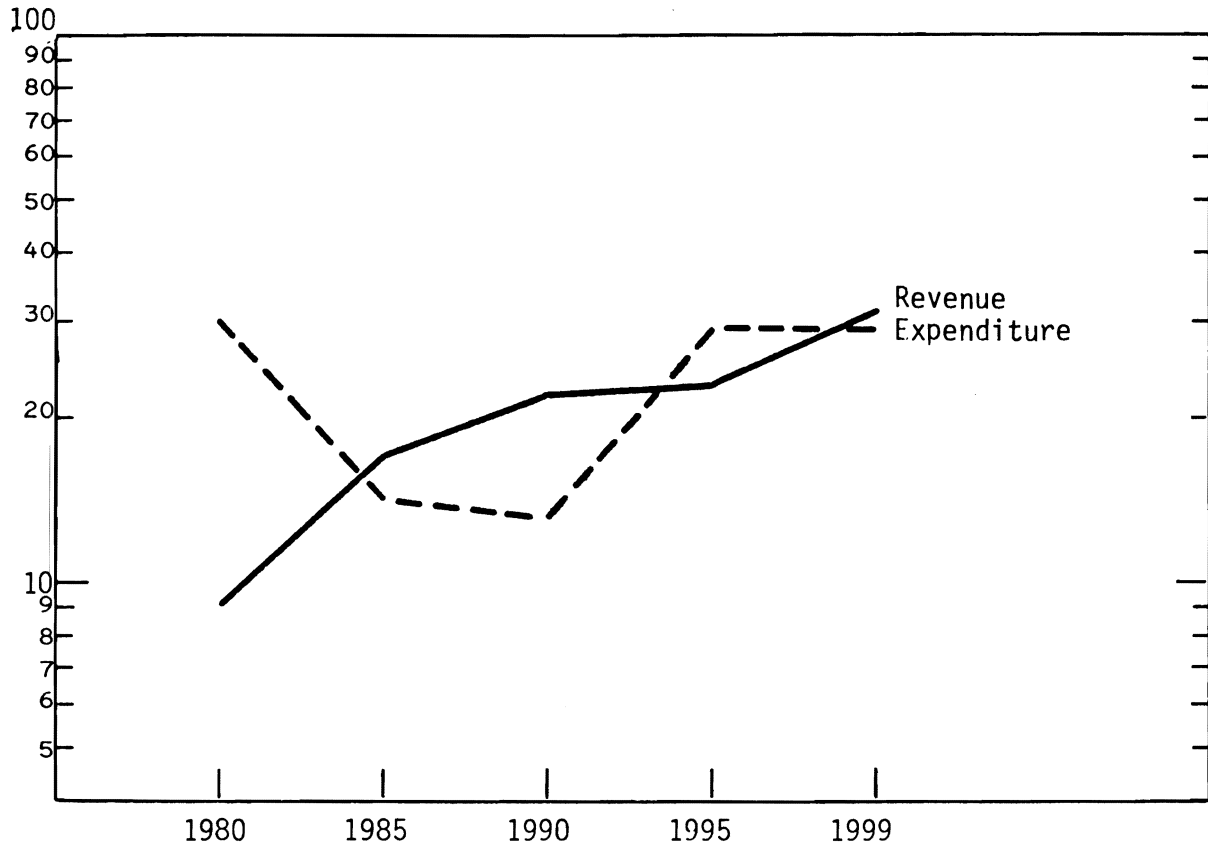


Appendix Table 2. Dunn County Fiscal Report Associated with Level I Development (\$000)

Year	Income					Expenditures			Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government	
1977	0	0	0	0	0	0	0	1	-1
1978	6	0	0	0	0	0	0	3	3
1979	16	0	1	0	0	1	1	9	6
1980	28	0	2	0	0	8	11	152	-141
1981	32	0	34	0	0	10	13	185	-142
1982	50	27	41	0	0	14	18	255	-169
1983	80	29	57	0	0	16	20	286	-156
1984	118	31	63	0	0	28	36	517	-369
1985	137	33	114	0	0	31	40	567	-354
1986	152	36	126	444	766	36	47	665	776
1987	242	38	147	444	820	39	50	721	959
1988	260	41	160	444	877	42	54	771	915
1989	279	44	171	444	939	45	58	825	949
1990	299	47	183	444	1,004	49	63	894	971
1995	418	195	274	444	1,409	73	93	1,345	1,229
1999	544	256	381	444	1,846	101	131	1,866	1,373

Appendix Figure 3. McLean County Revenues and Expenditures Associated with Level I Development

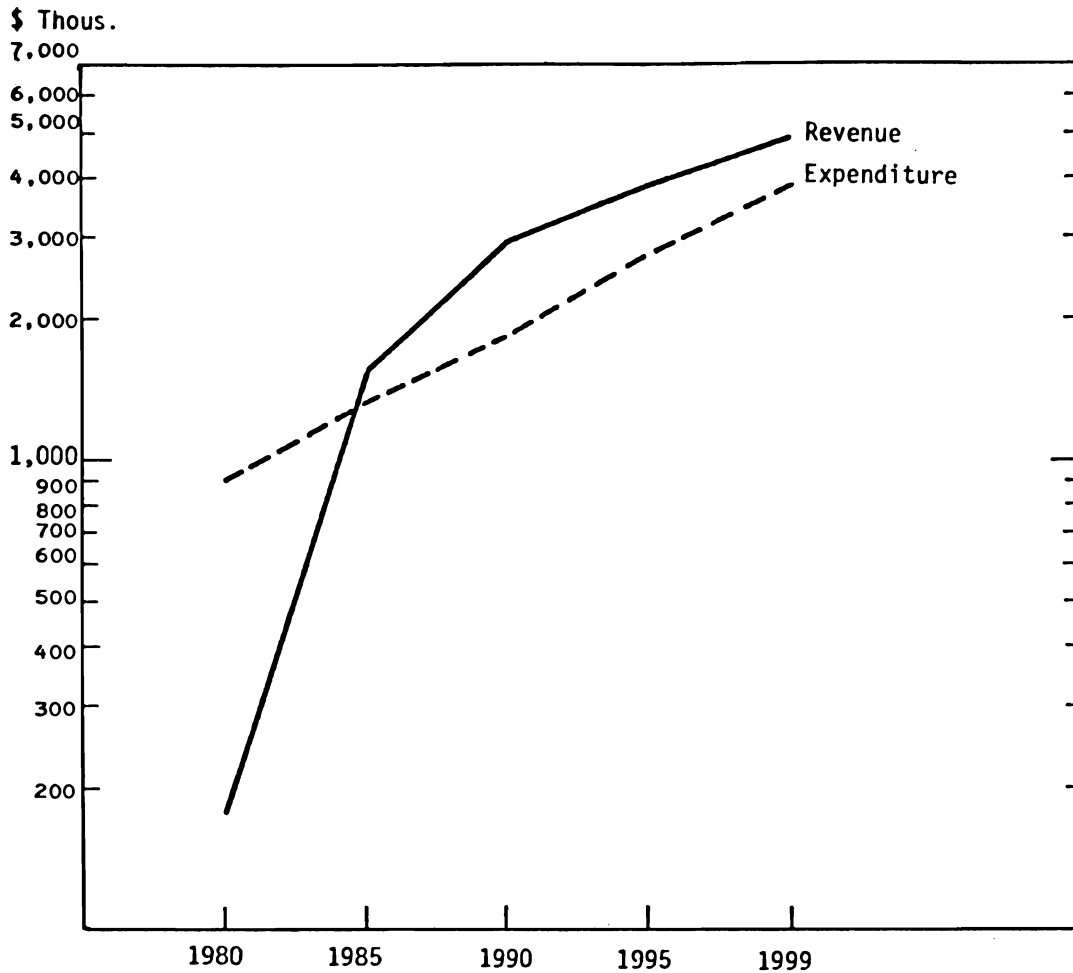
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Appendix Table 3. McLean County Fiscal Report Associated with Level I Development (\$000)

Year	Income					Expenditures			Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government	
1977	1	0	0	0	0	0	0	1	0
1978	2	0	0	0	0	1	1	8	-8
1979	3	0	2	0	0	2	1	22	-20
1980	4	0	5	0	0	1	2	27	-21
1981	4	0	6	0	0	2	2	35	-29
1982	7	5	8	0	0	2	3	36	-21
1983	9	6	8	0	0	2	2	30	-11
1984	9	5	7	0	0	1	1	16	3
1985	8	6	3	0	0	1	1	12	3
1986	8	7	3	0	0	1	1	12	4
1987	8	7	3	0	0	0	0	11	7
1988	9	7	3	0	0	1	0	10	8
1989	11	7	3	0	0	0	0	11	10
1990	12	8	2	0	0	0	1	12	9
1995	15	2	6	0	0	1	2	26	-6
1999	22	3	6	0	0	1	2	26	2

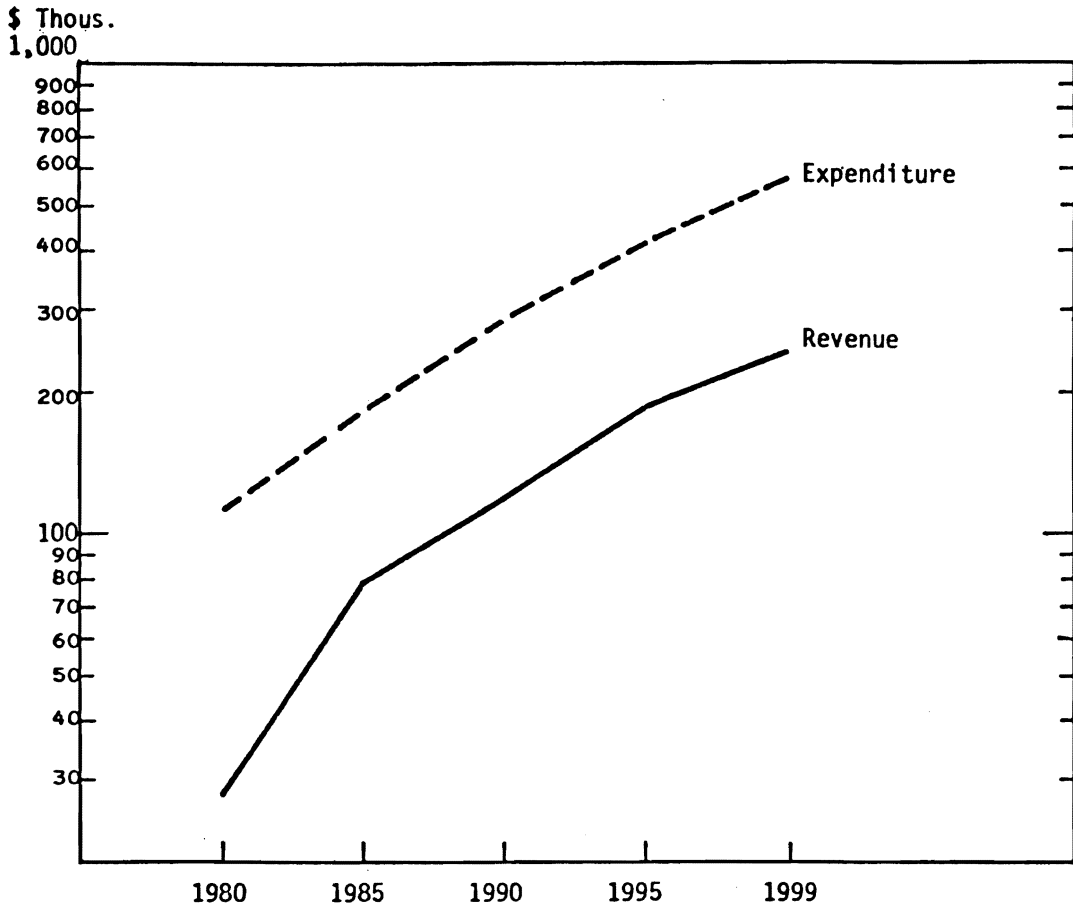
Appendix Figure 4. Mercer County Revenues and Expenditures Associated with Level I Development



Appendix Table 4. Mercer County Fiscal Report Associated with Level I Development (\$000)

Year	Income					Expenditures			Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government	
1977	4	0	0	0	0	4	5	63	-68
1978	13	0	14	0	0	14	18	253	-258
1979	29	0	55	0	0	31	39	574	-560
1980	46	0	127	0	0	44	56	802	-729
1981	67	0	177	0	0	51	66	948	-821
1982	127	143	209	108	96	44	56	799	-216
1983	176	153	177	108	102	52	68	963	-367
1984	209	163	213	402	459	59	76	1,093	218
1985	242	175	241	402	491	64	83	1,183	221
1986	272	186	261	402	525	69	89	1,273	215
1987	312	200	281	402	563	67	86	1,242	363
1988	347	214	274	402	601	73	95	1,352	318
1989	379	229	299	696	1,133	80	104	1,491	1,061
1990	455	245	329	696	1,213	86	113	1,621	1,118
1995	643	353	497	696	1,700	133	171	2,449	1,136
1999	836	463	696	696	2,229	185	239	3,429	1,067

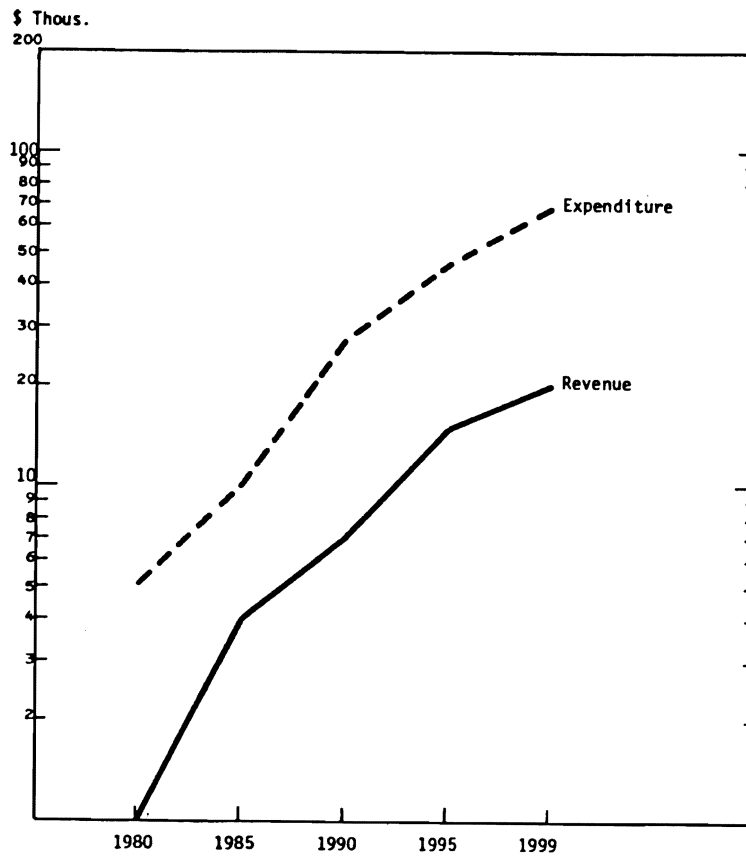
Appendix Figure 5. Morton County Revenues and Expenditures Associated with Level I Development



Appendix Table 5. Morton County Fiscal Report Associated with Level I Development (\$000)

Year	Revenue					Expenditures			Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government	
1977	1	0	0	0	0	0	0	1	0
1978	6	0	0	0	0	1	2	17	-14
1979	12	0	3	0	0	2	3	46	-36
1980	16	0	11	0	0	5	6	100	-84
1981	18	0	22	0	0	6	8	114	-88
1982	23	18	15	0	0	7	9	122	-82
1983	26	18	27	0	0	6	7	110	-52
1984	29	20	24	0	0	8	10	141	-86
1985	25	22	31	0	0	9	12	160	-103
1986	27	23	35	0	0	10	12	177	-114
1987	30	24	39	0	0	10	14	198	-129
1988	33	27	44	0	0	12	15	216	-139
1989	35	29	48	0	0	13	16	233	-150
1990	37	31	51	0	0	14	17	252	-164
1995	53	55	76	0	0	20	25	369	-230
1999	69	72	104	0	0	27	36	511	-329

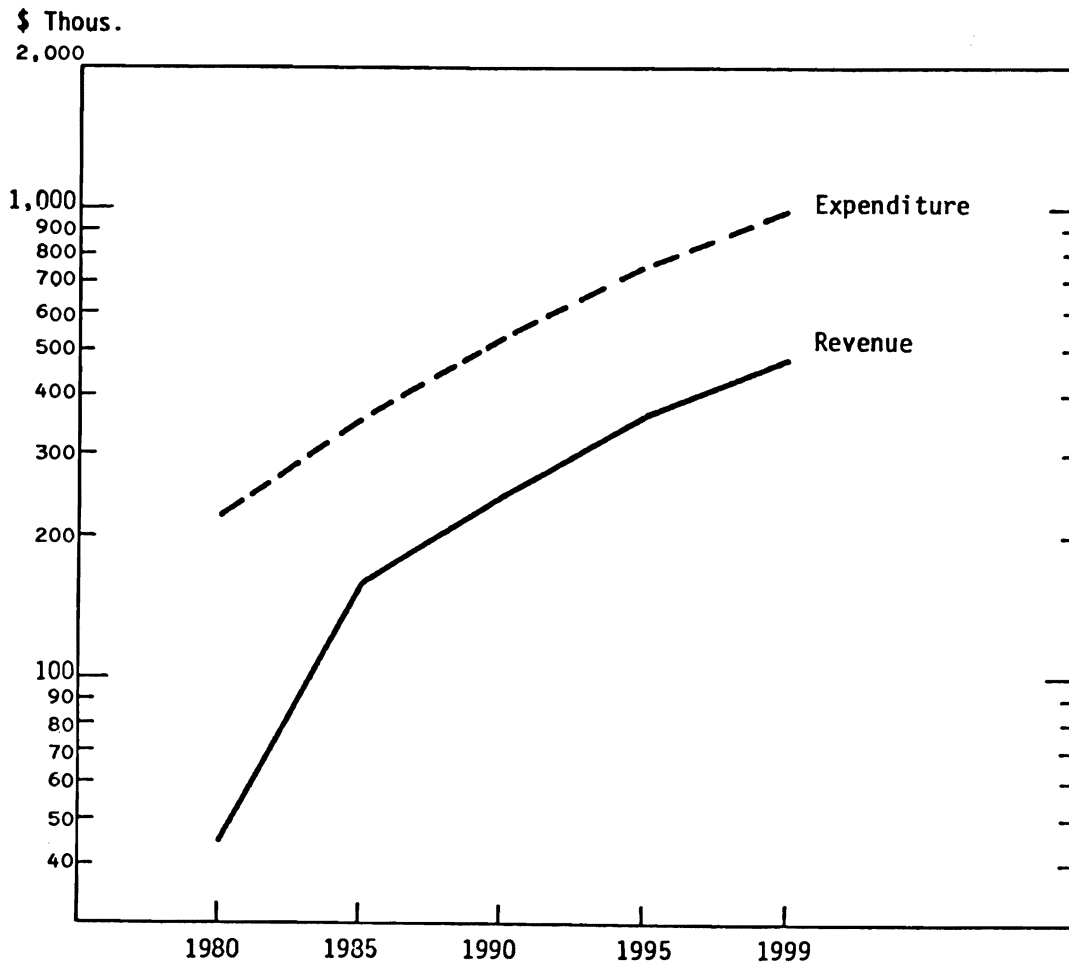
Appendix Figure 6. Oliver County Revenues and Expenditures Associated with Level I Development



Appendix Table 6. Oliver County Fiscal Report Associated with Level I Development (\$000)

Year	Income					Expenditures			Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government	
1977	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	1	0	1	-2
1979	0	0	0	0	0	0	0	3	-3
1980	0	0	0	0	0	0	1	4	-5
1981	1	0	1	0	0	0	0	6	-4
1982	1	1	1	0	0	0	0	7	-4
1983	2	1	1	0	0	1	1	7	-5
1984	2	1	1	0	0	0	1	8	-5
1985	1	1	2	0	0	0	1	9	-6
1986	1	1	2	0	0	1	1	12	-10
1987	1	1	3	0	0	1	1	16	-13
1988	1	1	3	0	0	1	2	18	-16
1989	1	2	4	0	0	1	1	21	-16
1990	1	1	5	0	0	1	2	24	-20
1995	1	5	9	0	0	2	3	41	-31
1999	1	7	12	0	0	4	4	60	-48

Appendix Figure 7. Stark County Revenues and Expenditures Associated with Level I Development

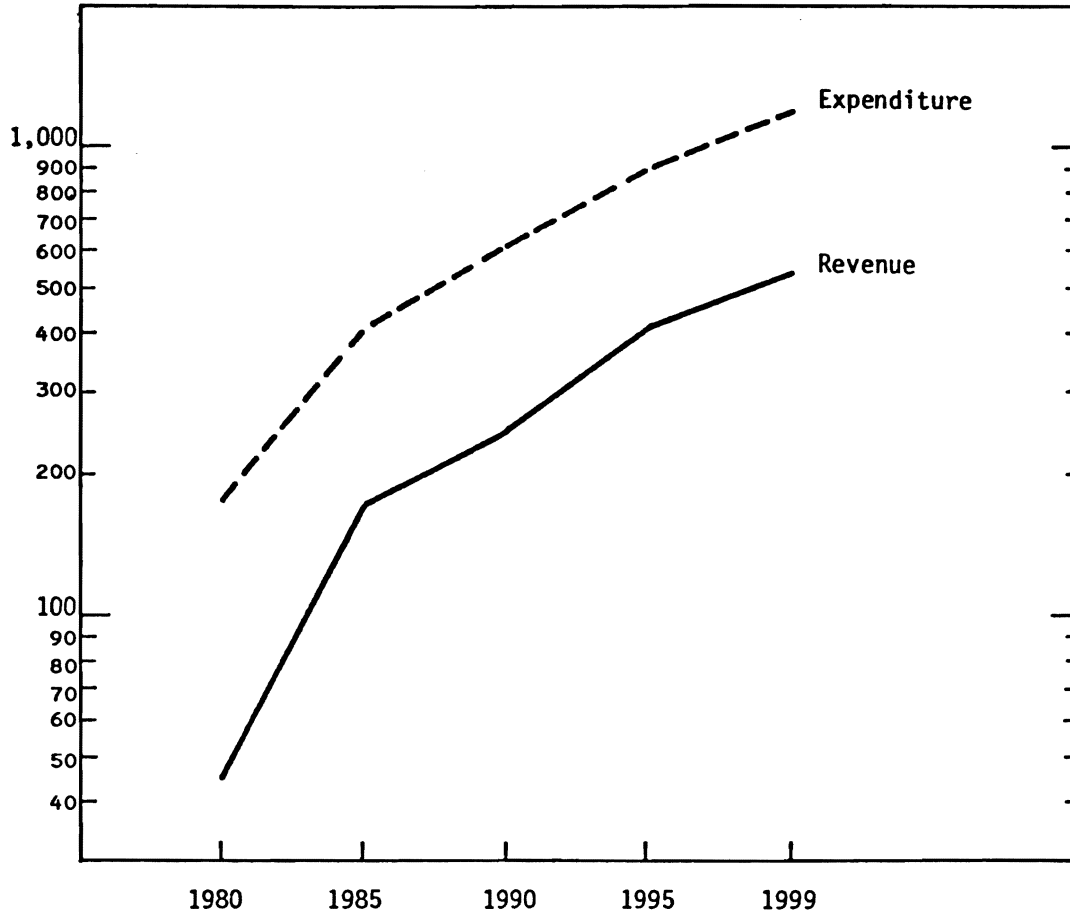


Appendix Table 7. Stark County Fiscal Report Associated with Level I Development (\$000)

Year	Income					Expenditures			Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government	
1977	2	0	0	0	0	0	0	2	0
1978	10	0	1	0	0	1	1	15	-6
1979	23	0	4	0	0	2	2	36	-13
1980	36	0	8	0	0	11	13	196	-176
1981	41	0	44	0	0	11	14	198	-138
1982	51	35	44	0	0	11	14	205	-100
1983	58	37	45	0	0	12	16	219	-107
1984	62	40	49	0	0	14	17	253	-133
1985	58	43	56	0	0	15	22	317	-197
1986	63	45	70	0	0	19	25	343	-219
1987	69	49	78	0	0	20	27	379	-230
1988	74	53	84	0	0	22	28	407	-246
1989	80	56	90	0	0	24	30	435	-263
1990	86	60	96	0	0	26	33	467	-284
1995	121	102	137	0	0	36	46	663	-385
1999	158	133	183	0	0	47	62	881	-516

Appendix Figure 8. Burleigh County Revenues and Expenditures Associated with Level II Development

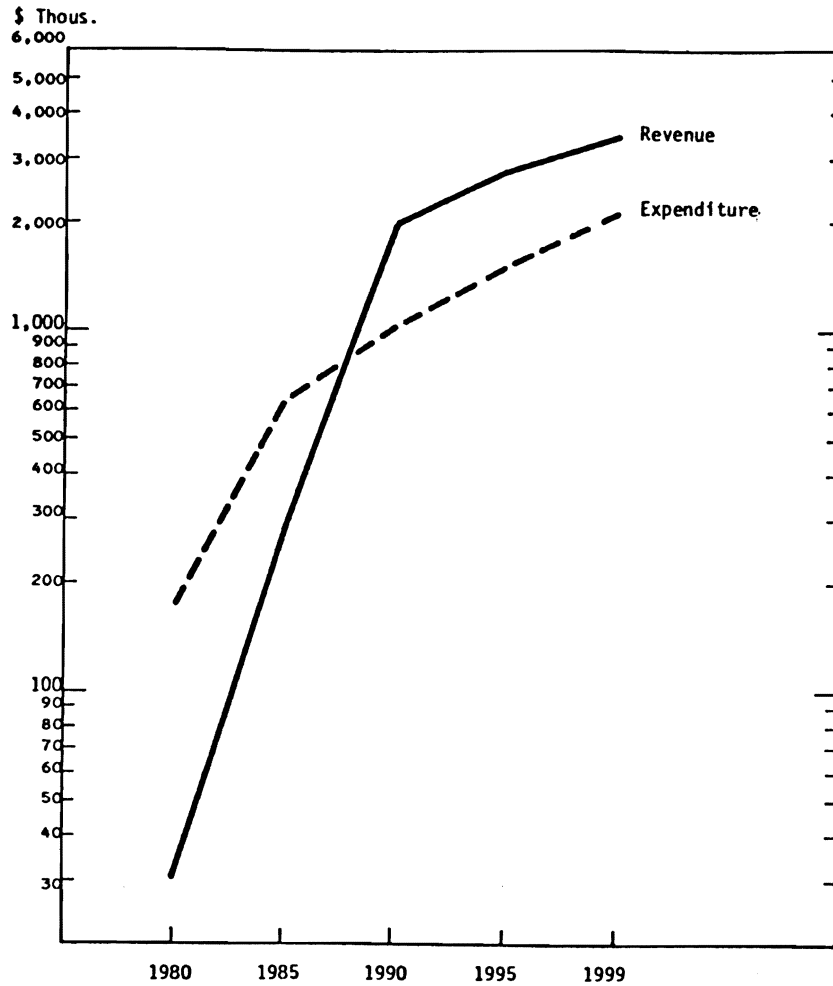
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Appendix Table 8. Burleigh County Fiscal Report Associated with Level II Development (\$000)

Year	Income					Expenditures			Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government	
1977	3	0	0	0	0	1	0	3	-1
1978	11	0	1	0	0	1	2	29	-20
1979	20	0	6	0	0	5	5	75	-59
1980	27	0	17	0	0	9	11	153	-129
1981	30	0	34	0	0	10	13	182	-141
1982	43	27	40	0	0	11	14	208	-123
1983	55	29	46	0	0	13	17	235	-135
1984	66	31	52	0	0	16	21	304	-192
1985	70	33	67	0	0	20	25	363	-238
1986	73	35	81	0	0	21	27	395	-254
1987	78	38	87	0	0	23	30	431	-281
1988	79	41	95	0	0	26	33	467	-311
1989	84	44	103	0	0	27	36	502	-334
1990	91	47	111	0	0	29	37	539	-356
1995	127	118	161	0	0	43	55	784	-476
1999	167	154	218	0	0	57	73	1,058	-649

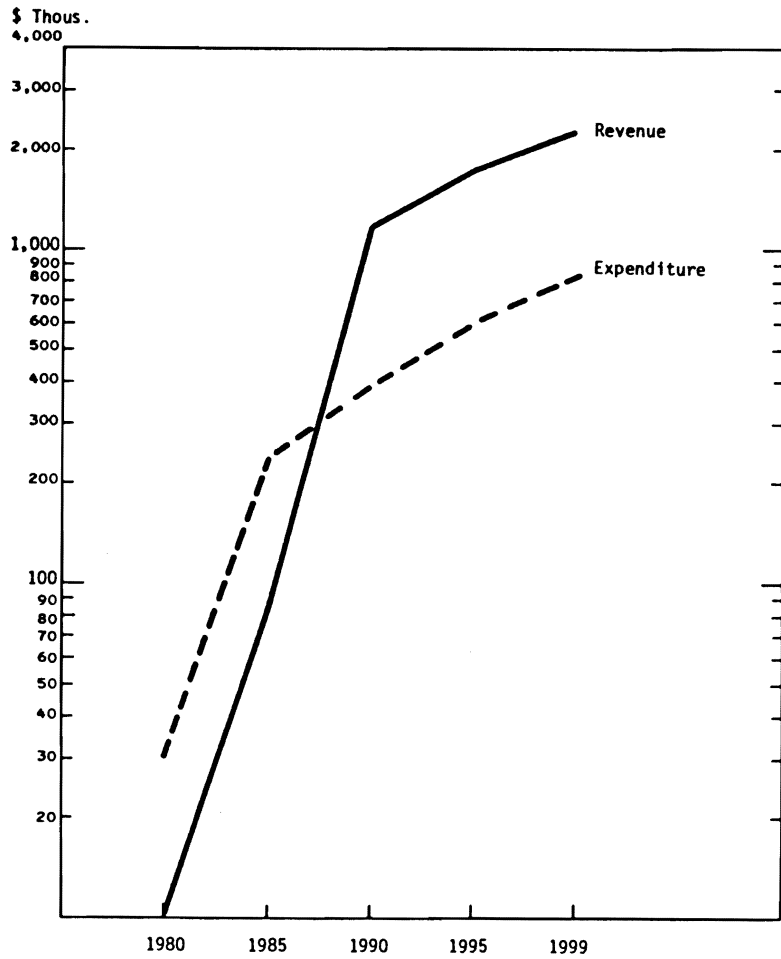
Appendix Figure 9. Dunn County Revenues and Expenditures Associated with Level II Development



Appendix Table 9. Dunn County Fiscal Report Associated with Level II Development (\$000)

Year	Income					Expenditures			Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government	
1977	0	0	0	0	0	0	0	1	-1
1978	6	0	0	0	0	0	0	3	3
1979	16	0	1	0	0	1	1	9	6
1980	28	0	2	0	0	8	11	152	-141
1981	32	0	34	0	0	10	13	186	-143
1982	50	27	41	0	0	14	18	256	-170
1983	79	29	57	0	0	16	20	290	-161
1984	117	31	64	0	0	28	36	513	-365
1985	137	33	113	0	0	31	40	567	-355
1986	151	36	126	444	766	36	47	666	774
1987	241	38	148	444	820	39	51	724	877
1988	259	41	160	444	877	42	54	773	912
1989	278	44	171	444	939	45	58	829	944
1990	298	47	183	444	1,004	49	63	896	968
1995	416	196	274	444	1,409	73	94	1,346	1,226
1999	547	256	382	444	1,846	102	131	1,879	1,363

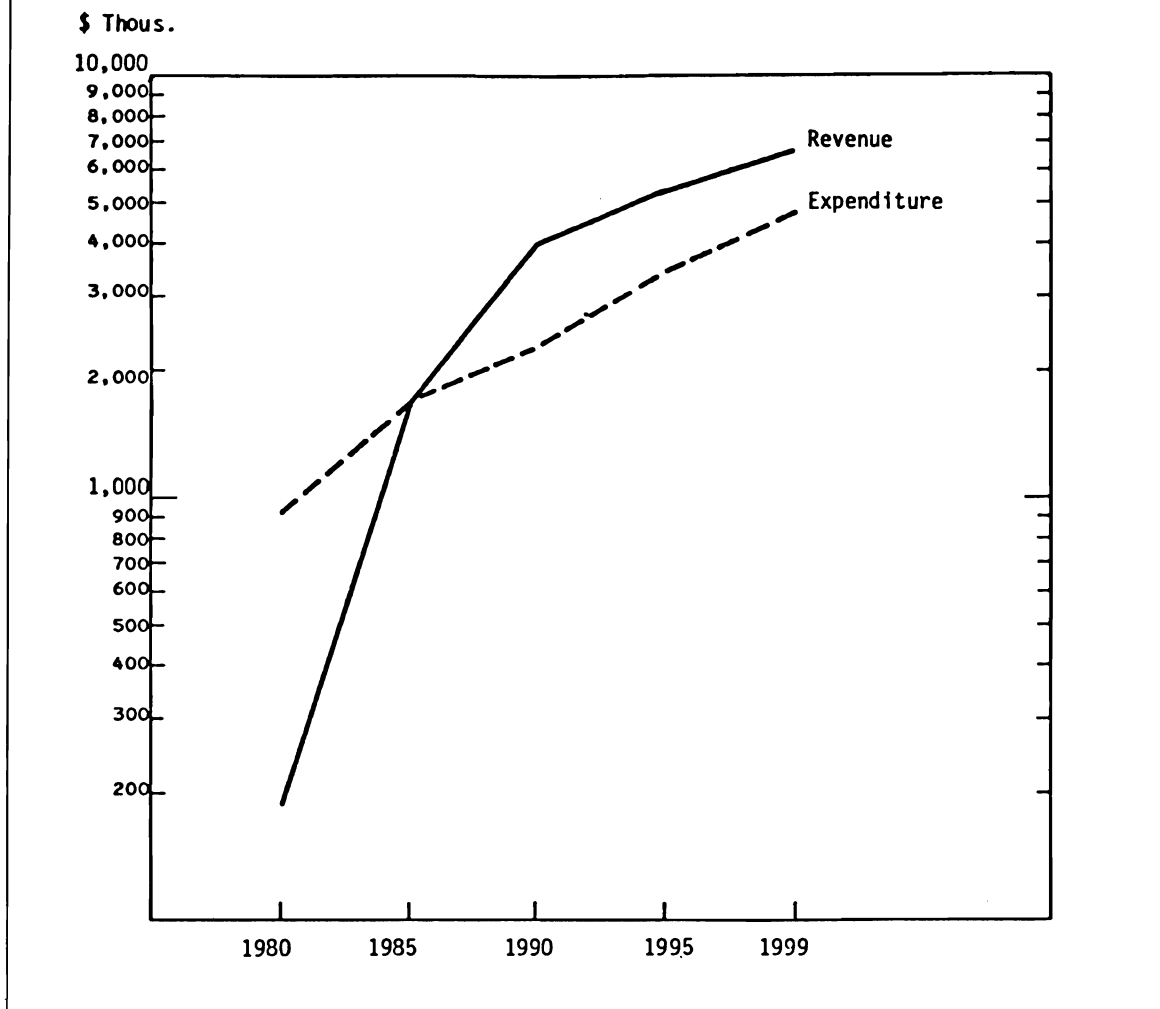
Appendix Figure 10. McLean County Revenues and Expenditures Associated with Level II Development



Appendix Table 10. McLean County Fiscal Report Associated with Level II Development (\$000)

Year	Income					Expenditures			Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government	
1977	1	0	0	0	0	0	0	1	0
1978	2	0	0	0	0	1	1	8	-8
1979	3	0	2	0	0	2	1	22	-20
1980	5	0	5	0	0	1	2	27	-25
1981	9	0	6	0	0	2	3	35	-25
1982	18	5	8	0	0	4	5	72	-50
1983	28	6	16	0	0	5	6	97	-58
1984	41	5	22	0	0	6	8	113	-59
1985	56	6	25	0	0	12	15	209	-149
1986	64	7	46	0	356	14	17	250	192
1987	103	7	55	0	767	15	19	274	624
1988	146	7	61	0	821	16	20	298	701
1989	157	7	66	0	879	17	22	321	749
1990	168	8	71	0	939	18	24	348	796
1995	231	75	109	0	1,318	29	37	534	1,133
1999	298	99	151	0	1,727	40	52	737	1,446

Appendix Figure 11. Mercer County Revenues and Expenditures Associated with Level II Development

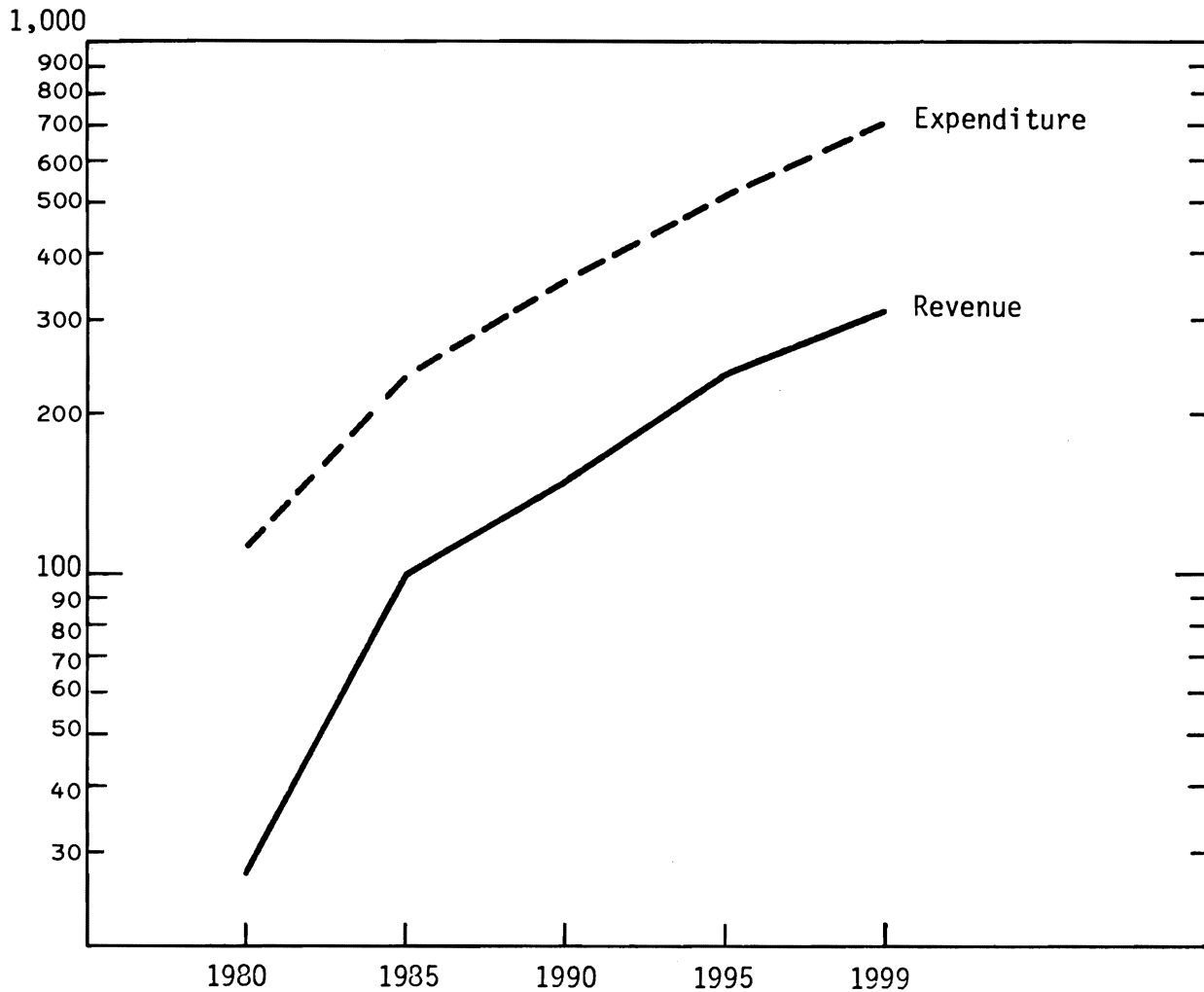


Appendix Table 11. Mercer County Fiscal Report Associated with Level II Development (\$000)

Year	Income					Expenditures			Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government	
1977	4	0	0	0	0	4	5	67	-72
1978	13	0	14	0	0	14	18	253	-258
1979	34	0	55	0	0	31	40	574	-556
1980	59	0	127	0	0	44	56	802	-716
1981	86	0	177	0	0	57	74	1,058	-926
1982	143	143	233	108	96	55	70	1,005	-407
1983	195	152	222	108	102	65	84	1,201	-571
1984	241	163	311	402	459	74	94	1,355	53
1985	302	175	299	402	491	81	105	1,502	-19
1986	341	186	331	402	908	83	107	1,529	449
1987	427	200	338	510	1,107	82	106	1,525	869
1988	472	214	336	510	1,184	91	117	1,677	831
1989	513	229	371	804	1,756	100	129	1,853	1,591
1990	599	245	409	804	1,880	100	140	2,012	1,676
1995	834	438	618	804	2,636	178	213	3,048	1,900
1999	1,098	574	865	804	3,455	231	297	4,262	2,006

Appendix Figure 12. Morton County Revenues and Expenditures Associated with Level II Development

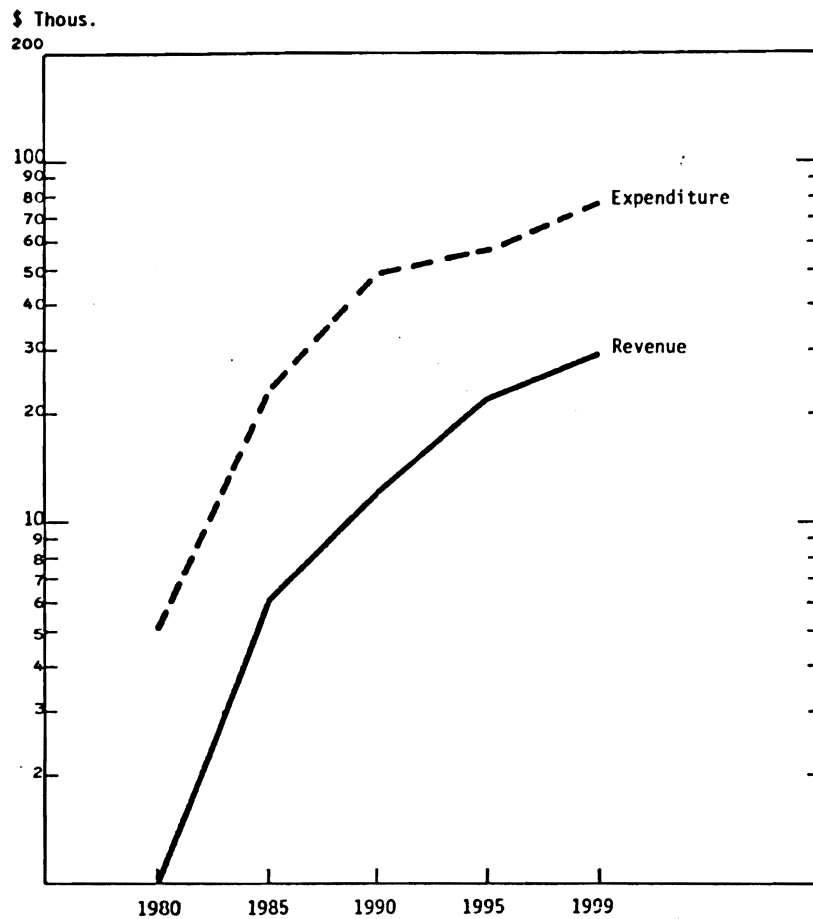
\$ Thous.



Appendix Table 12. Morton County Fiscal Report Associated with Level II Development (\$000)

Year	Income					Expenditures			Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government	
1977	1	0	0	0	0	0	0	1	0
1978	6	0	0	0	0	1	2	17	-14
1979	12	0	3	0	0	2	3	46	-36
1980	16	0	11	0	0	5	6	100	-84
1981	18	0	22	0	0	6	8	116	-90
1982	24	18	25	0	0	7	9	127	-76
1983	30	18	28	0	0	7	9	135	-75
1984	37	20	30	0	0	9	12	177	-111
1985	38	22	39	0	0	11	15	207	-134
1986	40	23	46	0	0	13	16	228	-148
1987	44	24	50	0	0	13	17	250	-162
1988	45	27	55	0	0	15	19	270	-177
1989	48	29	60	0	0	16	20	295	-194
1990	51	31	65	0	0	18	22	319	-212
1995	73	70	94	0	0	24	31	453	-271
1999	95	91	128	0	0	34	44	629	-393

Appendix Figure 13. Oliver County Revenues and Expenditures Associated with Level II Development

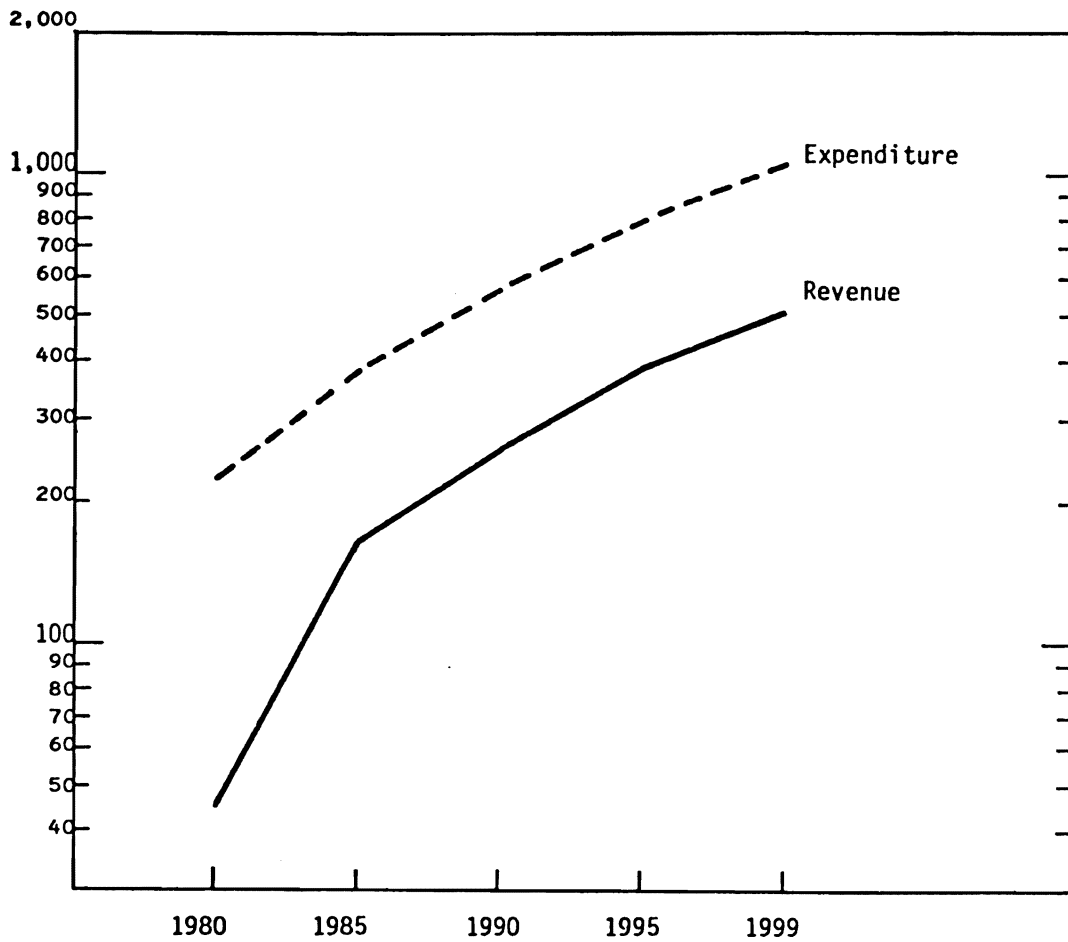


Appendix Table 13. Oliver County Fiscal Report Associated with Level II Development (\$000)

Year	Income					Expenditures			Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government	
1977	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	1	0	1	-2
1979	0	0	0	0	0	0	0	3	-3
1980	0	0	0	0	0	0	1	4	-5
1981	1	0	1	0	0	0	0	6	-4
1982	1	1	1	0	0	0	0	7	-4
1983	2	1	1	0	0	1	1	9	-7
1984	2	1	1	0	0	0	1	11	-8
1985	2	1	3	0	0	1	2	20	-17
1986	3	1	4	0	0	1	1	23	-17
1987	3	1	5	0	0	2	2	27	-22
1988	3	1	6	0	0	2	3	30	-25
1989	3	2	7	0	0	2	2	33	-25
1990	3	1	8	0	0	2	3	43	-36
1995	4	7	11	0	0	2	4	51	-35
1999	5	10	14	0	0	4	5	68	-48

Appendix Figure 14. Stark County Revenues and Expenditures Associated with Level II Development

\$ Thous.

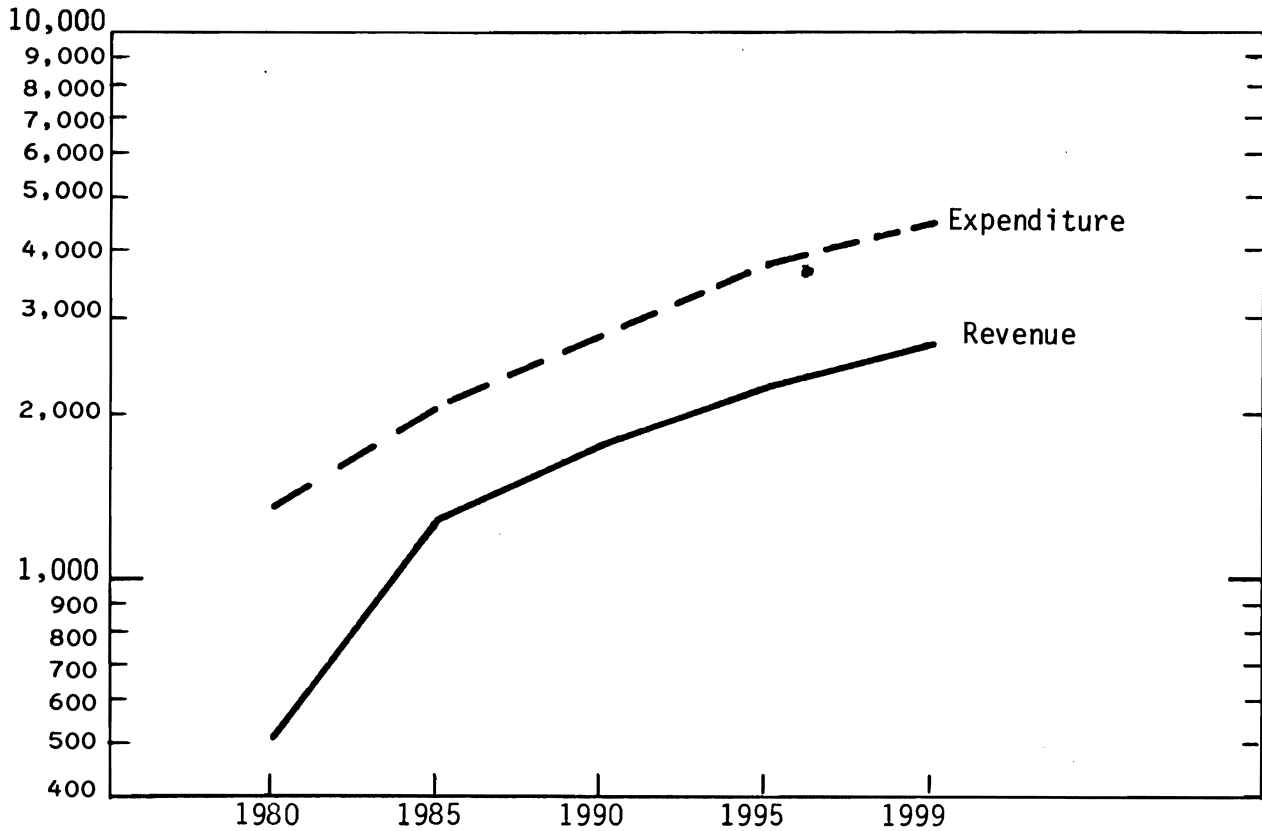


Appendix Table 14. Stark County Fiscal Report Associated with Level II Development (\$000)

Year	Income					Expenditures			Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government	
1977	2	0	0	0	0	0	0	2	0
1978	10	0	1	0	0	1	1	15	-6
1979	23	0	4	0	0	2	2	36	-13
1980	36	0	8	0	0	11	13	196	-176
1981	41	0	44	0	0	11	14	196	-136
1982	51	35	43	0	0	11	15	215	-112
1983	59	37	47	0	0	13	17	239	-126
1984	64	40	53	0	0	14	18	262	-137
1985	62	43	58	0	0	19	23	340	-219
1986	68	45	75	0	0	21	26	380	-239
1987	75	49	84	0	0	21	29	406	-248
1988	80	53	90	0	0	23	30	435	-265
1989	87	56	96	0	0	25	32	465	-283
1990	93	60	103	0	0	27	35	498	-308
1995	130	108	145	0	0	39	49	705	-410
1999	170	142	193	0	0	50	66	937	-548

Appendix Figure 15. Bismarck Revenues and Expenditures Associated with Level I Development

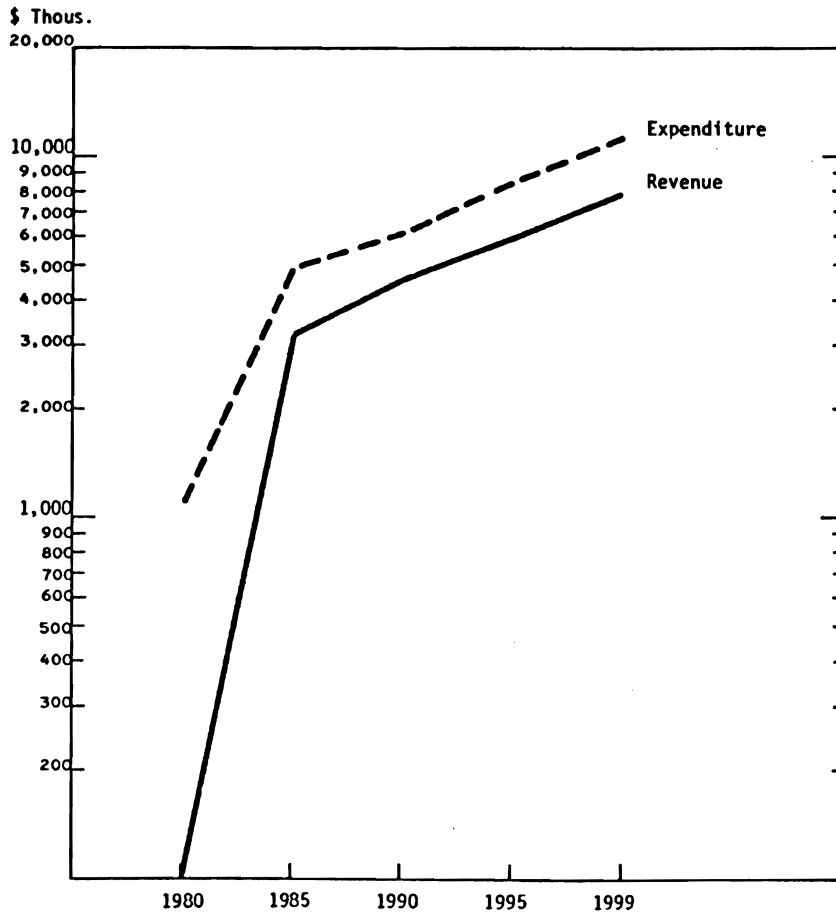
\$ Thous.



Appendix Table 15. Municipality of Bismarck, Fiscal Report Associated with Level I Development (\$000)

Year	Income								Expenditures					Net Fiscal
	Share of Local Property Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess.	Highway Fund	Cigarette and Tobacco	Conversion Tax	Debt Service	Schools	Streets	Police and Fire	City Govmt.	
1977	10	0	0	0	0	0	0	0	14	7	0	2	9	-22
1978	35	5	0	3	12	1	0	0	110	61	3	16	71	-205
1979	65	44	0	20	89	4	2	0	283	163	8	40	186	-455
1980	88	119	0	55	228	10	4	0	534	328	17	81	377	-833
1981	96	237	0	111	432	21	7	0	589	376	19	94	440	-614
1982	128	271	23	129	478	25	8	0	600	405	21	102	479	-545
1983	146	293	24	141	488	27	10	0	599	389	20	103	471	-470
1984	158	281	26	138	488	26	9	0	710	469	25	123	577	-778
1985	140	338	28	169	579	32	11	0	746	514	28	137	642	-770
1986	145	370	29	189	612	37	12	0	768	555	31	150	703	-813
1987	158	400	32	207	631	40	14	0	805	610	35	166	777	-911
1988	170	441	33	228	662	43	15	0	818	647	37	180	843	-933
1989	182	468	36	247	677	47	17	0	823	698	40	192	904	-953
1990	195	505	40	266	680	61	18	0	826	741	43	206	970	-1,021
1995	234	724	71	388	714	75	26	0	867	1,084	63	305	1,432	-1,480
1999	357	924	93	531	665	102	36	0	621	1,346	86	413	1,940	-1,698

Appendix Figure 16. Killdeer Revenues and Expenditures Associated with Level I Development

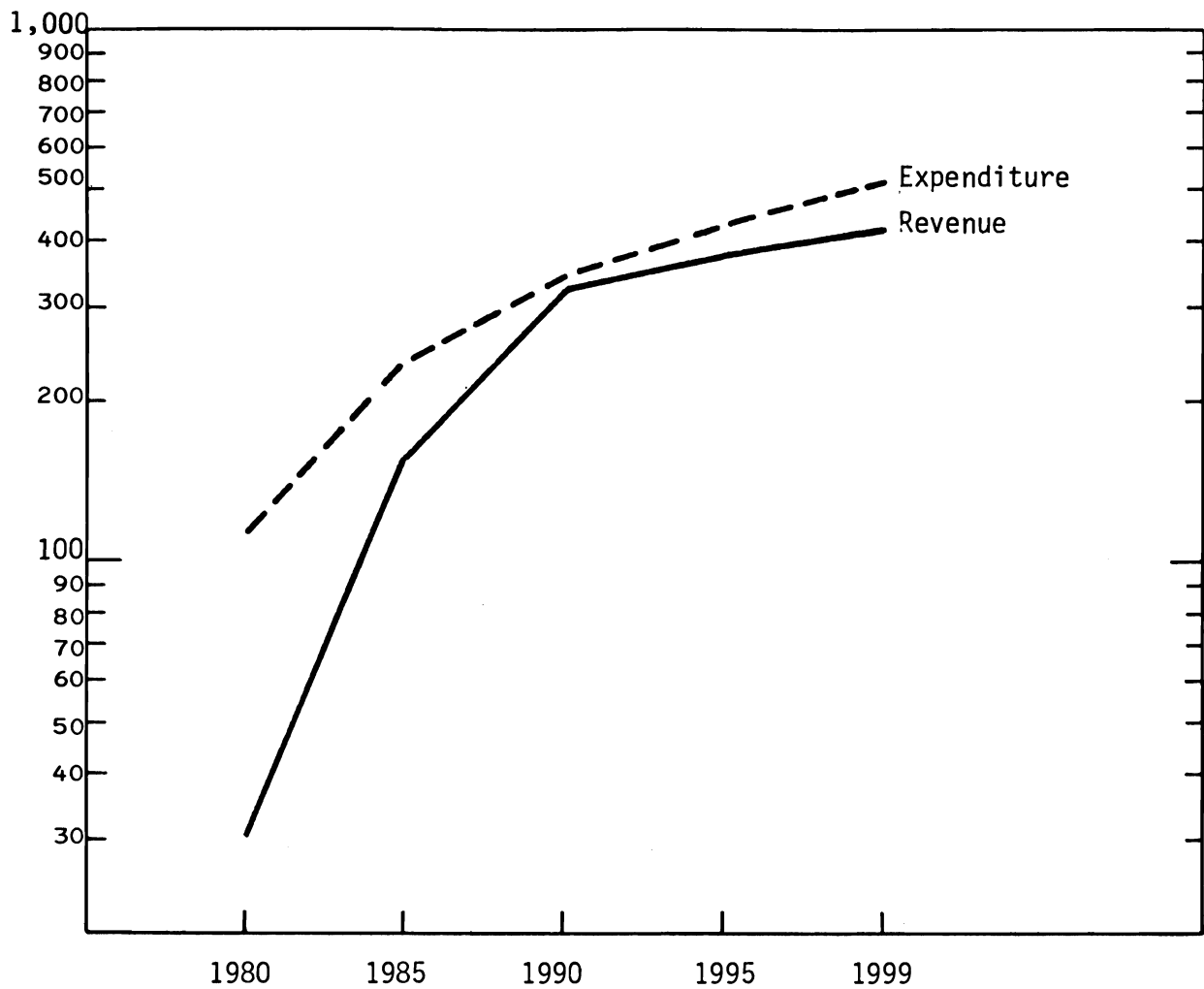


Appendix Table 16. Municipality of Killdeer, Fiscal Report Associated with Level I Development (\$000)

Year	Income								Expenditures						Net Fiscal
	Share of Local Property Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess.	Highway Fund	Cigarette and Tobacco	Conversion Tax	Debt Service	Schools	Streets	Police and Fire	City Govt.		
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1978	16	0	0	0	0	0	0	0	3	2	0	1	3	7	
1979	41	2	0	1	3	0	0	0	7	5	0	1	6	28	
1980	70	4	0	2	6	0	0	0	465	248	13	64	303	-1,011	
1981	80	179	0	89	378	17	6	0	532	304	16	78	367	-548	
1982	133	220	18	108	433	21	7	0	679	424	21	103	482	-769	
1983	221	309	19	142	545	27	10	0	748	489	25	120	560	-669	
1984	329	357	21	165	602	32	11	0	1,564	1,077	49	233	1,095	-2,500	
1985	384	781	22	322	1,226	62	22	0	1,630	1,248	53	256	1,200	-1,569	
1986	422	903	24	352	1,260	68	24	476	1,827	1,261	62	299	1,406	-1,326	
1987	459	1,056	25	413	1,413	79	28	483	1,847	1,560	67	324	1,521	-1,363	
1988	494	1,146	27	447	1,434	86	30	486	1,847	1,641	71	346	1,625	-1,350	
1989	532	1,184	29	477	1,434	91	32	485	1,845	1,733	76	369	1,733	-1,432	
1990	571	1,252	31	509	1,432	98	34	487	1,880	1,867	83	400	1,078	-1,694	
1995	803	1,879	138	766	1,626	147	52	495	2,159	2,810	125	603	2,831	-2,622	
1999	1,407	2,608	181	1,069	1,881	205	72	504	2,489	3,583	174	842	3,954	-3,775	

Appendix Figure 17. Halliday Revenues and Expenditures Associated with Level I Development

\$ Thous.



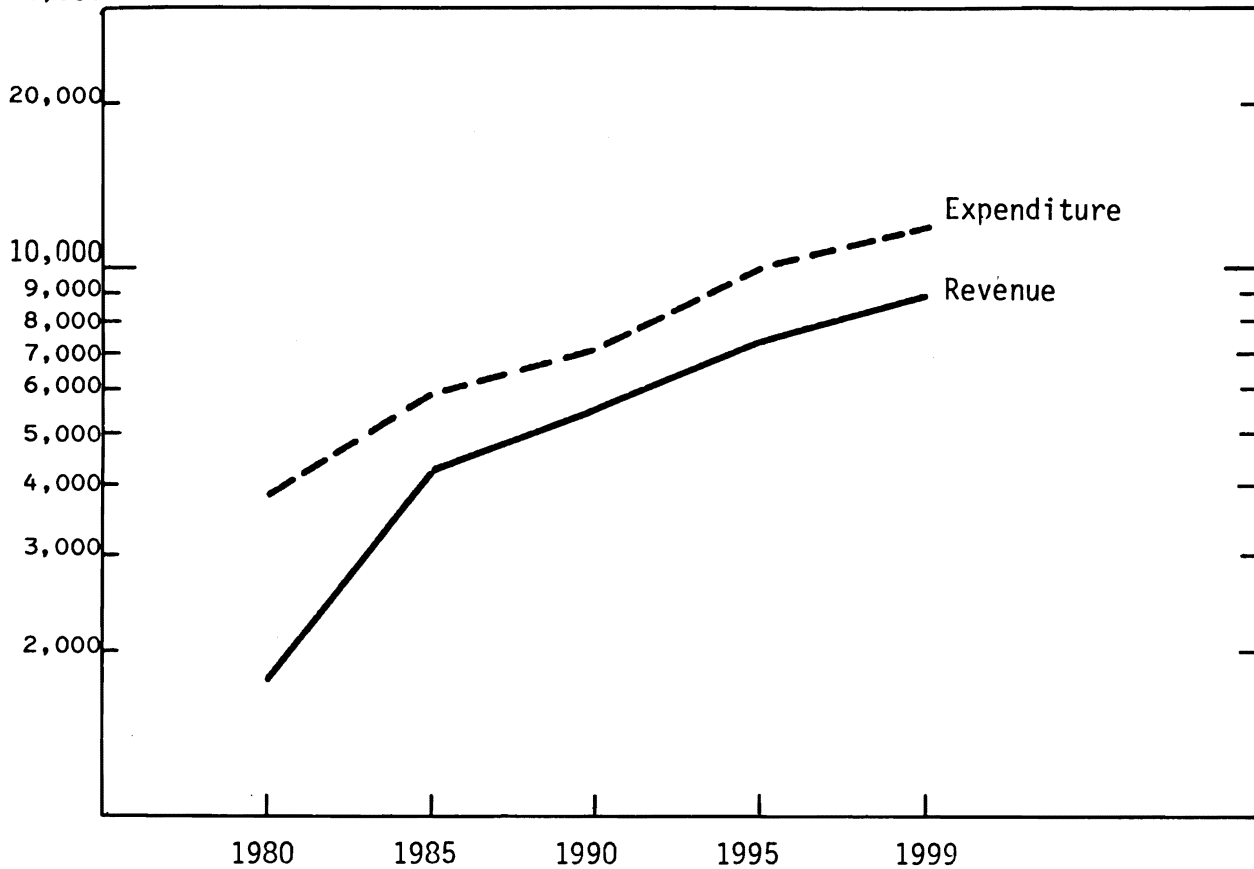
Appendix Table 17. Municipality of Halliday, Fiscal Report Associated with Level I Development (\$000)

Year	Income								Expenditures					Net Fiscal
	Share of Local Property Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess.	Highway Fund	Cigarette and Tobacco	Conversion Tax	Debt Service	Schools	Streets	Police and Fire	City Govmt.	
1977	1	0	0	0	0	0	0	0	1	0	0	1	1	-2
1978	2	0	0	0	1	0	0	0	7	2	0	2	5	-13
1979	5	2	0	1	6	0	0	0	16	8	1	3	11	-25
1980	7	6	0	3	14	1	0	0	45	33	1	6	28	-82
1981	8	24	0	8	34	2	1	0	55	30	2	9	40	-59
1982	11	23	2	12	44	2	1	0	97	46	3	16	73	-140
1983	12	33	2	21	81	4	1	0	95	52	3	15	68	-79
1984	16	39	2	20	78	4	1	0	95	45	3	11	53	-47
1985	21	34	2	16	78	3	1	0	110	38	3	15	71	-82
1986	25	29	2	21	92	4	1	104	124	43	4	18	85	3
1987	28	32	3	25	105	5	2	99	126	45	4	20	93	11
1988	30	34	3	28	108	5	2	97	127	48	5	21	101	5
1989	32	36	3	30	108	6	2	97	131	52	5	25	115	-14
1990	34	39	3	34	111	6	2	96	131	55	6	27	124	-18
1995	49	54	9	48	114	10	3	89	133	78	8	38	176	-57
1999	63	72	12	63	109	14	5	84	122	102	10	50	235	-97

Appendix Figure 18. Beulah Revenues and Expenditures Associated with Level I Development

\$ Thous.

30,000

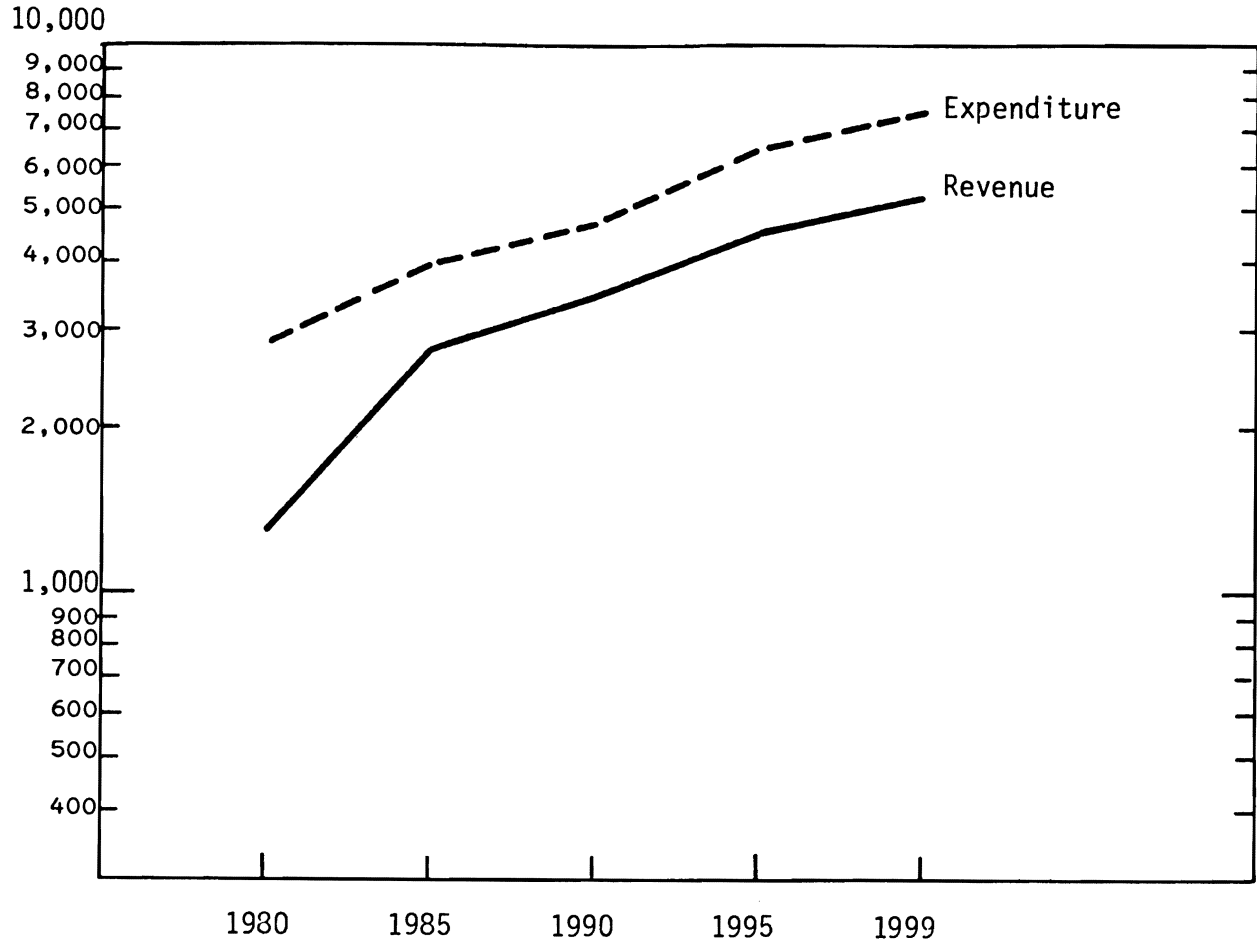


Appendix Table 18. Municipality of Beulah, Fiscal Report Associated with Level I Development (\$000)

Year	Income								Expenditures					Net Fiscal
	Share of Local Property Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess.	Highway Fund	Cigarette and Tobacco	Conversion Tax	Debt Service	Schools	Streets	Police and Fire	City Govnt.	
1977	8	0	0	0	0	0	0	0	118	73	4	16	76	-279
1978	25	53	0	22	94	4	2	0	504	283	15	71	333	-1,006
1979	56	205	0	98	409	19	7	1	1,154	648	35	165	776	-1,993
1980	89	472	0	227	936	44	15	5	1,562	930	49	233	1,055	-2,021
1981	132	678	0	322	1,263	62	22	8	1,799	1,147	58	220	1,317	-2,114
1982	239	837	66	387	1,446	75	26	83	1,799	950	49	239	1,123	-1,001
1983	342	694	71	330	1,445	63	22	86	2,045	1,181	60	253	1,351	-1,872
1984	407	861	75	397	1,634	76	27	288	2,216	1,364	69	331	1,554	-1,769
1985	523	995	80	457	1,771	88	31	297	2,253	1,474	74	359	1,687	-1,605
1986	554	1,074	86	496	1,803	94	33	302	2,269	1,573	80	387	1,818	-1,555
1987	661	1,146	92	535	1,818	102	36	306	2,269	1,491	79	380	1,757	-1,231
1988	733	1,025	98	525	1,818	101	35	311	2,306	1,591	86	414	1,944	-1,595
1989	798	1,081	106	571	1,855	110	38	529	2,409	1,636	95	458	2,152	-1,652
1990	1,014	1,186	112	632	1,943	122	42	535	2,459	1,773	103	499	2,342	-1,590
1995	1,424	1,781	172	964	2,215	184	65	547	2,815	2,668	158	759	3,569	-2,617
1999	1,857	2,442	225	1,354	2,132	259	91	554	2,042	3,630	220	1,064	5,001	-3,043

Appendix Figure 19. Hazen Revenues and Expenditures Associated with Level I Development

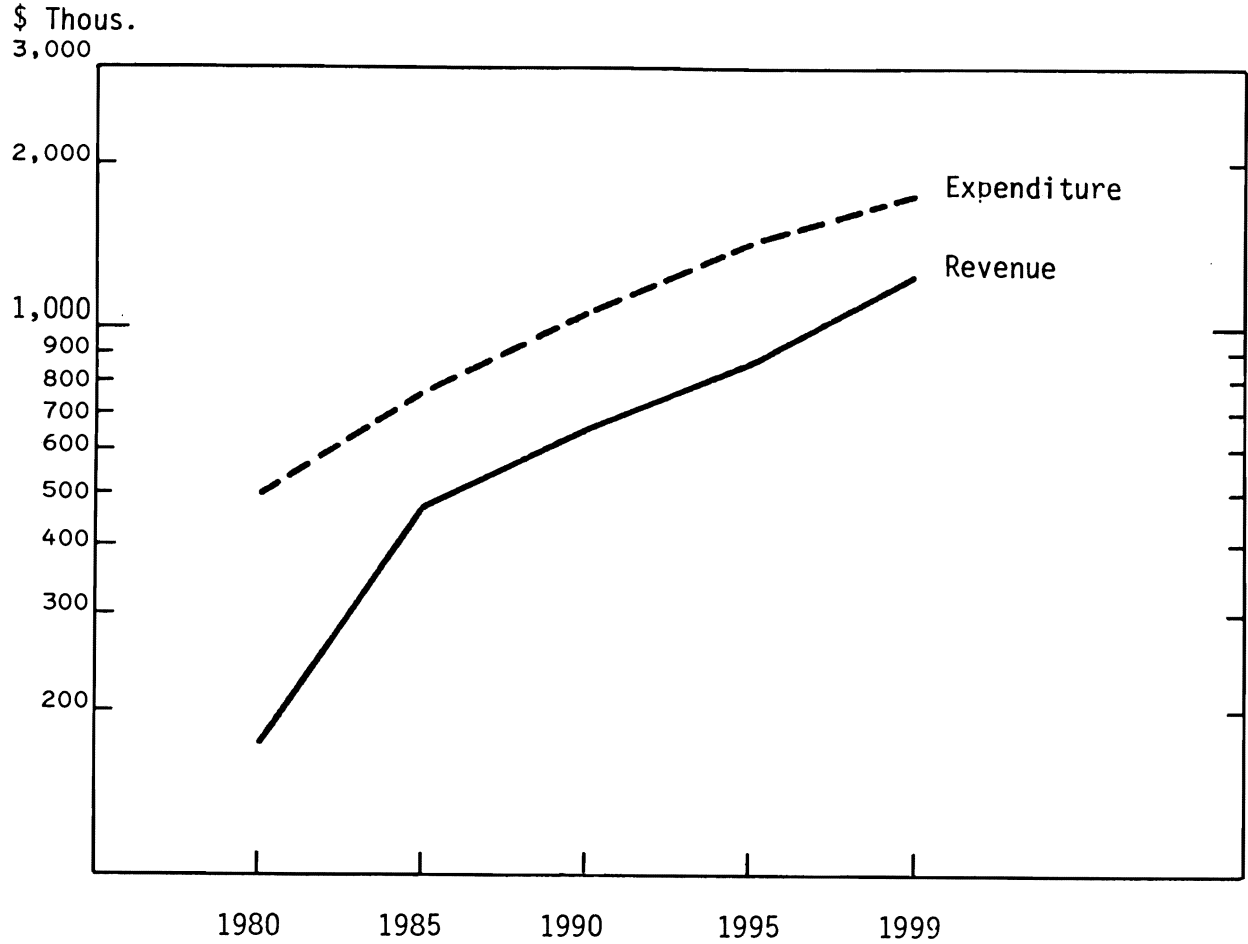
\$ Thous.



Appendix Table 19. Municipality of Hazen, Fiscal Report Associated with Level I Development (\$000)

Year	Income								Expenditures					Net Fiscal
	Share of Local Property Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess.	Highway Fund	Cigarette and Tobacco	Conversion Tax	Debt Service	Schools	Streets	Police and Fire	City Govt.	
1977	5	0	0	0	0	0	0	0	112	58	3	16	74	-253
1978	15	42	0	22	91	5	2	0	380	219	11	53	249	-735
1979	31	158	0	74	305	14	5	0	847	494	25	120	564	-1,463
1980	48	360	0	165	680	32	11	0	1,121	705	35	165	776	-1,506
1981	73	512	0	223	893	44	15	0	1,230	854	39	189	888	-1,435
1982	150	622	46	261	966	50	17	54	1,227	711	33	156	733	-72
1983	198	517	50	215	963	42	14	55	1,402	872	39	189	892	-1,340
1984	255	635	54	262	1,099	50	18	210	1,502	995	45	217	1,018	-1,224
1985	228	724	57	299	1,177	58	20	211	1,505	1,065	48	233	1,032	-1,169
1986	258	774	61	321	1,179	61	22	210	1,502	1,126	51	248	1,168	-1,209
1987	301	818	65	243	1,178	66	23	211	1,500	1,011	49	235	1,195	-555
1988	340	732	70	325	1,177	62	22	210	1,524	1,055	52	256	1,202	-1,151
1989	374	763	74	353	1,202	68	24	366	1,590	1,153	59	284	1,331	-1,153
1990	400	834	80	391	1,259	75	26	369	1,622	1,239	63	308	1,448	-1,369
1995	571	1,229	106	591	1,416	113	39	370	1,829	1,845	97	466	2,188	-1,930
1999	750	1,671	139	822	1,297	158	55	370	1,203	2,488	134	650	3,054	-2,267

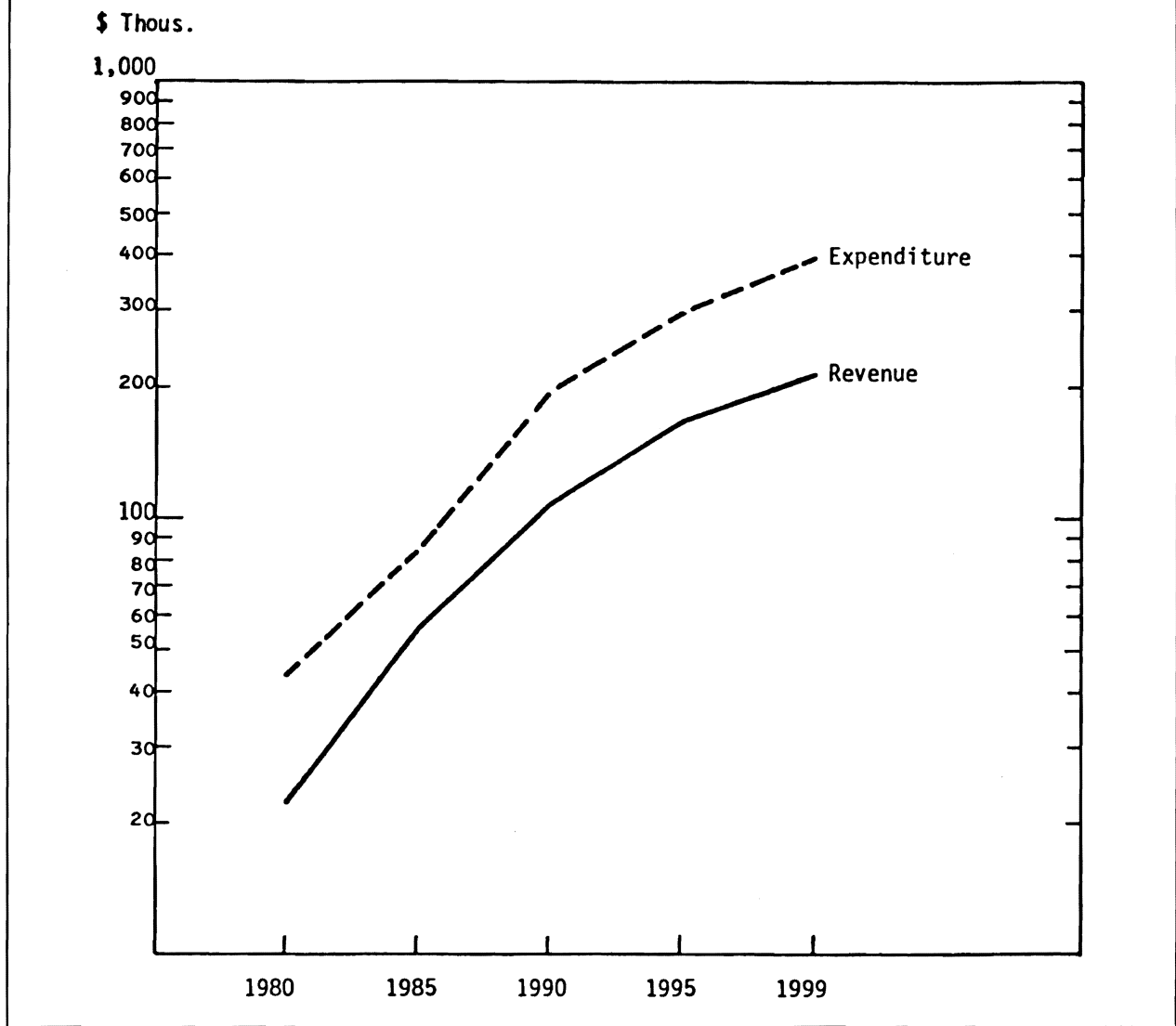
Appendix Figure 20. Mandan Revenues and Expenditures Associated with Level I Development



Appendix Table 20. Municipality of Mandan, Fiscal Report Associated with Level I Development (\$000)

Year	Income								Expenditures					Net Fiscal
	Share of Local Property Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess.	Highway Fund	Cigarette and Tobacco	Conversion Tax	Debt Service	Schools	Streets	Police and Fire	City Govmt.	
1977	3	0	0	0	0	0	0	0	1	1	0	0	1	0
1978	10	1	0	0	0	0	0	0	34	21	1	4	22	-71
1979	20	15	0	6	27	1	0	0	99	62	3	14	64	-173
1980	27	45	0	19	78	3	1	0	189	129	6	29	137	-317
1981	29	92	0	40	148	8	3	0	191	136	6	32	149	-154
1982	40	98	8	43	150	8	3	0	211	141	8	38	176	-224
1983	45	102	9	52	173	10	4	0	210	114	7	34	162	-138
1984	48	82	10	48	172	9	3	0	270	163	9	44	209	-323
1985	42	118	10	61	217	11	4	0	284	192	11	39	231	-234
1986	44	138	11	67	225	13	4	0	289	211	11	53	249	-311
1987	49	152	11	73	229	14	5	0	306	235	13	59	277	-357
1988	54	170	13	81	242	16	6	0	313	265	13	64	301	-374
1989	59	190	13	89	247	17	5	0	313	289	15	69	326	-352
1990	63	207	14	95	247	19	6	0	313	315	16	76	356	-425
1995	89	297	26	145	257	38	9	0	326	433	23	114	536	-571
1999	116	375	34	205	242	39	14	0	239	552	33	161	758	-718

Appendix Figure 21. Center Revenues and Expenditures Associated with Level I Development

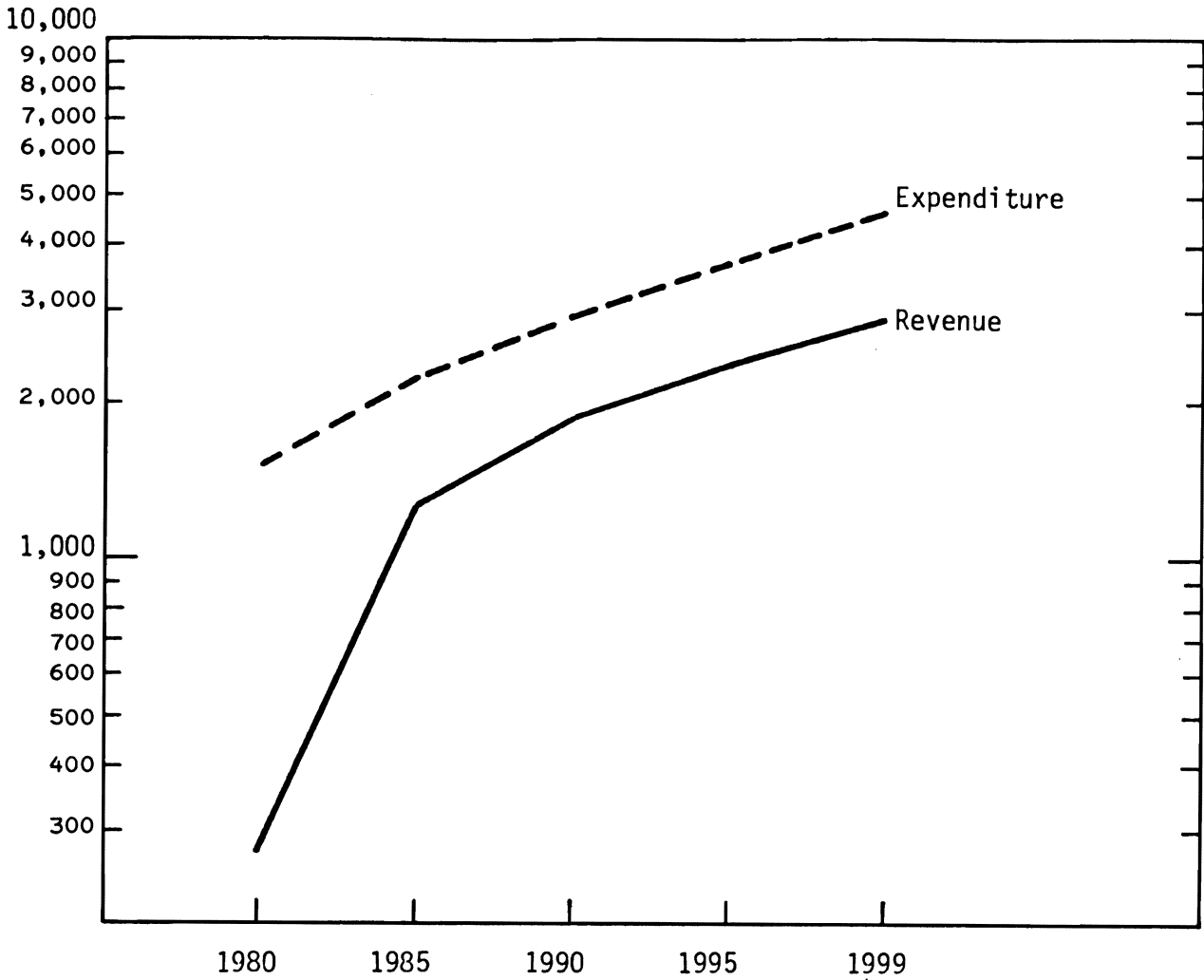


Appendix Table 21. Municipality of Center, Fiscal Report Associated with Level I Development (\$000)

Year	Income							Expenditures					Net Fiscal	
	Share of Local Property Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess.	Highway Fund	Cigarette and Tobacco	Conversion Tax	Debt Service	Schools	Streets	Police and Fire		City Govt.
1977	0	0	0	0	0	0	0	0	1	0	0	0	0	-1
1978	1	0	0	0	1	0	0	0	3	0	0	1	2	-4
1979	1	0	0	1	3	0	0	0	17	9	1	1	8	-27
1980	1	7	0	2	10	1	1	0	13	12	0	3	11	-21
1981	1	9	0	3	12	0	0	0	25	21	1	3	16	-41
1982	5	16	1	5	18	1	0	0	24	22	1	3	17	-27
1983	6	17	1	5	18	1	0	0	21	18	0	3	17	-11
1984	6	14	0	6	17	1	0	0	29	31	1	4	21	-42
1985	2	23	1	6	21	1	1	0	28	27	1	5	23	-29
1986	2	20	1	7	21	1	1	0	36	29	1	7	31	-51
1987	2	22	1	9	28	2	0	0	50	40	2	8	41	-77
1988	2	31	1	12	38	2	1	0	53	43	2	9	46	-66
1989	2	33	1	14	42	2	1	0	58	51	2	11	52	-89
1990	2	39	1	15	45	3	1	0	62	56	3	13	59	-67
1995	3	59	4	27	66	6	2	0	84	86	5	21	101	-130
1999	4	74	6	40	80	8	2	0	91	112	6	32	150	-177

Appendix Figure 22. Dickinson Revenues and Expenditures Associated with Level I Development

\$ Thous.

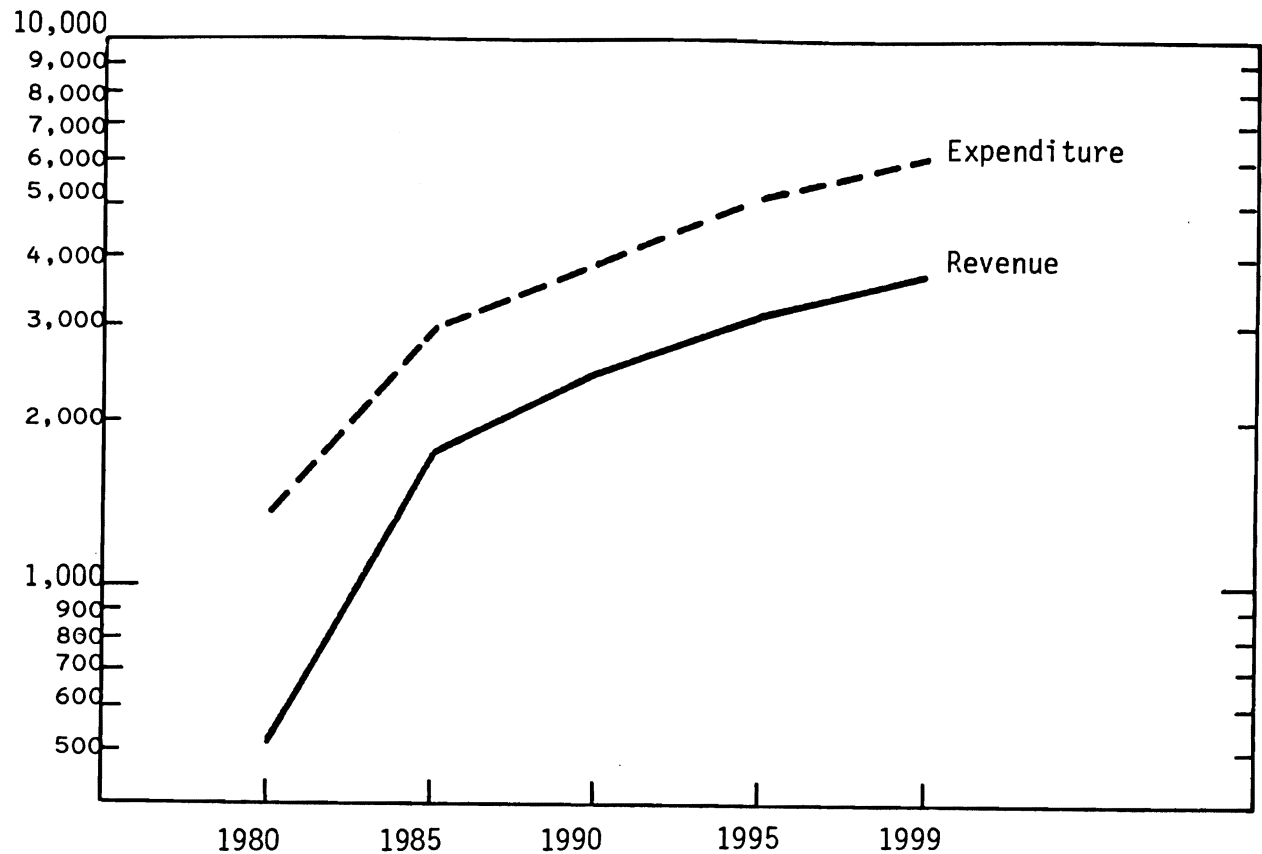


Appendix Table 22. Municipality of Dickinson, Fiscal Report Associated with Level I Development (\$000)

Year	Income								Expenditures					Net Fiscal
	Share of Local Property Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess.	Highway Fund	Cigarette and Tobacco	Conversion Tax	Debt Service	Schools	Streets	Police and Fire	City Govmt.	
1977	4	0	0	0	0	0	0	0	7	3	0	2	5	-13
1978	28	3	0	1	6	1	0	0	45	26	1	6	29	-68
1979	64	19	0	8	36	2	0	0	109	64	3	15	72	-135
1980	111	45	0	21	88	4	1	0	633	347	18	88	415	-1,230
1981	114	250	0	122	513	23	8	0	624	346	18	90	425	-473
1982	143	249	25	125	506	24	9	0	624	374	19	92	434	-462
1983	150	270	27	128	504	24	9	0	648	419	21	102	477	-564
1984	174	304	29	140	521	27	10	0	677	448	24	123	522	-599
1985	162	325	30	156	548	30	10	0	832	557	29	143	671	-971
1985	174	402	33	197	676	38	13	0	876	623	33	159	746	-904
1987	191	448	35	220	711	42	15	0	880	657	36	170	802	-923
1988	263	471	37	235	715	45	16	0	879	691	38	182	858	-921
1989	224	495	40	252	714	48	17	0	893	739	41	195	919	-927
1990	240	531	43	270	717	51	19	0	889	793	43	210	937	-1,051
1995	336	743	73	394	736	73	26	0	908	1,097	62	298	1,402	-1,396
1999	441	994	95	514	720	98	35	0	827	1,448	82	398	1,868	-1,726

Appendix Figure 23. Bismarck Revenues and Expenditures Associated with Level II Development

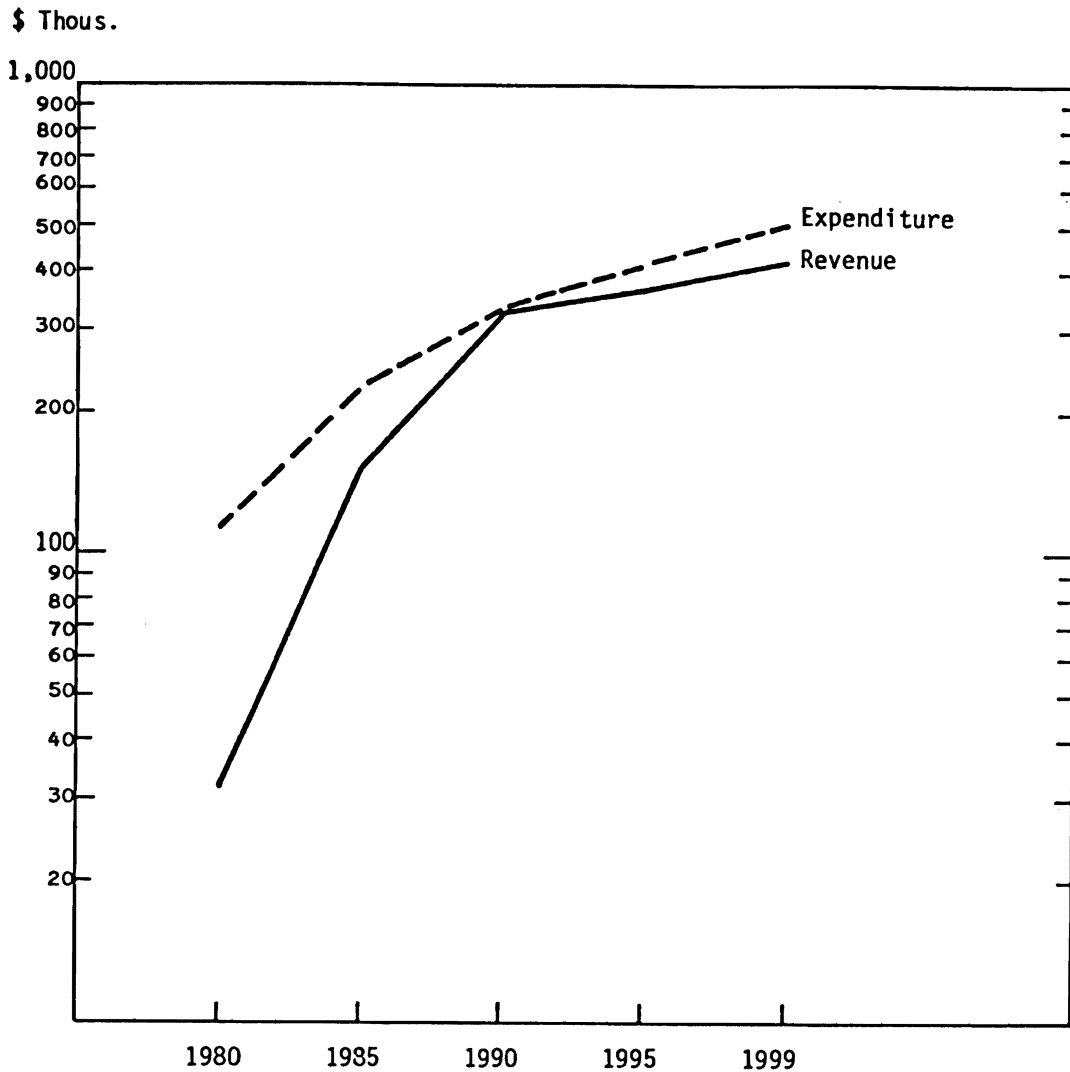
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Appendix Table 23. Municipality of Bismarck, Fiscal Report Associated with Level II Development (\$000)

Year	Income							Expenditures					Net Fiscal	
	Share of Local Property Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess.	Highway Fund	Cigarette and Tobacco	Conversion Tax	Debt Service	Schools	Streets	Police and Fire		City Govat.
1977	10	0	0	0	0	0	0	0	14	7	0	2	9	-22
1978	35	5	0	3	12	1	0	0	110	61	3	16	71	-205
1979	65	44	0	20	89	4	2	0	283	163	8	40	185	-456
1980	83	119	0	55	228	10	4	0	534	328	17	81	377	-833
1981	96	237	0	111	432	21	7	0	603	382	19	96	449	-645
1982	136	276	23	132	489	25	9	0	653	433	22	109	514	-611
1983	175	313	24	151	531	29	10	0	698	481	25	123	580	-674
1984	211	348	26	170	570	32	11	0	900	618	33	160	752	-1,035
1985	223	446	28	221	735	42	15	0	1,044	741	39	191	897	-1,202
1986	232	534	29	264	852	51	17	0	1,069	797	43	208	977	-1,114
1987	250	575	32	287	873	55	19	0	1,092	857	47	327	1,064	-1,296
1988	253	619	33	313	896	60	21	0	1,112	917	51	346	1,154	-1,325
1989	271	663	36	339	916	65	23	0	1,120	984	55	264	1,239	-1,349
1990	291	712	39	364	922	69	25	0	1,130	1,059	59	283	1,333	-1,442
1995	408	1,009	98	526	956	101	35	0	1,163	1,498	85	412	1,934	-1,959
1999	534	1,237	128	714	915	137	48	0	934	1,866	115	556	2,611	-2,319

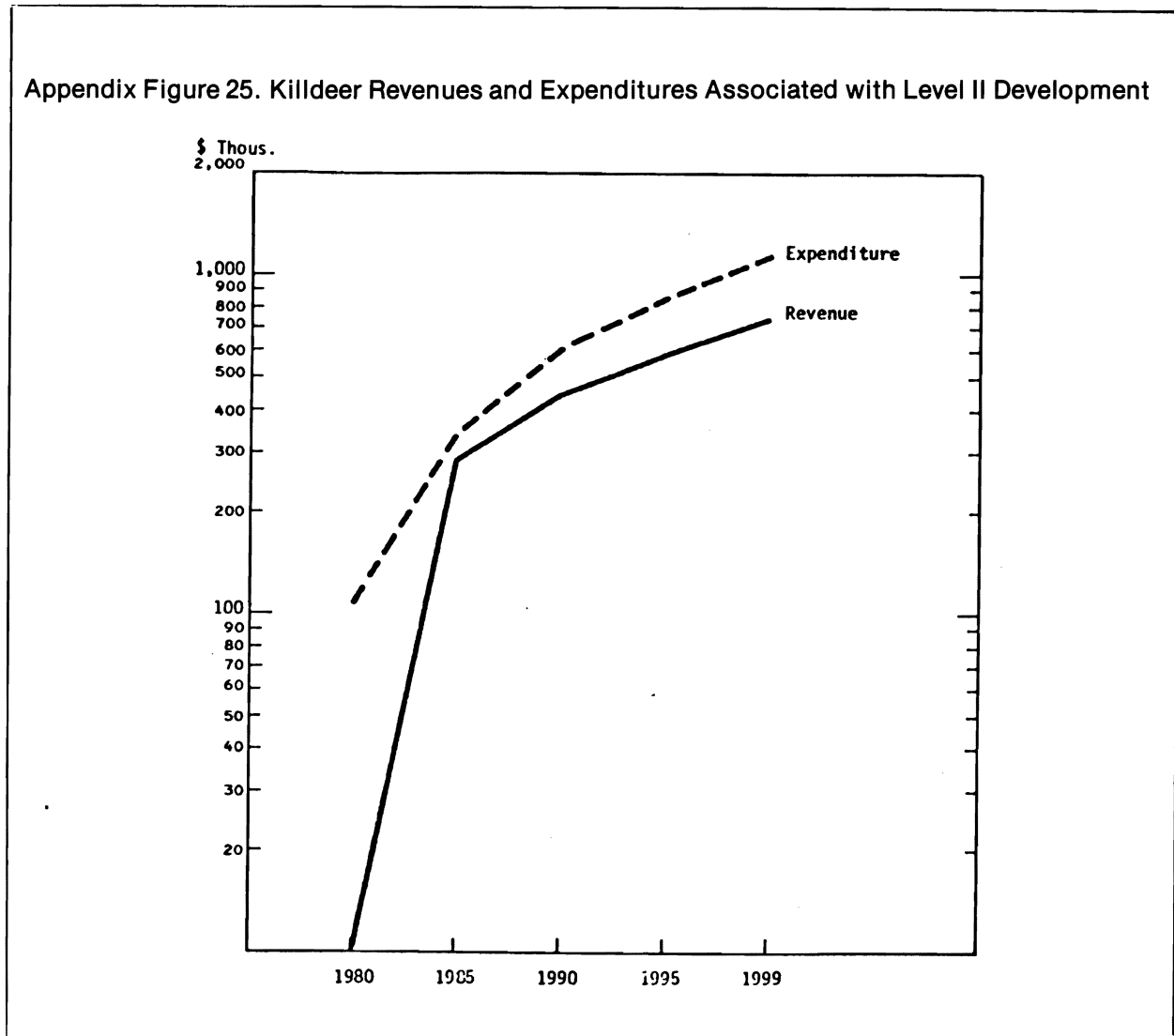
Appendix Figure 24. Halliday Revenues and Expenditures Associated with Level II Development



Appendix Table 24. Municipality of Halliday, Fiscal Report Associated with Level II Development (\$000)

Year	Income								Expenditures					Net Fiscal
	Share of Local Property Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess.	Highway Fund	Cigarette and Tobacco	Conversion Tax	Debt Service	Schools	Streets	Police and Fire	City Govmt.	
1977	1	0	0	0	0	0	0	0	1	0	0	1	1	-2
1978	2	0	0	0	1	0	0	0	7	2	0	2	5	-13
1979	5	2	0	1	6	0	0	0	16	8	1	3	11	-25
1980	7	6	0	3	14	1	0	0	45	33	1	6	29	-82
1981	8	24	0	8	34	2	1	0	56	30	2	9	42	-62
1982	11	23	2	12	45	2	1	0	99	46	3	16	75	-143
1983	13	33	2	22	83	4	2	0	98	52	3	15	72	-81
1984	17	39	2	22	80	4	2	0	98	39	2	11	52	-36
1985	21	29	2	16	80	3	1	0	111	31	3	14	68	-75
1986	25	24	2	20	94	4	1	103	129	36	4	18	86	0
1987	28	27	3	25	109	5	2	99	133	35	4	20	95	11
1988	30	27	3	28	114	6	2	98	134	38	5	22	103	6
1989	32	29	3	30	114	6	2	97	134	41	5	24	115	-6
1990	34	31	3	34	115	6	2	96	134	44	5	27	123	-12
1995	49	43	9	48	117	10	3	90	136	62	8	37	174	-48
1999	63	57	12	63	124	12	5	84	127	80	10	50	235	-82

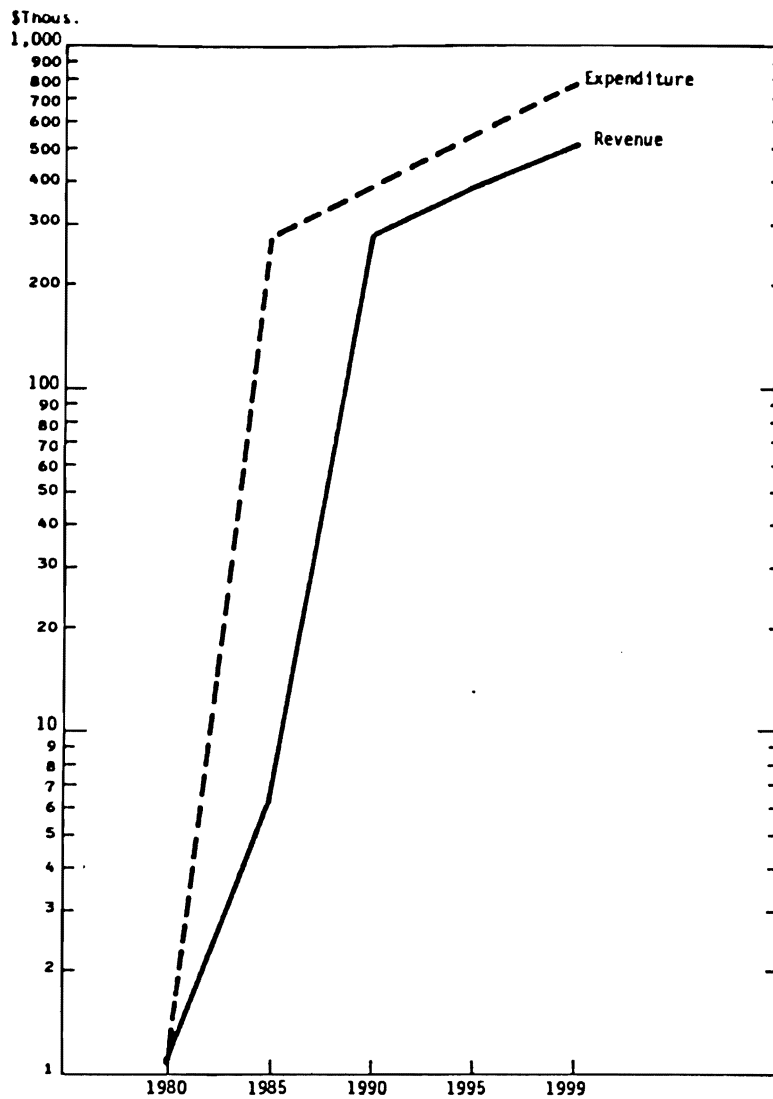
Appendix Figure 25. Killdeer Revenues and Expenditures Associated with Level II Development



Appendix Table 25. Municipality of Killdeer, Fiscal Report Associated with Level II Development (\$000)

Year	Income								Expenditures					Net Fiscal
	Share of Local Property Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess.	Highway Fund	Cigarette and Tobacco	Conversion Tax	Debt Service	Schools	Streets	Police and Fire	City Govmt.	
1977	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	16	0	0	0	0	0	0	0	3	2	0	1	3	7
1979	41	2	0	1	3	0	0	0	7	5	0	1	6	28
1980	70	4	0	2	6	0	0	0	465	248	13	64	303	-1,011
1981	80	179	0	87	378	17	6	0	533	306	16	78	568	-554
1982	133	221	18	108	434	21	7	0	680	422	21	103	494	-769
1983	221	307	19	142	547	27	10	0	751	493	25	120	258	-374
1984	328	359	21	166	604	32	11	0	1,553	1,071	48	232	1,033	-2,471
1985	383	776	22	320	1,217	61	22	0	1,631	1,254	53	255	1,158	-1,550
1986	420	907	24	352	1,259	68	24	477	1,830	1,473	62	299	1,405	-1,533
1987	456	1,063	25	413	1,413	79	28	483	1,858	1,581	67	325	1,525	-1,396
1988	492	1,141	27	448	1,440	86	30	486	1,858	1,663	72	346	1,627	-1,416
1989	529	1,200	29	478	1,440	92	32	485	1,856	1,758	77	370	1,738	-1,514
1990	568	1,269	31	510	1,438	98	34	486	1,888	1,893	83	401	1,651	-1,712
1995	758	1,892	138	767	1,630	147	52	495	2,162	2,835	125	604	2,635	-2,643
1999	1,045	2,619	181	1,073	1,893	205	72	504	2,510	3,920	176	845	3,969	-3,628

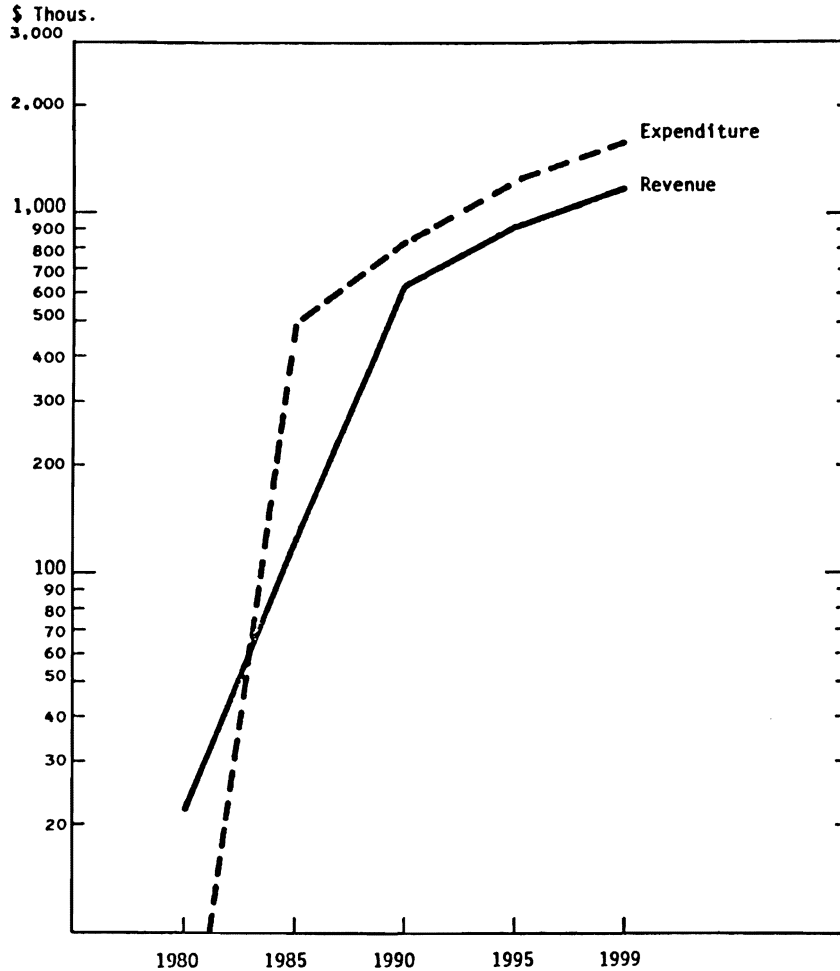
Appendix Figure 26. Underwood Revenues and Expenditures Associated with Level II Development



Appendix Table 26. Municipality of Underwood, Fiscal Report Associated with Level II Development (\$000)

Year	Income							Expenditures						Net Fiscal
	Share of Local Property Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess.	Highway Fund	Cigarette and Tobacco	Conversion Tax	Debt Service	Schools	Streets	Police and Fire	City Govmt.	
1977	-1	0	0	0	0	0	0	0	2	-1	0	1	2	-3
1978	0	-1	0	1	2	0	0	0	5	-1	1	1	5	-4
1979	0	-1	0	2	6	1	0	0	-5	2	0	-1	-4	16
1980	0	1	0	-1	-5	0	0	-1	-1	2	0	0	-1	6
1981	0	1	0	0	-2	0	0	-1	4	3	0	0	3	-12
1982	1	2	0	1	4	0	0	-1	13	17	0	0	1	-24
1983	4	12	0	1	2	1	0	-3	18	39	0	1	5	-46
1984	11	27	0	1	5	0	0	-3	23	52	0	1	6	-36
1985	19	38	0	2	6	0	1	-4	96	114	3	10	48	-209
1986	21	82	0	15	59	3	1	-3	105	134	3	12	57	-133
1987	48	96	0	17	66	3	1	-4	107	145	3	13	61	-102
1988	51	104	0	18	66	3	2	-4	108	156	3	14	66	-107
1989	55	111	0	20	67	4	1	-4	107	163	3	15	71	-105
1990	59	118	0	21	67	4	2	-4	112	181	3	16	78	-124
1995	79	180	6	35	84	7	2	-5	132	275	5	17	125	-166
1999	104	258	7	48	93	9	3	-5	159	386	8	38	178	-252

Appendix Figure 27. Washburn Revenues and Expenditures Associated with Level II Development

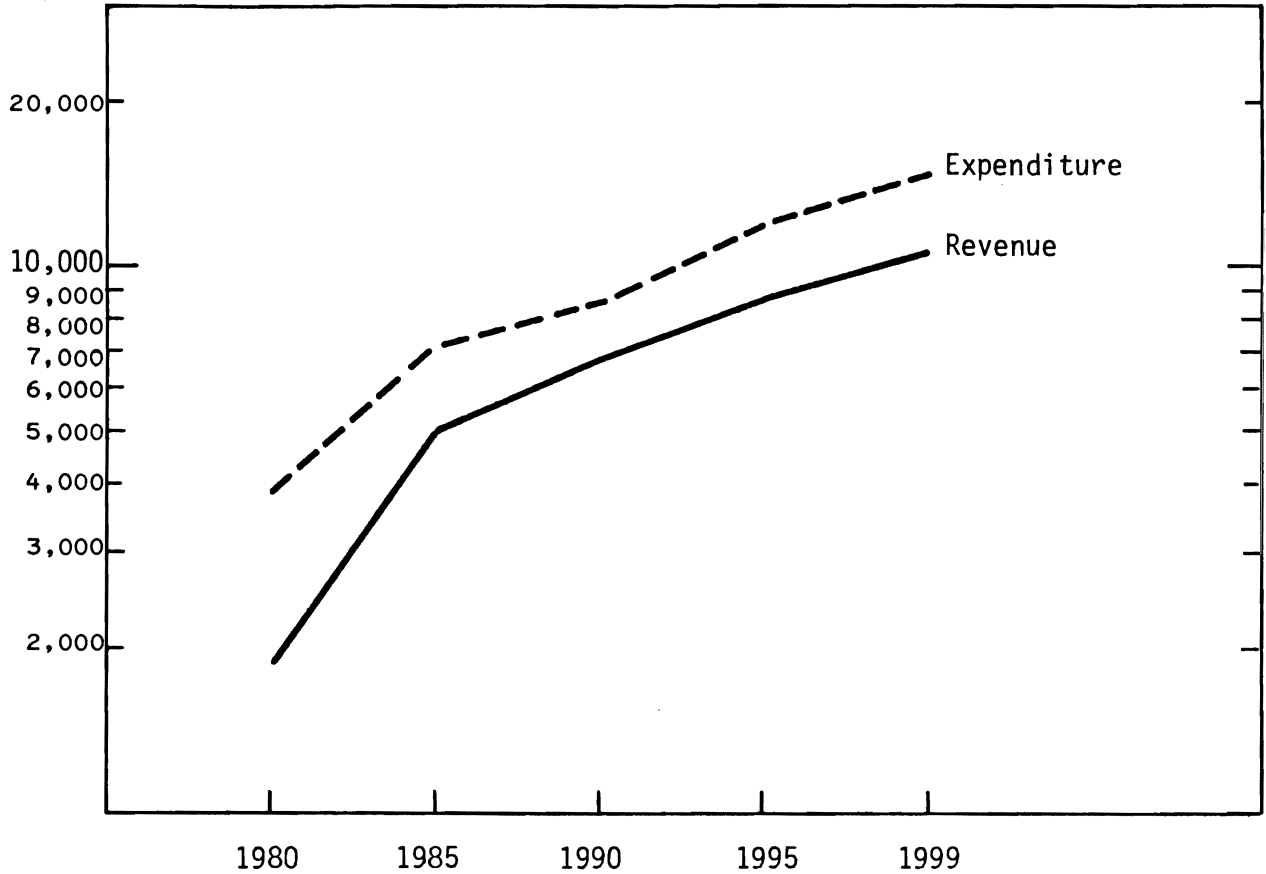


Appendix Table 27. Municipality of Washburn, Fiscal Report Associated with Level II Development (\$000)

Year	Income								Expenditures					Net Fiscal
	Share of Local Property Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess.	Highway Fund	Cigarette and Tobacco	Conversion Tax	Debt Service	Schools	Streets	Police and Fire	City Govmt.	
1977	0	0	0	0	0	0	0	0	2	0	0	0	2	-4
1978	-1	0	0	1	2	0	0	0	3	1	0	1	2	-5
1979	-2	1	0	1	3	0	0	0	17	11	1	3	10	-39
1980	-4	8	0	3	14	1	0	0	-8	15	0	-2	-9	26
1981	-6	11	0	-2	-13	-1	0	0	-4	23	-1	-2	-9	-18
1982	-3	16	-1	-3	-12	0	0	0	14	53	0	-1	-2	-67
1983	6	37	0	0	-2	-1	0	0	29	89	0	0	1	-79
1984	22	64	-1	0	1	0	0	0	31	118	0	-1	-4	-58
1985	40	85	-1	-1	4	-1	0	0	207	247	4	22	2	-355
1986	48	179	-1	31	130	6	2	0	231	292	5	26	121	-260
1987	139	211	-1	36	145	7	2	0	234	314	6	28	131	-174
1988	145	227	0	38	147	7	2	0	237	336	7	31	144	-189
1989	154	243	-1	43	151	8	2	0	235	354	7	32	154	-182
1990	163	255	-1	45	150	11	3	0	239	382	7	36	167	-200
1995	243	384	12	71	182	14	5	0	291	581	12	58	270	-301
1999	290	530	16	104	219	20	7	0	311	783	17	81	382	-388

Appendix Figure 28. Beulah Revenues and Expenditures Associated with Level II Development

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30,000

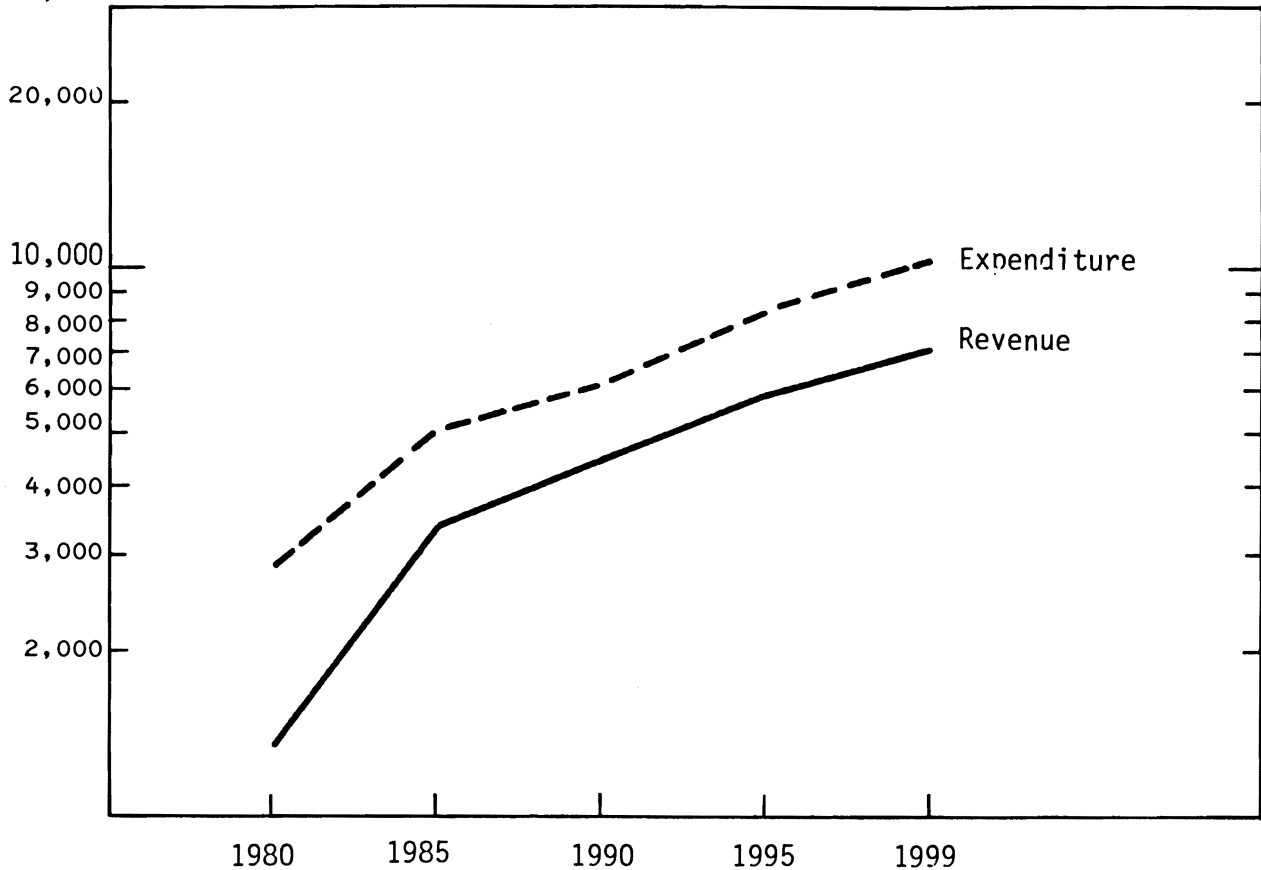


Appendix Table 28. Municipality of Beulah, Fiscal Report Associated with Level II Development (\$000)

Year	Income								Expenditures					Net Fiscal
	Share of Local Property Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess.	Highway Fund	Cigarette and Tobacco	Conversion Tax	Debt Service	Schools	Streets	Police and Fire	City Govmt.	
1977	8	0	0	0	0	0	0	0	118	73	4	15	76	-279
1978	25	53	0	22	94	4	2	-1	504	283	15	71	333	-1,007
1979	65	205	0	98	409	19	7	1	1,154	648	35	165	776	-1,974
1980	113	472	0	227	936	44	15	5	1,562	930	49	233	1,095	-2,057
1981	165	678	0	322	1,263	62	22	8	2,039	1,301	64	312	1,465	-2,651
1982	265	953	66	430	1,633	83	29	87	2,039	1,234	61	298	1,400	-1,450
1983	370	900	71	411	1,632	78	28	90	2,298	1,500	73	352	1,653	-2,295
1984	455	1,094	75	485	1,827	93	33	291	2,485	1,722	83	401	1,885	-2,223
1985	614	1,256	80	554	1,974	106	38	298	2,590	1,913	91	453	2,080	-2,207
1986	668	1,393	86	611	2,055	117	41	302	2,590	1,889	93	451	2,117	-1,647
1987	832	1,474	92	622	2,055	119	42	381	2,590	1,757	93	451	2,118	-1,352
1988	540	1,274	98	622	2,055	119	42	368	2,651	1,891	102	492	2,315	-1,513
1989	1,019	1,370	106	680	2,114	130	46	603	2,775	2,075	113	545	2,563	-2,003
1990	1,251	1,503	106	753	2,220	145	51	609	2,837	2,240	123	594	2,792	-1,948
1995	1,754	2,224	205	1,148	2,549	220	78	621	3,254	3,326	188	905	4,253	-3,127
1999	2,292	3,050	268	1,610	2,520	308	108	630	2,564	4,542	262	1,267	5,955	-3,804

Appendix Figure 29. Hazen Revenues and Expenditures Associated with Level II Development

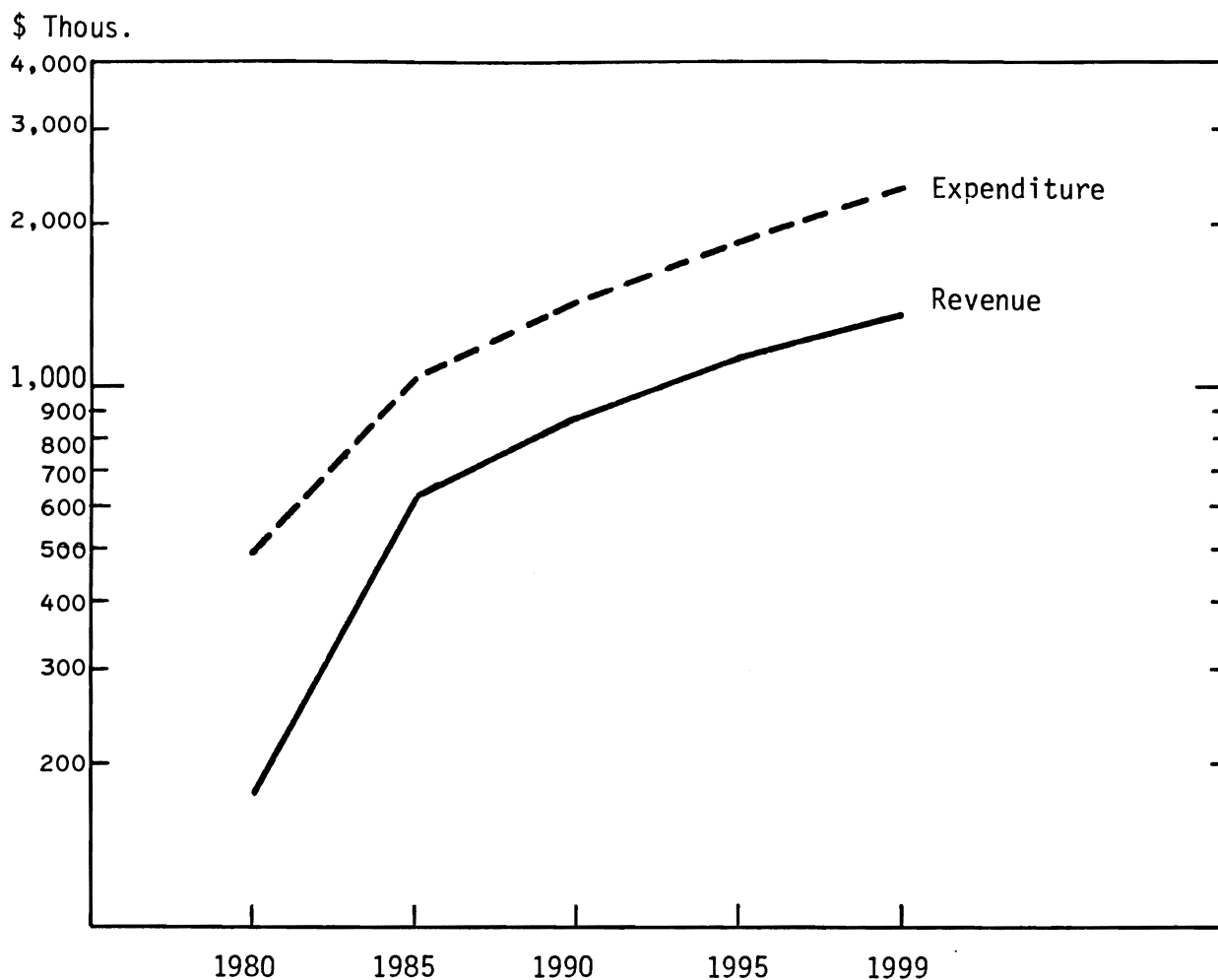
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Appendix Table 29. Municipality of Hazen, Fiscal Report Associated with Level II Development (\$000)

Year	Income								Expenditures						Net Fiscal
	Share of Local Property Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess.	Highway Fund	Cigarette and Tobacco	Conversion Tax	Debt Service	Schools	Streets	Police and Fire	City Govmt.		
1977	5	0	0	0	0	0	1	0	212	58	3	16	74	-357	
1978	15	42	0	22	91	5	2	0	380	219	11	53	249	-735	
1979	33	158	0	74	305	14	5	0	847	494	25	120	564	-1,456	
1980	66	360	0	165	680	32	11	0	1,121	705	35	165	776	-1,488	
1981	99	512	0	228	893	44	15	0	1,408	959	44	213	1,000	-1,833	
1982	173	693	46	294	1,107	56	20	56	1,405	910	42	200	940	-1,047	
1983	228	662	50	276	1,104	53	18	57	1,618	1,099	50	242	1,140	-1,701	
1984	285	801	54	335	1,273	64	23	216	1,731	1,253	57	274	1,289	-1,554	
1985	317	913	57	379	1,359	73	26	216	1,827	1,387	64	308	1,444	-1,690	
1986	359	1,009	61	424	1,439	81	29	222	1,822	1,366	64	310	1,458	-1,356	
1987	434	991	65	428	1,436	82	28	281	1,820	1,278	62	301	1,416	-1,032	
1988	519	924	70	416	1,435	80	28	279	1,891	1,371	69	334	1,570	-1,094	
1989	568	989	74	461	1,503	89	31	444	1,978	1,502	77	371	1,739	-1,508	
1990	608	1,064	80	510	1,578	98	35	446	2,016	1,612	83	402	1,889	-1,563	
1995	859	1,597	139	774	1,794	148	52	449	2,300	2,393	127	610	2,866	-2,484	
1999	1,121	2,176	182	1,078	1,733	206	72	450	1,755	3,255	176	851	4,001	-3,020	

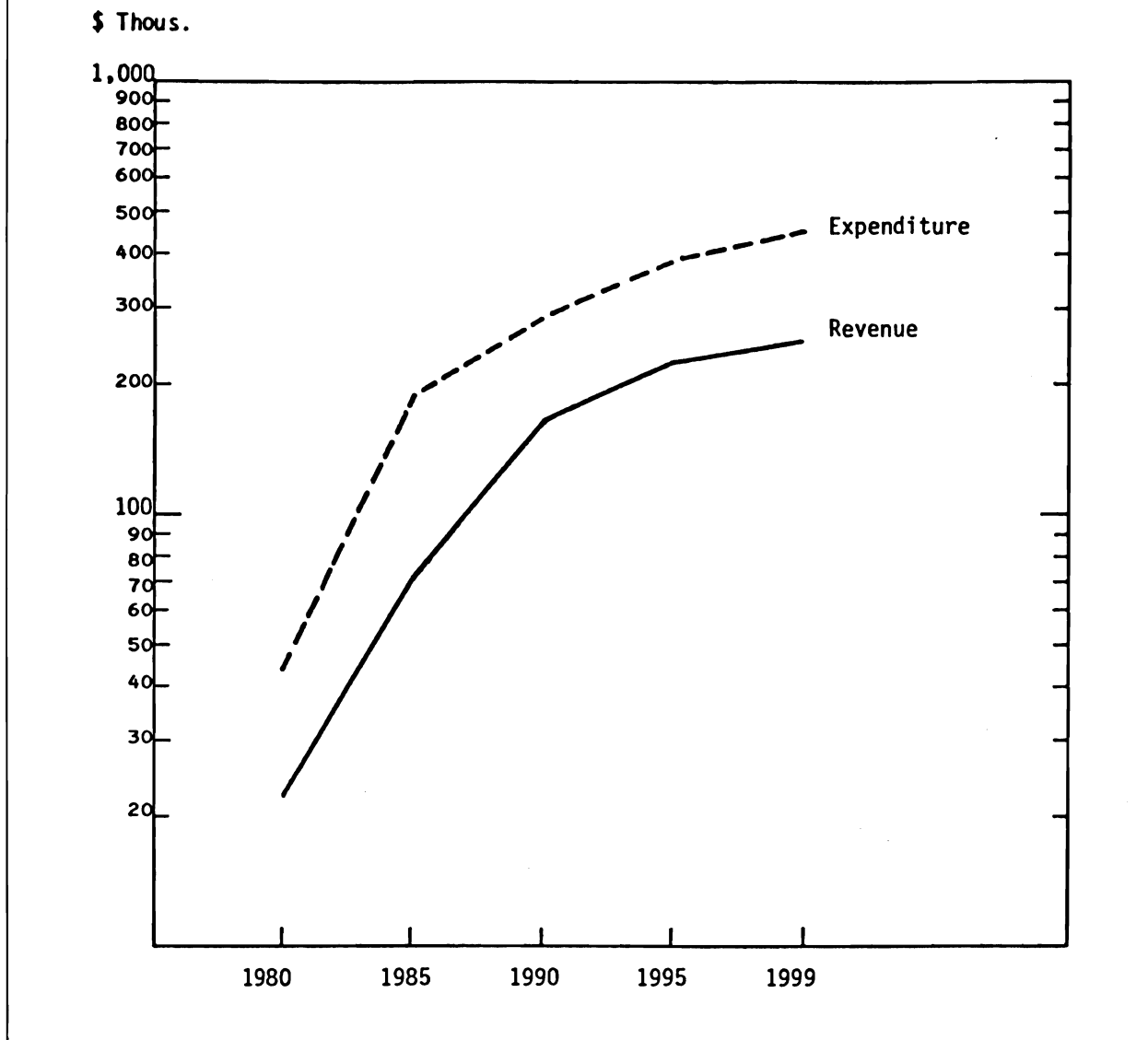
Appendix Figure 30. Mandan Revenues and Expenditures Associated with Level II Development



Appendix Table 30. Municipality of Mandan, Fiscal Report Associated with Level II Development (\$000)

Year	Income								Expenditures					Net Fiscal
	Share of Local Property Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess.	Highway Fund	Cigarette and Tobacco	Conversion Tax	Debt Service	Schools	Streets	Police and Fire	City Govmt.	
1977	3	0	0	0	0	0	0	0	1	1	0	0	1	0
1978	10	1	0	0	0	0	0	0	34	21	1	4	22	-71
1979	20	15	0	6	27	1	0	0	99	62	3	14	64	-173
1980	27	45	0	19	78	3	1	0	189	129	6	29	137	-317
1981	29	92	0	40	148	8	3	0	191	136	6	32	149	-195
1982	44	98	8	47	151	8	3	0	226	144	8	10	187	-216
1983	58	105	9	55	186	10	4	0	234	141	9	44	206	-207
1984	73	103	10	61	193	12	4	0	336	210	13	61	285	-449
1985	77	153	10	84	275	16	5	0	383	262	15	71	333	-444
1986	79	190	11	97	309	19	6	0	388	289	16	76	359	-416
1987	87	210	11	105	312	20	7	0	359	311	17	82	381	-428
1988	85	226	13	112	312	22	8	0	390	341	18	87	409	-467
1989	92	247	13	120	312	23	8	0	396	379	20	94	445	-519
1990	99	275	14	130	317	25	8	0	397	409	22	103	483	-546
1995	138	394	36	192	318	37	12	0	397	572	31	150	704	-727
1999	181	493	46	269	316	51	18	0	331	724	44	212	996	-933

Appendix Figure 31. Center Revenues and Expenditures Associated with Level II Development

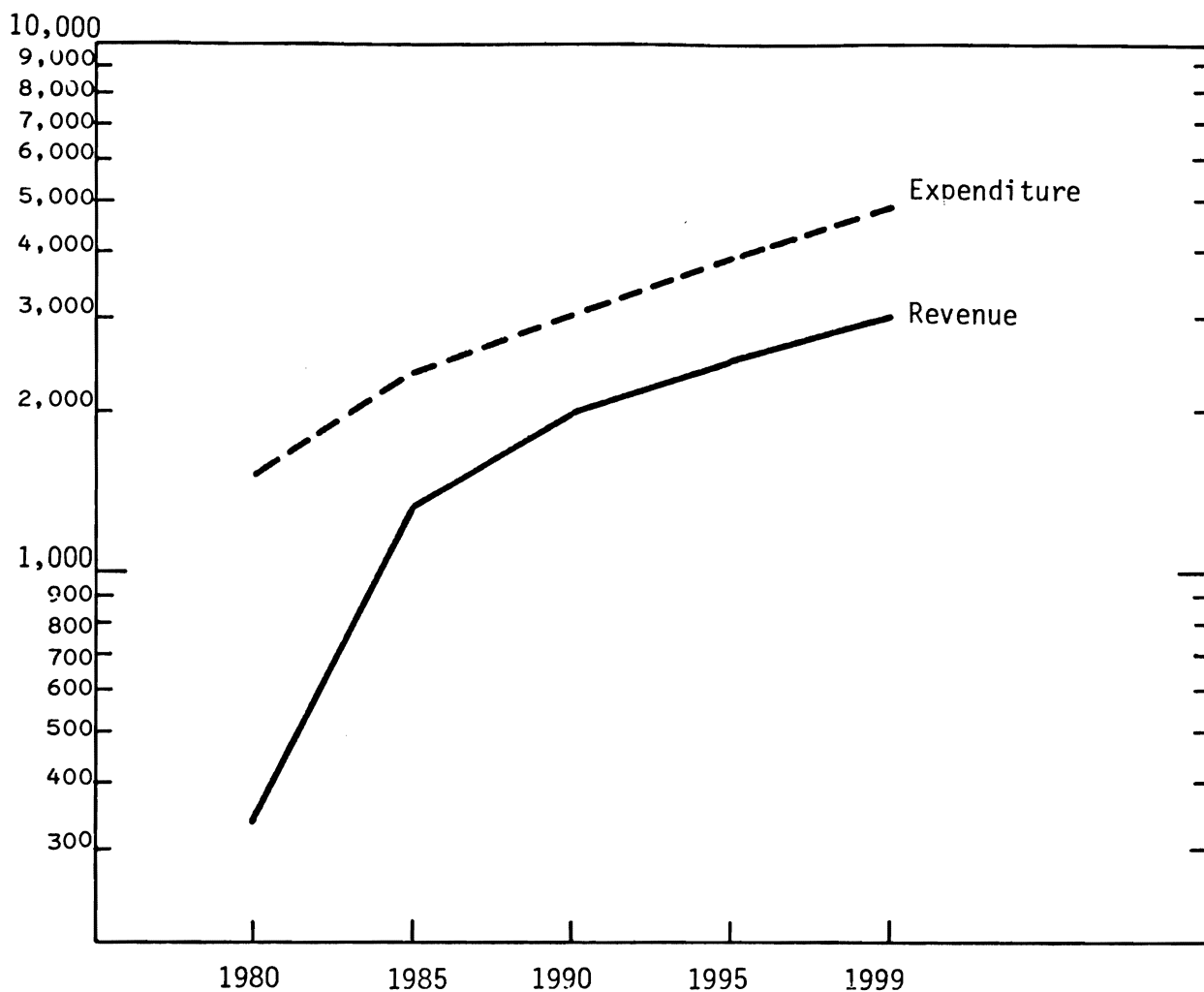


Appendix Table 31. Municipality of Center, Fiscal Report Associated with Level II Development (\$000)

Year	Income							Expenditures						Net Fiscal
	Share of Local Property Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess.	Highway Fund	Cigarette and Tobacco	Conversion Tax	Debt Service	Schools	Streets	Police and Fire	City Govmt.	
1977	0	0	0	0	0	0	0	0	1	0	0	0	0	-1
1978	1	0	0	0	1	0	0	0	3	0	0	1	2	-4
1979	1	0	0	1	3	0	0	0	13	9	1	1	8	-27
1980	1	7	0	2	10	1	1	0	17	12	0	3	11	-21
1981	1	9	0	3	8	0	0	0	25	21	1	3	16	-45
1982	5	16	1	5	18	1	0	0	25	22	1	3	17	-22
1983	6	17	1	6	19	1	0	0	26	18	1	4	21	-20
1984	7	14	0	7	21	1	1	0	37	31	1	6	28	-52
1985	7	23	1	8	29	1	1	0	67	56	3	11	49	-116
1985	7	41	1	5	53	3	1	0	74	58	2	13	58	-94
1987	9	43	1	17	59	4	1	0	82	60	3	14	68	-93
1988	8	43	1	20	67	4	1	0	85	64	3	16	75	-99
1989	10	46	1	22	70	4	2	0	87	71	3	17	81	-104
1990	10	52	1	24	71	4	2	0	91	82	4	19	88	-120
1995	14	85	6	35	76	7	3	0	96	127	6	27	126	-156
1999	18	101	9	45	69	9	3	0	88	150	7	36	170	-197

Appendix Figure 32. Dickinson Revenues and Expenditures Associated with Level II Development

\$ Thous.



Appendix Table 32. Municipality of Dickinson, Fiscal Report Associated with Level II Development (\$000)

Year	Income								Expenditures					Net Fiscal
	Share of Local Property Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess.	Highway Fund	Cigarette and Tobacco	Conversion Tax	Debt Service	Schools	Streets	Police and Fire	City Govmt.	
1977	6	17	0	9	40	0	0	0	7	3	0	2	5	55
1978	33	20	0	12	48	1	0	0	45	26	1	6	29	7
1979	71	35	0	19	75	2	0	0	109	64	3	15	72	-61
1980	166	61	0	31	120	4	1	0	633	347	18	88	415	-1,178
1981	119	252	0	127	520	23	8	0	624	340	18	89	419	-441
1982	148	252	26	130	517	24	8	0	641	395	20	97	455	-493
1983	167	287	28	142	528	25	9	0	694	445	23	111	520	-607
1984	123	332	30	162	571	29	11	0	692	460	25	117	553	-529
1985	177	342	31	172	565	32	10	0	888	591	31	154	720	-1,055
1986	194	431	34	220	719	40	14	0	939	667	35	170	802	-551
1987	212	561	36	243	753	45	16	0	939	700	38	182	858	-251
1988	230	507	39	260	753	48	17	0	936	734	40	194	916	-556
1989	247	531	42	278	749	52	18	0	938	785	43	263	931	-1,028
1990	263	569	44	297	752	55	20	0	941	831	46	223	1,052	-1,093
1995	369	781	80	420	764	77	28	0	957	1,154	66	317	1,468	-1,463
1999	484	1,037	105	559	718	114	37	0	882	1,539	88	423	1,987	-1,865

Appendix Table 33. Aggregate Increased State Level Revenue Associated with Coal Development, REAP Scenario (\$000)

Year	Sales & Use Tax	Personal Income	Corporate Income	Corporate Privilege Tax	Highway Tax	Tobacco & Liquor Taxes	Equilization	Coal Conversion Tax	Severance Tax	Total Revenue
1977	1,430	886	120	82	335	76	20	800	1,431	5,180
1978	1,610	1,004	137	94	512	115	65	800	1,531	5,868
1979	1,749	1,047	146	100	946	213	113	1,600	3,928	9,842
1980	2,544	1,429	193	133	1,600	361	157	3,225	9,865	19,507
1981	2,721	1,433	189	130	1,951	440	216	3,225	11,510	21,815
1982	2,946	1,514	197	135	2,113	476	311	4,025	16,150	27,867
1983	2,670	1,348	171	118	1,789	403	394	4,025	18,442	29,360
1984	3,170	1,643	203	140	2,062	465	469	9,375	32,719	50,246
1985	3,526	1,783	219	150	2,476	558	516	9,375	36,829	55,432
1986	4,223	2,071	254	174	2,705	610	606	9,375	41,226	61,244
1987	4,944	2,356	283	195	2,814	634	719	9,375	45,932	67,252
1988	5,290	2,521	303	208	2,719	613	837	9,375	50,966	72,832
1989	4,566	2,221	261	179	2,839	640	957	14,725	76,719	103,107
1990	4,473	2,269	253	174	3,004	677	1,151	14,725	84,566	111,292
1991	4,786	2,428	271	186	3,205	722	1,314	14,725	92,962	120,599
1992	5,121	2,598	290	199	3,423	772	1,505	14,725	101,947	130,580
1993	5,479	2,780	310	213	3,655	824	1,724	14,725	111,560	141,270
1994	5,863	2,974	332	228	3,897	878	1,974	14,725	121,846	152,717
1995	6,273	3,183	355	244	4,160	938	2,259	14,725	132,852	164,989
1996	6,712	3,405	380	261	4,439	1,000	2,586	14,725	144,628	178,136
1997	7,182	3,644	406	279	4,734	1,067	2,961	14,725	157,229	192,227
1998	7,685	3,899	435	299	5,052	1,139	3,387	14,725	170,712	207,333
1999	8,223	4,172	465	320	5,372	1,211	3,870	14,725	185,139	223,497

Appendix Table 34. Aggregate Increased State Level Expenditure Associated with Coal Development, REAP Scenario (\$000)

Year	Education Transfers	Highway Fund	Cigarette and Tobacco	Conversion Tax	Severance Tax	Highway Construction	General Govt. Functions	Total Expenditures	Net Balance
1977	455	100	14	270	72	851	1,953	3,715	1,465
1978	649	146	20	280	306	1,282	3,520	6,203	333
1979	1,164	262	36	560	786	1,754	5,909	10,471	628
1980	1,939	440	60	1,129	1,973	2,354	7,197	15,092	4,413
1981	2,387	537	73	1,129	2,302	4,037	7,925	18,390	3,427
1982	2,676	591	80	1,409	3,230	4,466	7,210	19,662	8,204
1983	2,370	538	73	1,409	3,688	5,114	8,315	21,507	7,854
1984	2,775	620	84	3,281	6,544	6,322	9,911	29,537	20,709
1985	3,357	739	100	3,281	7,366	7,228	10,906	32,977	22,455
1986	3,712	813	110	3,281	8,245	7,876	11,580	35,617	25,626
1987	3,903	863	117	3,281	9,186	9,282	11,781	38,413	28,837
1988	3,827	878	119	3,281	10,193	10,229	12,642	41,169	31,662
1989	4,033	942	128	5,154	15,344	11,067	13,602	50,270	52,835
1990	4,285	1,014	138	5,154	16,913	11,952	14,711	54,167	57,125
1991	4,613	1,097	149	5,154	18,592	12,906	15,926	58,437	62,162
1992	4,977	1,187	161	5,154	20,389	13,941	17,249	63,058	67,521
1993	5,358	1,286	175	5,154	22,312	15,064	18,656	68,005	73,264
1994	5,764	1,391	189	5,154	24,369	16,272	20,205	73,344	79,374
1995	6,189	1,506	205	5,154	26,570	17,574	21,867	79,065	85,922
1996	6,649	1,630	221	5,154	28,926	18,980	23,685	85,245	92,893
1997	7,135	1,766	240	5,154	31,446	20,508	25,660	91,909	100,320
1998	7,638	1,913	260	5,154	34,142	22,143	27,754	99,004	108,329
1999	8,130	2,069	281	5,154	37,028	23,916	30,007	106,585	116,912

Appendix Table 35. Aggregate County Fiscal Report for Burleigh, Dunn, McLean, Morton, Oliver, and Stark Counties, REAP Scenario (\$000)

Year	Income					Expenditures				Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government		
1977	23	0	47	0	0	15	19	272	-235	
1978	65	0	59	0	0	19	27	370	-292	
1979	105	0	82	112	157	25	34	484	-88	
1980	133	0	107	340	603	29	36	525	592	
1981	166	0	116	340	703	33	42	602	649	
1982	189	92	133	340	811	35	47	659	826	
1983	206	99	145	340	926	39	51	723	908	
1984	220	107	158	340	1,050	42	54	783	996	
1985	220	115	174	340	1,182	46	59	848	1,077	
1986	234	123	188	340	1,322	49	65	915	1,177	
1987	249	132	202	340	1,474	52	70	984	1,291	
1988	268	141	217	340	1,635	59	75	1,071	1,395	
1989	287	149	236	340	1,808	63	81	1,156	1,522	
1990	307	161	256	340	1,993	67	86	1,246	1,655	
1991	327	172	276	340	2,190	73	94	1,346	1,792	
1992	351	221	298	340	2,402	79	102	1,453	1,977	
1993	375	236	321	340	2,628	84	109	1,561	2,146	
1994	400	254	344	340	2,871	91	118	1,687	2,312	
1995	428	270	372	340	3,130	98	126	1,820	2,499	
1996	458	291	400	340	3,408	107	137	1,961	2,693	
1997	490	310	432	340	3,704	114	148	2,112	2,904	
1998	523	334	467	340	4,023	122	158	2,270	3,135	
1999	560	356	502	340	4,362	131	170	2,433	3,384	

Appendix Table 36. Burleigh County Fiscal Report Associated with Coal Development, REAP Scenario (\$000)

Year	Income					Expenditures				Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government		
1977	7	0	17	0	0	5	6	88	-75	
1978	18	0	19	0	0	6	8	111	-87	
1979	30	0	25	0	0	8	11	154	-118	
1980	35	0	34	0	0	9	11	164	-115	
1981	38	0	36	0	0	10	13	190	-139	
1982	46	29	42	0	0	11	15	209	-118	
1983	50	31	46	0	0	12	16	227	-127	
1984	53	33	50	0	0	13	17	244	-137	
1985	51	36	54	0	0	14	18	262	-153	
1986	55	38	58	0	0	15	20	280	-164	
1987	58	41	62	0	0	16	21	299	-175	
1988	62	44	66	0	0	18	23	324	-191	
1989	67	47	71	0	0	19	24	348	-206	
1990	72	50	77	0	0	20	26	374	-221	
1991	77	54	83	0	0	22	28	402	-239	
1992	82	66	89	0	0	23	30	432	-248	
1993	88	71	95	0	0	25	32	464	-267	
1994	94	76	102	0	0	27	35	498	-288	
1995	100	81	110	0	0	29	37	536	-310	
1996	107	87	118	0	0	31	40	575	-334	
1997	115	93	127	0	0	33	43	618	-360	
1998	123	100	137	0	0	36	46	664	-388	
1999	131	107	147	0	0	39	50	714	-418	

Appendix Table 37. Dunn County Fiscal Report Associated with Coal Development, REAP Scenario (\$000)

Year	Income					Expenditures			Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government	
1977	0	0	0	0	0	0	0	2	-2
1978	1	0	0	0	0	0	0	5	-4
1979	1	0	1	0	0	0	1	8	-7
1980	1	0	2	0	0	1	1	12	-10
1981	2	0	3	0	0	1	1	13	-10
1982	2	2	3	0	0	1	1	11	5
1983	3	2	2	0	0	1	1	16	-10
1984	3	2	3	0	0	1	1	18	-11
1985	3	3	4	0	0	1	2	22	-15
1986	3	3	5	0	0	1	2	25	-18
1987	3	3	6	0	0	1	2	25	-16
1988	4	3	5	0	0	2	2	29	-21
1989	4	3	6	0	0	2	2	30	-20
1990	4	4	7	0	0	2	2	32	-22
1991	4	4	7	0	0	2	2	33	-22
1992	5	6	7	0	0	2	2	34	-21
1993	5	6	8	0	0	2	2	33	-18
1994	5	7	7	0	0	2	3	38	-24
1995	6	7	8	0	0	2	3	42	-26
1996	6	8	9	0	0	3	3	47	-30
1997	7	8	10	0	0	3	4	52	-33
1998	7	9	11	0	0	3	4	55	-34
1999	8	9	12	0	0	3	4	61	-39

Appendix Table 38. McLean County Fiscal Report Associated with Coal Development, REAP Scenario (\$000)

Year	Income					Expenditures			Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government	
1977	8	0	12	0	0	5	6	92	-83
1978	23	0	20	0	0	7	10	138	-112
1979	39	0	30	0	0	9	11	162	-113
1980	48	0	36	228	417	9	12	175	531
1981	73	0	39	228	486	11	14	204	596
1982	80	31	45	228	561	12	16	225	692
1983	87	33	50	228	640	13	17	245	763
1984	93	36	54	228	726	14	19	267	836
1985	97	38	59	228	817	16	20	288	914
1986	102	41	64	228	914	17	22	312	998
1987	109	44	69	228	1,019	18	24	339	1,087
1988	117	47	75	228	1,130	20	26	370	1,180
1989	125	50	82	228	1,250	22	28	401	1,284
1990	134	54	89	228	1,378	23	30	433	1,394
1991	143	57	96	228	1,514	26	33	471	1,508
1992	153	77	104	228	1,661	28	36	512	1,647
1993	164	82	113	228	1,817	30	39	552	1,783
1994	175	88	122	228	1,985	32	42	600	1,924
1995	187	94	132	228	2,164	35	45	649	2,077
1996	201	101	143	228	2,356	38	49	702	2,240
1997	215	108	155	228	2,561	41	53	759	2,414
1998	230	116	168	228	2,781	44	57	821	2,600
1999	246	124	181	228	3,016	48	62	881	2,804

Appendix Table 39. Mercer County Fiscal Report Associated with Coal Development, REAP Scenario (\$000)

Year	Income					Expenditures				Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government		
1977	10	0	14	108	72	7	9	133	54	
1978	36	0	29	112	123	19	25	358	-103	
1979	60	0	79	112	157	40	52	738	-422	
1980	80	0	163	112	186	52	67	964	-543	
1981	109	0	213	112	217	56	73	1,039	-516	
1982	180	171	229	224	481	45	58	832	350	
1983	233	183	184	224	549	54	70	1,000	250	
1984	267	196	221	973	1,568	69	89	1,268	1,800	
1985	281	210	280	973	1,765	76	98	1,410	1,924	
1986	315	224	311	973	1,976	80	103	1,481	2,135	
1987	359	240	327	973	2,201	79	102	1,454	2,466	
1988	395	257	321	973	2,442	84	108	1,545	2,652	
1989	422	275	341	1,722	4,330	90	116	1,660	5,224	
1990	490	294	367	1,722	4,773	97	126	1,798	5,624	
1991	522	315	397	1,722	5,246	106	136	1,950	6,011	
1992	559	320	431	1,722	5,753	115	148	2,117	6,406	
1993	599	342	467	1,722	6,296	125	161	2,299	6,843	
1994	642	366	508	1,722	6,877	135	174	2,494	7,312	
1995	687	392	551	1,722	7,498	147	189	2,707	7,807	
1996	735	419	598	1,722	8,162	159	205	2,940	8,331	
1997	786	448	649	1,722	8,873	173	223	3,197	8,886	
1998	840	480	706	1,722	9,634	188	243	3,474	9,478	
1999	897	513	767	1,722	10,449	205	264	3,777	10,103	

Appendix Table 40. Morton County Fiscal Report Associated with Coal Development, REAP Scenario (\$000)

Year	Income					Expenditures				Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government		
1977	3	0	7	0	0	2	3	37	-31	
1978	10	0	8	0	0	3	4	51	-40	
1979	15	0	11	0	0	4	5	75	-57	
1980	18	0	16	0	0	4	6	81	-57	
1981	19	0	18	0	0	5	6	91	-65	
1982	23	14	20	0	0	5	7	101	-56	
1983	25	15	22	0	0	6	8	110	-61	
1984	27	17	24	0	0	7	8	120	-68	
1985	25	18	27	0	0	7	9	131	-78	
1986	27	19	29	0	0	8	10	142	-85	
1987	29	20	31	0	0	8	11	154	-92	
1988	31	22	34	0	0	9	12	167	-101	
1989	33	23	37	0	0	10	13	180	-108	
1990	36	25	40	0	0	10	14	194	-117	
1991	38	27	43	0	0	11	15	208	-126	
1992	41	34	46	0	0	12	16	224	-131	
1993	44	37	49	0	0	13	17	240	-140	
1994	47	39	53	0	0	14	18	256	-149	
1995	50	42	57	0	0	15	19	273	-158	
1996	54	45	60	0	0	16	21	294	-172	
1997	57	48	65	0	0	17	22	315	-184	
1998	61	52	70	0	0	18	23	334	-192	
1999	65	55	74	0	0	19	25	355	-205	

Appendix Table 41. Oliver County Fiscal Report Associated with Coal Development, REAP Scenario (\$000)

Year	Income					Expenditures			Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government	
1977	3	0	8	0	0	2	3	36	-30
1978	8	0	8	0	0	2	3	39	-28
1979	12	0	9	112	157	2	3	43	241
1980	22	0	10	112	186	3	3	47	277
1981	24	0	10	112	217	3	4	51	306
1982	26	8	11	112	250	3	4	54	347
1983	28	9	12	112	286	3	4	59	381
1984	30	10	13	112	324	3	4	64	417
1985	31	10	14	112	365	4	5	69	455
1986	33	11	15	112	408	4	5	74	496
1987	35	12	16	112	455	4	6	81	539
1988	37	13	18	112	505	5	6	89	584
1989	40	13	20	112	558	5	7	97	633
1990	42	14	21	112	615	6	7	106	686
1991	45	15	23	112	676	6	8	116	742
1992	48	19	26	112	741	7	9	126	804
1993	51	20	28	112	811	7	10	138	868
1994	54	22	30	112	886	8	10	150	936
1995	58	23	33	112	966	9	11	164	1,009
1996	62	25	36	112	1,052	10	12	178	1,086
1997	66	26	39	112	1,143	11	14	194	1,169
1998	70	28	43	112	1,242	11	15	211	1,257
1999	75	30	47	112	1,346	12	16	229	1,353

Appendix Table 42. Stark County Fiscal Report Associated with Coal Development, REAP Scenario (\$000)

Year	Income					Expenditures			Net Fiscal Balance
	Share of Local Property Tax	Federal Revenue Sharing	Highway Fund	Conversion Tax	Severance Tax	Law Enforcement	Social Services	Other Government	
1977	2	0	3	0	0	1	1	17	-14
1978	5	0	4	0	0	1	2	26	-21
1979	8	0	6	0	0	2	3	42	-34
1980	9	0	9	0	0	3	3	46	-34
1981	10	0	10	0	0	3	4	53	-39
1982	12	8	12	0	0	3	4	59	-34
1983	13	9	13	0	0	4	5	66	-38
1984	14	9	14	0	0	4	5	70	-41
1985	13	10	16	0	0	4	5	76	-46
1986	14	11	17	0	0	4	6	82	-50
1987	15	12	18	0	0	5	6	86	-52
1988	17	12	19	0	0	5	6	92	-56
1989	18	13	20	0	0	5	7	100	-61
1990	19	14	22	0	0	6	7	107	-65
1991	20	15	24	0	0	6	8	116	-71
1992	22	19	26	0	0	7	9	125	-74
1993	23	20	28	0	0	7	9	134	-80
1994	25	22	30	0	0	8	10	145	-87
1995	27	23	32	0	0	8	11	156	-93
1996	28	25	34	0	0	9	12	165	-97
1997	30	27	36	0	0	9	12	174	-102
1998	32	29	38	0	0	10	13	185	-108
1999	35	31	41	0	0	10	13	193	-111

Appendix Table 43. Aggregate Municipality Fiscal Report for Golden Valley, Zap, Beulah, Pick City, Hazen, and Stanton Associated with Coal Development, REAP Scenario (\$000)

Year	Income								Expenditures					Net Fiscal Impact
	Share of Local Prop. Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess	Highway Fund	Cigarette & Tobacco	Conversion Tax	Schools	Streets	Police & Fire	City Government	Debt Service	
1977	31	109	0	47	195	8	3	163	290	14	71	331	495	-643
1978	115	208	0	97	398	18	6	352	774	39	189	887	13,333	-2,028
1979	193	562	0	259	1,072	49	16	404	1,599	81	390	1,829	2,716	-4,057
1980	258	1,162	0	538	2,183	103	36	448	2,129	106	508	2,387	3,416	-3,822
1981	355	1,551	0	701	2,733	134	47	493	2,369	113	548	2,573	3,561	-3,148
1982	582	1,727	143	756	2,843	145	51	1,057	1,845	91	437	2,061	3,564	-696
1983	755	1,342	154	605	2,843	116	41	1,161	2,289	109	527	2,477	4,021	-2,406
1984	864	1,664	164	726	3,191	139	49	3,811	2,983	138	669	3,142	4,827	-1,144
1985	909	2,167	174	922	3,809	176	62	4,107	3,349	154	743	3,493	5,069	-482
1986	1,020	2,434	187	1,027	3,999	197	69	4,424	3,485	161	780	3,669	5,073	186
1987	1,162	2,528	200	1,078	4,000	206	73	4,762	3,257	157	766	3,603	5,086	1,140
1988	1,278	2,359	214	1,059	4,007	203	71	5,124	3,366	168	815	3,826	5,093	1,046
1989	1,365	2,435	229	1,125	4,010	215	75	9,077	3,558	181	876	4,113	5,127	4,680
1990	1,586	2,574	246	1,208	4,044	232	81	9,742	3,833	197	948	4,454	5,205	5,077
1991	1,691	2,775	264	1,309	4,112	251	87	10,453	4,149	213	1,030	4,832	5,304	5,416
1992	1,810	3,005	267	1,420	4,194	272	95	11,212	4,491	231	1,116	5,243	5,418	5,775
1993	1,941	3,255	285	1,540	4,288	294	103	12,027	4,874	252	1,213	5,695	5,550	6,151
1994	2,078	3,532	305	1,674	4,396	320	113	12,897	5,272	273	1,316	6,177	5,680	6,602
1995	2,225	3,820	327	1,815	4,504	348	122	13,828	5,706	295	1,427	6,707	5,611	7,244
1996	2,380	4,135	350	1,971	4,459	377	132	14,826	6,162	320	1,550	7,284	5,737	7,573
1997	2,546	4,463	374	2,140	4,569	410	143	15,893	6,641	349	1,686	7,922	5,663	8,277
1998	2,719	4,806	401	2,329	4,526	445	156	17,035	7,141	379	1,832	8,606	4,999	9,460
1999	2,907	5,164	428	2,529	4,015	484	169	18,257	7,679	412	1,992	9,357	3,815	10,697

Appendix Table 44. Bismarck Municipality and School District Fiscal Report Associated with Coal Development, REAP Scenario (\$000)

Year	Income								Expenditures					Net Fiscal Impact
	Share of Local Prop. Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess	Highway Fund	Cigarette & Tobacco	Conversion Tax	Schools	Streets	Police & Fire	City Government	Debt Service	
1977	24	117	0	54	228	10	4	0	191	10	46	216	313	-339
1978	60	139	0	63	251	12	4	0	238	12	58	273	378	-431
1979	98	172	0	80	304	15	5	0	330	17	80	378	512	-641
1980	115	239	0	111	412	21	7	0	345	18	86	405	513	-462
1981	123	250	0	119	413	23	8	0	393	21	100	467		-610
1982	149	285	24	137	456	26	9	0	424	23	110	515	585	-568
1983	161	308	26	151	474	29	10	0	456	25	119	558	595	-593
1984	173	331	28	164	484	31	11	0	484	26	128	601	600	-618
1985	166	352	30	177	488	34	12	0	516	28	137	644	602	-669
1986	177	375	32	189	490	36	13	0	550	30	147	690	602	-706
1987	189	400	34	203	491	39	14	0	586	32	157	736	602	-744
1988	202	426	36	216	491	41	15	0	634	35	170	798	617	-826
1989	216	461	39	234	503	45	16	0	676	38	182	857	622	-860
1990	232	491	42	252	508	48	17	0	720	41	196	921	627	-915
1991	248	523	45	271	513	52	18	0	771	44	211	990	632	-978
1992	265	560	55	291	518	56	20	0	815	47	226	1,063	637	-1,025
1993	283	591	59	312	523	60	21	0	858	50	243	1,142	643	-1,087
1994	303	621	63	336	529	64	23	0	902	54	261	1,227	650	-1,155
1995	324	654	68	361	535	69	24	0	949	58	281	1,319	573	-1,145
1996	347	687	72	387	475	74	26	0	998	62	302	1,417	380	-1,089
1997	371	722	77	416	321	80	28	0	1,040	67	324	1,522	358	-1,295
1998	397	752	83	447	306	86	30	0	1,082	72	348	1,635	302	-1,339
1999	424	782	89	480	261	92	32	0	1,126	77	374	1,756	177	-1,350

Appendix Table 45. Killdeer Municipality and School District Fiscal Report Associated with Coal Development, REAP Scenario (\$000)

Year	Income								Expenditures					Net Fiscal Impact
	Share of Local Prop. Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess	Highway Fund	Cigarette & Tobacco	Conversion Tax	Schools	Streets	Police & Fire	City Government	Debt Service	
1977	0	2	0	0	2	0	0	0	2	0	0	2	3	-3
1978	1	2	0	1	2	0	0	0	5	0	1	4	6	-11
1979	2	4	0	1	5	0	0	0	8	0	1	7	11	-16
1980	2	6	0	2	8	0	0	0	10	0	2	9	13	-15
1981	2	7	0	3	9	0	0	0	11	0	2	10	13	-15
1982	2	8	1	3	10	1	0	0	8	0	2	11	14	-12
1983	3	6	1	3	11	1	0	0	13	1	3	12	16	-19
1984	3	9	1	4	11	1	0	0	14	1	3	15	19	-23
1985	3	10	1	4	14	1	0	0	15	1	4	17	20	-23
1986	3	11	1	5	15	1	0	0	16	1	4	18	20	-23
1987	3	11	1	5	15	1	0	0	12	1	4	20	20	-20
1988	3	8	1	6	16	1	0	0	18	1	5	21	22	-31
1989	3	13	1	6	16	1	0	0	14	1	5	24	23	-25
1990	4	10	1	7	16	1	0	0	15	1	5	25	23	-30
1991	4	10	1	7	16	1	0	0	16	1	6	27	23	-31
1992	4	11	2	8	16	2	1	0	17	1	5	24	23	-26
1993	4	12	2	7	16	1	0	0	11	1	6	26	23	-24
1994	5	7	2	8	17	1	1	0	11	1	7	31	27	-37
1995	5	8	2	9	21	2	1	0	12	1	7	34	25	-33
1996	5	8	2	10	20	2	1	0	13	2	8	37	26	-38
1997	6	9	2	11	21	2	1	0	14	2	8	40	26	-39
1998	6	10	2	12	21	2	1	0	15	2	9	43	23	-39
1999	7	10	2	13	19	2	1	0	16	2	10	46	19	-39

Appendix Table 46. Washburn Municipality and School District Fiscal Report Associated with Coal Development, REAP Scenario (\$000)

Year	Income								Expenditures					Net Fiscal Impact
	Share of Local Prop. Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess	Highway Fund	Cigarette & Tobacco	Conversion Tax	Schools	Streets	Police & Fire	City Government	Debt Service	
1977	13	47	0	18	74	3	1	0	108	4	21	99	151	-227
1978	35	78	0	29	116	6	2	0	164	7	32	150	224	-312
1979	59	119	0	44	172	8	3	0	193	8	37	176	248	-256
1980	72	139	0	52	190	10	3	203	218	9	42	197	263	-59
1981	78	157	0	58	201	11	4	236	251	10	50	233	298	-97
1982	87	181	12	69	230	13	5	273	272	11	55	259	312	-40
1983	94	196	13	76	242	15	5	305	292	12	60	283	320	-22
1984	102	212	13	83	250	16	6	338	313	14	66	308	327	-8
1985	106	226	14	91	256	17	6	372	337	15	71	334	332	2
1986	113	244	15	98	261	19	7	410	365	16	77	361	339	8
1987	121	265	17	106	267	20	7	449	395	17	84	394	351	10
1988	130	287	18	116	276	22	8	493	431	19	92	430	364	15
1989	141	312	19	126	287	24	8	541	466	21	99	466	373	34
1990	152	338	20	137	294	26	9	590	505	22	108	505	383	43
1991	162	366	22	148	302	28	10	644	546	24	117	548	395	54
1992	175	396	30	161	311	31	11	701	588	26	127	597	410	68
1993	188	426	32	175	325	34	12	764	629	28	138	647	420	94
1994	203	456	35	190	335	36	13	832	677	31	150	703	434	106
1995	217	490	37	206	348	40	14	904	728	34	162	763	383	186
1996	233	527	40	224	310	43	15	983	784	36	176	826	368	184
1997	252	566	42	243	301	46	16	1,069	834	39	190	892	323	258
1998	272	601	45	262	269	50	18	1,159	877	42	205	963	260	328
1999	290	631	49	283	224	54	19	1,259	912	46	222	1,042	251	339

Appendix Table 47. Beulah Municipality and School District Fiscal Report Associated with Coal Development, REAP Scenario (\$000)

Year	Income								Expenditures					Net Fiscal Impact
	Share of Local Prop. Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess	Highway Fund	Cigarette & Tobacco	Conversion Tax	Schools	Streets	Police & Fire	City Government	Debt Service	
1977	15	27	0	16	66	3	1	58	131	7	35	164	243	-393
1978	46	95	0	48	199	9	3	122	421	23	110	518	775	-1,325
1979	96	306	0	152	631	29	10	147	930	50	240	1,129	1,670	-2,647
1980	141	676	0	332	1,356	64	22	180	1,260	67	323	1,515	2,151	-2,546
1981	204	919	0	445	1,742	85	30	215	1,420	75	364	1,708	2,287	-2,214
1982	347	1,036	91	502	1,852	96	34	526	1,032	59	283	1,331	2,287	-508
1983	479	752	97	391	1,852	75	26	569	1,328	72	348	1,635	2,631	-1,773
1984	564	967	104	480	2,118	92	32	1,974	1,806	94	453	2,128	3,243	-1,391
1985	639	1,314	111	625	2,595	120	42	2,263	2,048	106	513	2,410	3,451	-821
1986	720	1,490	119	708	2,763	136	48	2,494	2,121	113	545	2,561	3,451	-313
1987	825	1,540	127	752	2,763	144	51	2,717	1,914	111	538	2,530	3,451	374
1988	911	1,387	136	743	2,763	142	50	2,985	1,951	119	574	2,695	3,451	327
1989	977	1,412	146	792	2,763	152	53	5,383	2,061	128	619	2,907	3,482	2,480
1990	1,181	1,491	156	854	2,793	164	57	5,854	2,225	139	671	3,151	3,541	2,823
1991	1,259	1,611	167	926	2,844	177	62	6,318	2,416	151	729	3,424	3,619	3,027
1992	1,349	1,750	189	1,006	2,909	193	68	6,839	2,625	164	791	3,718	3,703	3,302
1993	1,447	1,902	202	1,092	2,978	209	73	7,369	2,862	178	860	4,039	3,798	3,536
1994	1,549	2,075	216	1,187	3,055	227	80	7,985	3,108	193	934	4,387	3,897	3,856
1995	1,658	2,253	231	1,289	3,137	247	87	8,606	3,375	210	1,014	4,764	3,949	4,197
1996	1,774	2,446	248	1,400	3,183	268	94	9,319	3,659	228	1,101	5,174	4,035	4,534
1997	1,899	2,649	265	1,520	3,255	291	102	10,029	3,953	247	1,197	5,625	3,996	4,992
1998	2,029	2,860	284	1,653	3,235	316	111	10,870	4,260	269	1,301	6,114	3,594	4,820
1999	2,167	3,079	303	1,796	2,922	344	121	11,696	4,590	292	1,415	6,647	2,843	6,642

Appendix Table 48. Hazen Municipality and School District Fiscal Report Associated with Coal Development, REAP Scenario (\$000)

Year	Income								Expenditures					Net Fiscal Impact
	Share of Local Prop. Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess	Highway Fund	Cigarette & Tobacco	Conversion Tax	Schools	Streets	Police & Fire	City Government	Debt Service	
1977	8	40	0	16	65	3	1	54	102	5	23	107	162	-212
1978	25	73	0	32	129	6	2	116	256	12	59	277	419	-641
1979	40	186	0	81	334	16	5	131	514	25	121	567	844	-1,278
1980	55	374	0	167	674	32	11	142	673	32	154	725	1,037	-1,167
1981	83	490	0	213	823	41	14	151	711	32	154	725	1,037	-842
1982	153	519	43	213	823	41	14	293	558	27	128	603	1,037	-254
1983	186	407	47	177	823	34	12	349	663	31	149	701	1,130	-639
1984	204	483	50	206	894	39	14	1,114	834	37	180	847	1,296	-190
1985	175	607	53	249	1,016	48	17	1,146	927	41	196	921	1,327	-101
1986	199	675	57	271	1,035	52	18	1,218	959	41	200	939	1,327	59
1987	229	697	61	276	1,035	53	19	1,302	898	39	189	887	1,327	333
1988	252	651	65	261	1,035	50	18	1,383	922	41	198	931	1,327	295
1989	267	669	70	274	1,035	52	18	2,430	970	44	211	990	1,327	1,274
1990	275	703	75	291	1,035	56	20	2,579	1,044	47	227	1,068	1,340	1,307
1991	292	757	80	314	1,047	60	21	2,756	1,130	51	246	1,154	1,359	1,388
1992	313	819	64	339	1,061	65	23	2,930	1,222	55	266	1,250	1,384	1,436
1993	336	887	68	367	1,081	70	25	3,137	1,322	60	289	1,359	1,415	1,525
1994	360	959	73	399	1,107	76	27	3,340	1,426	65	313	1,470	1,439	1,630
1995	387	1,034	78	432	1,127	83	29	3,577	1,542	70	339	1,595	1,390	1,811
1996	414	1,119	84	469	1,090	90	31	3,812	1,659	76	369	1,732	1,425	1,848
1997	443	1,203	90	509	1,122	97	34	4,092	1,784	83	400	1,881	1,384	2,058
1998	473	1,292	96	553	1,093	106	37	4,349	1,914	90	435	2,041	1,165	2,354
1999	507	1,386	103	600	925	115	40	4,661	2,054	98	472	2,216	781	2,715

Appendix Table 49. Mandan Municipality and School District Fiscal Report Associated with Coal Development, REAP Scenario (\$000)

Year	Income								Expenditures				Net Fiscal Impact	
	Share of Local Prop. Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess	Highway Fund	Cigarette & Tobacco	Conversion Tax	Schools	Streets	Police & Fire	City Government		Debt Service
1977	8	41	0	19	75	4	1	0	65	3	15	72	100	-109
1978	22	47	0	21	80	4	1	0	88	4	20	92	126	-155
1979	33	63	0	27	99	5	2	0	121	6	27	127	170	-219
1980	39	86	0	37	134	7	2	0	130	6	29	138	173	-170
1981	42	93	0	40	137	8	3	0	148	7	32	152	182	-197
1982	51	105	8	45	143	9	3	0	161	8	37	174	197	-213
1983	55	115	9	51	157	10	3	0	173	8	40	188	200	-209
1984	59	123	9	55	160	11	4	0	190	9	44	206	208	-235
1985	57	136	10	61	166	12	4	0	208	10	47	223	212	-256
1986	61	148	11	66	169	13	4	0	223	11	51	241	216	-270
1987	65	159	12	71	172	14	5	0	243	12	56	262	223	-299
1988	70	173	12	77	178	15	5	0	257	12	60	284	227	-310
1989	74	183	13	83	182	16	6	0	275	13	65	307	231	-334
1990	80	196	14	90	186	17	6	0	289	15	71	332	235	-351
1991	85	205	15	97	190	19	7	0	303	16	76	358	239	-375
1992	91	215	20	105	194	20	7	0	317	17	82	387	244	-395
1993	98	225	21	114	199	22	8	0	343	18	88	412	245	-419
1994	104	243	23	121	199	23	8	0	356	19	94	442	247	-437
1995	112	251	24	130	201	25	9	0	368	21	100	472	159	-369
1996	119	260	26	139	130	27	9	0	385	22	108	509	159	-474
1997	128	271	28	150	132	29	10	0	417	24	116	543	154	-506
1998	137	293	30	160	126	31	11	0	416	25	123	579	128	-485
1999	146	291	32	170	107	33	11	0	434	27	131	614	84	-500

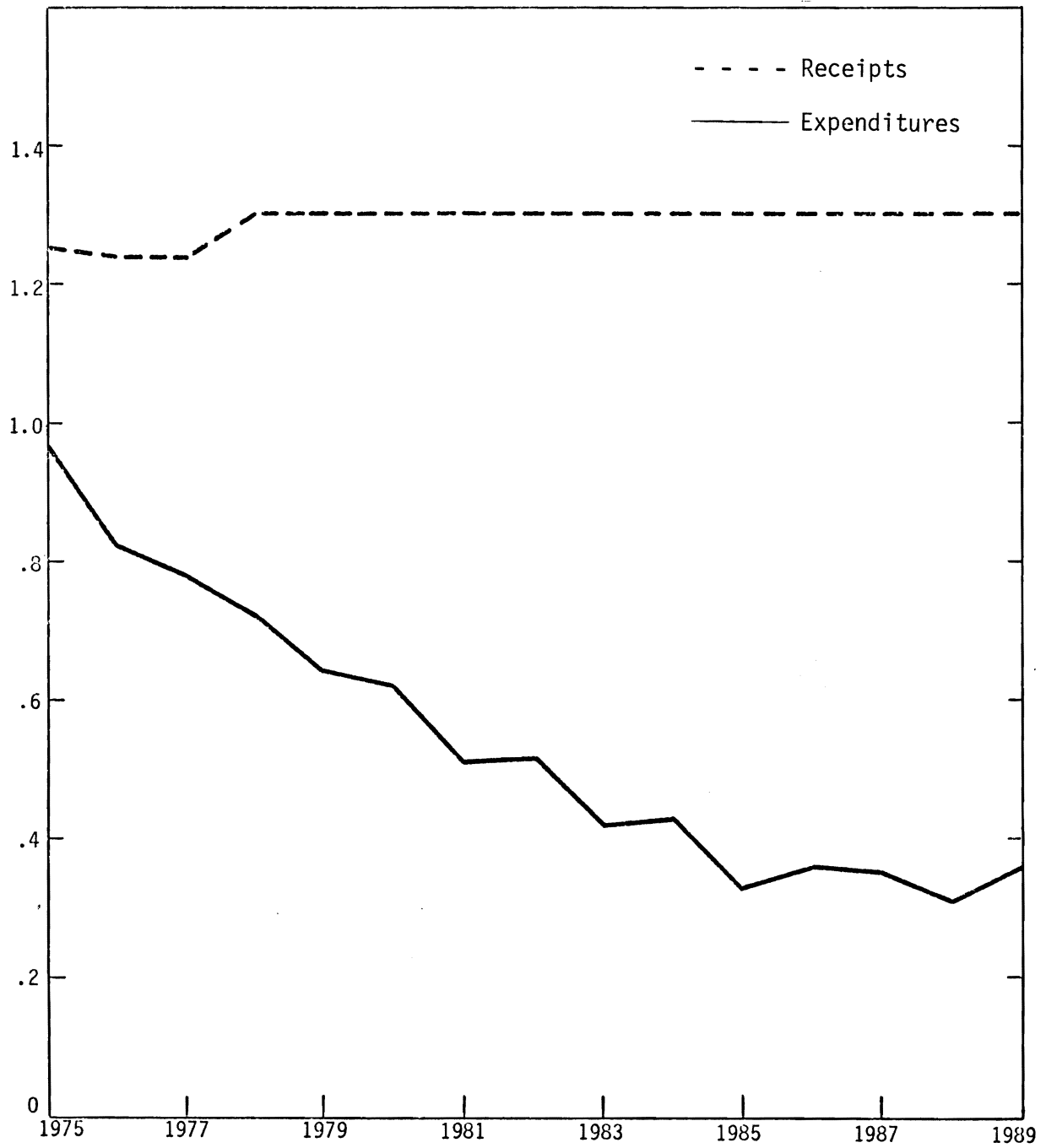
Appendix Table 50. Center Municipality and School District Fiscal Report Associated with Coal Development, REAP Scenario (\$000)

Year	Income								Expenditures				Net Fiscal Impact	
	Share of Local Prop. Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess	Highway Fund	Cigarette & Tobacco	Conversion Tax	Schools	Streets	Police & Fire	City Government		Debt Service
1977	9	63	0	25	103	5	2	0	92	4	19	89	131	-129
1978	26	67	0	26	103	5	2	0	100	4	21	98	134	-128
1979	39	72	0	29	105	5	2	404	111	5	23	108	140	270
1980	72	80	0	32	109	6	2	447	116	5	25	116	141	345
1981	77	83	0	34	111	7	2	494	122	6	27	126	143	384
1982	85	88	7	37	112	7	2	544	131	6	29	135	143	440
1983	91	94	7	40	112	8	3	597	140	6	31	145	144	485
1984	97	101	8	43	114	8	3	654	150	7	34	158	147	533
1985	100	108	9	46	117	9	3	715	160	7	36	170	149	583
1986	106	116	9	50	118	10	3	780	171	8	39	183	151	640
1987	113	124	10	54	120	10	4	850	183	9	43	200	155	695
1988	121	132	10	59	124	11	4	925	206	10	47	220	167	736
1989	128	149	11	65	133	12	4	1,005	229	11	51	241	176	801
1990	137	165	12	71	139	14	5	1,091	254	12	56	263	186	863
1991	146	183	13	77	146	15	5	1,182	275	13	61	287	194	938
1992	155	198	16	84	153	16	6	1,280	297	14	67	313	202	1,015
1993	165	213	17	92	160	18	6	1,385	318	15	73	341	210	1,100
1994	176	228	18	100	168	19	7	1,497	340	16	79	372	219	1,188
1995	188	244	19	109	177	21	7	1,617	364	18	86	405	117	1,393
1996	200	261	21	119	101	23	8	1,746	390	19	94	441	107	1,427
1997	213	280	22	130	94	25	9	1,883	417	21	102	481	118	1,516
1998	227	299	24	141	104	27	9	2,030	446	23	111	523	126	1,632
1999	241	320	25	154	113	29	10	2,188	477	25	121	567	130	1,760

Appendix Table 51. Dickinson Municipality and School District Fiscal Report Associated with Coal Development, REAP Scenario (\$000)

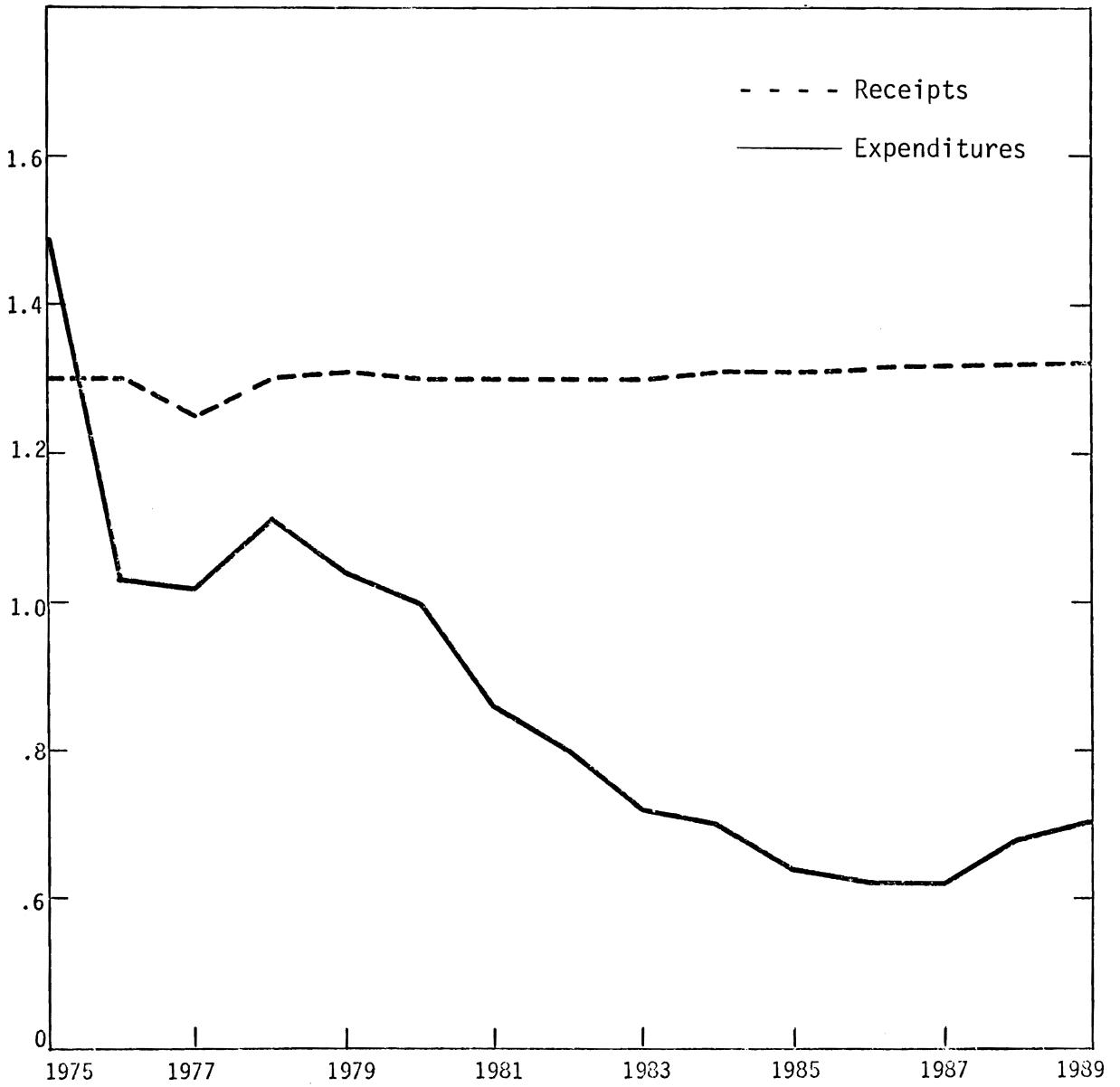
Year	Income								Expenditures				Net Fiscal Impact	
	Share of Local Prop. Tax	Education Transfers	Federal Revenue Sharing	Users Fees	Special Assess	Highway Fund	Cigarette & Tobacco	Conversion Tax	Schools	Streets	Police & Fire	City Government		Debt Service
1977	5	17	0	9	38	2	1	0	29	2	8	36	51	-54
1978	13	21	0	10	42	2	1	0	44	2	12	55	78	-102
1979	22	32	0	16	64	3	1	0	71	4	19	88	122	-166
1980	25	50	0	26	100	5	2	0	73	4	20	96	124	-109
1981	27	51	0	28	102	5	2	0	82	5	24	111	136	-141
1982	34	59	6	32	112	6	2	0	92	6	27	126	147	-147
1983	36	66	6	37	122	7	2	0	98	6	29	138	151	-145
1984	38	70	7	40	125	8	3	0	105	7	32	148	152	-152
1985	36	75	7	44	127	8	3	0	112	7	34	160	154	-168
1986	39	80	8	47	129	9	3	0	120	8	37	172	154	-175
1987	42	86	8	50	129	10	3	0	126	8	39	181	154	-180
1988	45	91	9	53	129	10	4	0	135	9	41	194	154	-193
1989	48	97	9	57	129	11	4	0	144	9	45	209	157	-209
1990	51	104	10	61	131	12	4	0	155	10	48	226	159	-224
1991	55	111	11	66	134	13	4	0	165	11	52	244	162	-240
1992	59	119	14	72	137	14	5	0	177	12	56	263	165	-255
1993	63	127	14	77	140	15	5	0	189	13	61	284	168	-274
1994	67	136	16	84	143	16	6	0	199	14	65	307	172	-290
1995	72	142	17	90	146	17	6	0	209	15	71	331	169	-304
1996	77	149	18	97	145	19	7	0	223	16	76	356	132	-292
1997	82	160	19	105	115	20	7	0	239	17	80	378	126	-333
1998	87	171	20	111	110	21	7	0	256	18	85	400	100	-330
1999	94	183	22	118	89	23	8	0	257	18	89	417	56	-302

Millions of Dollars



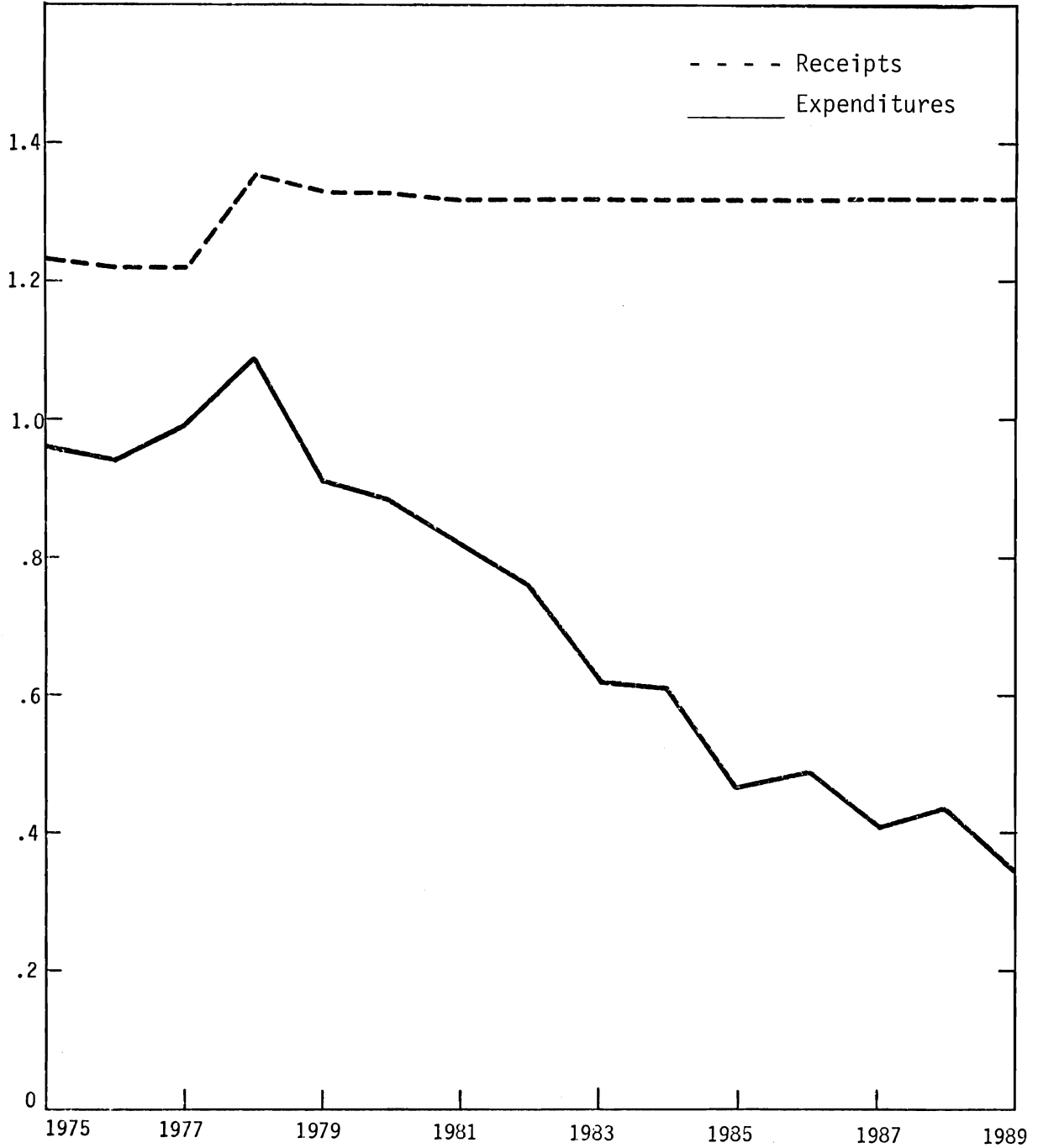
Appendix Figure 33. Big Horn County Educational Expenditures and Resources, Scenario I

Millions of Dollars



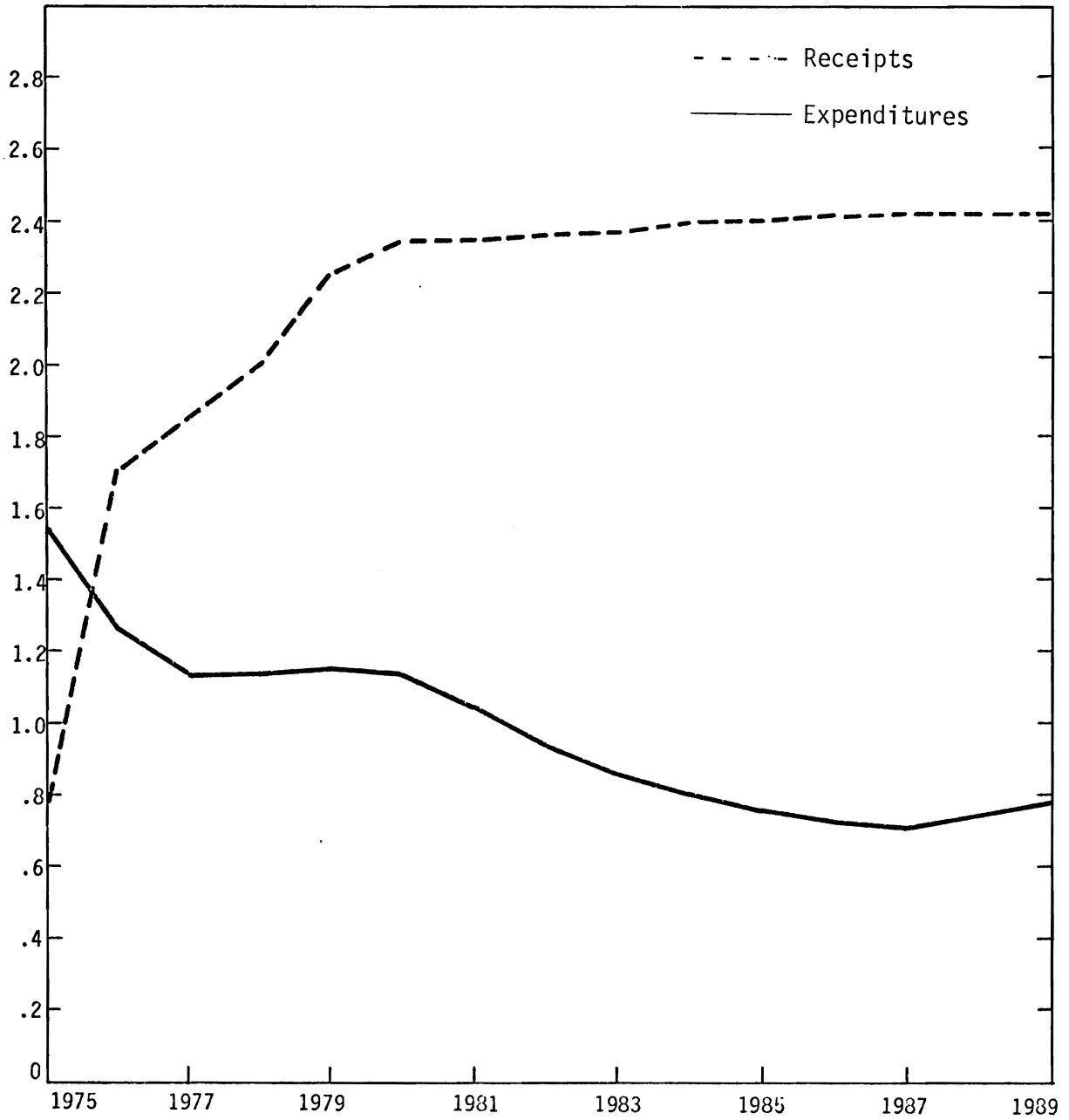
Appendix Figure 34. Rosebud County Educational Expenditures and Resources, Scenario I

Millions of Dollars



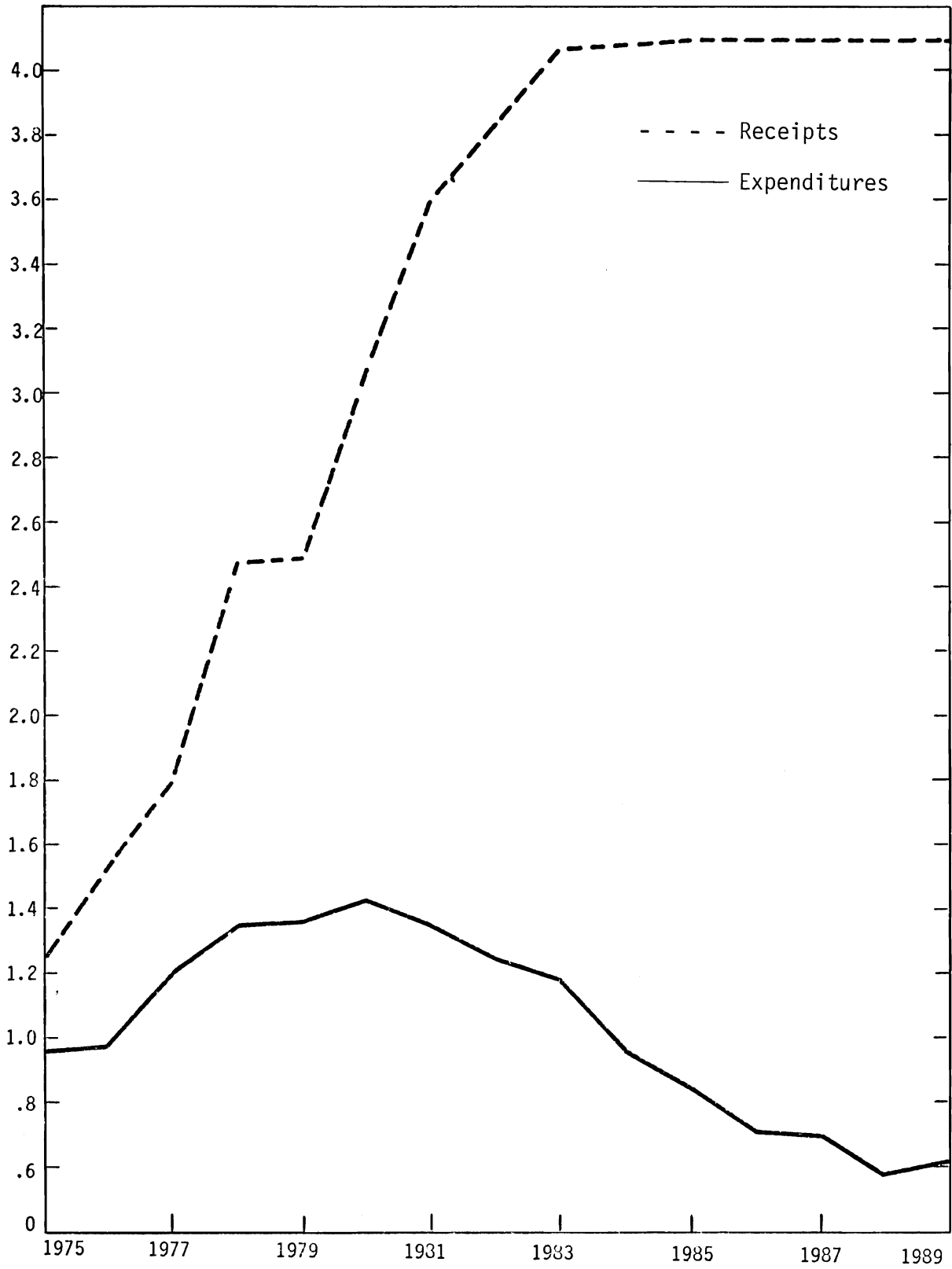
Appendix Figure 35. Big Horn County Educational Expenditures and Resources, Scenario II

Millions of Dollars



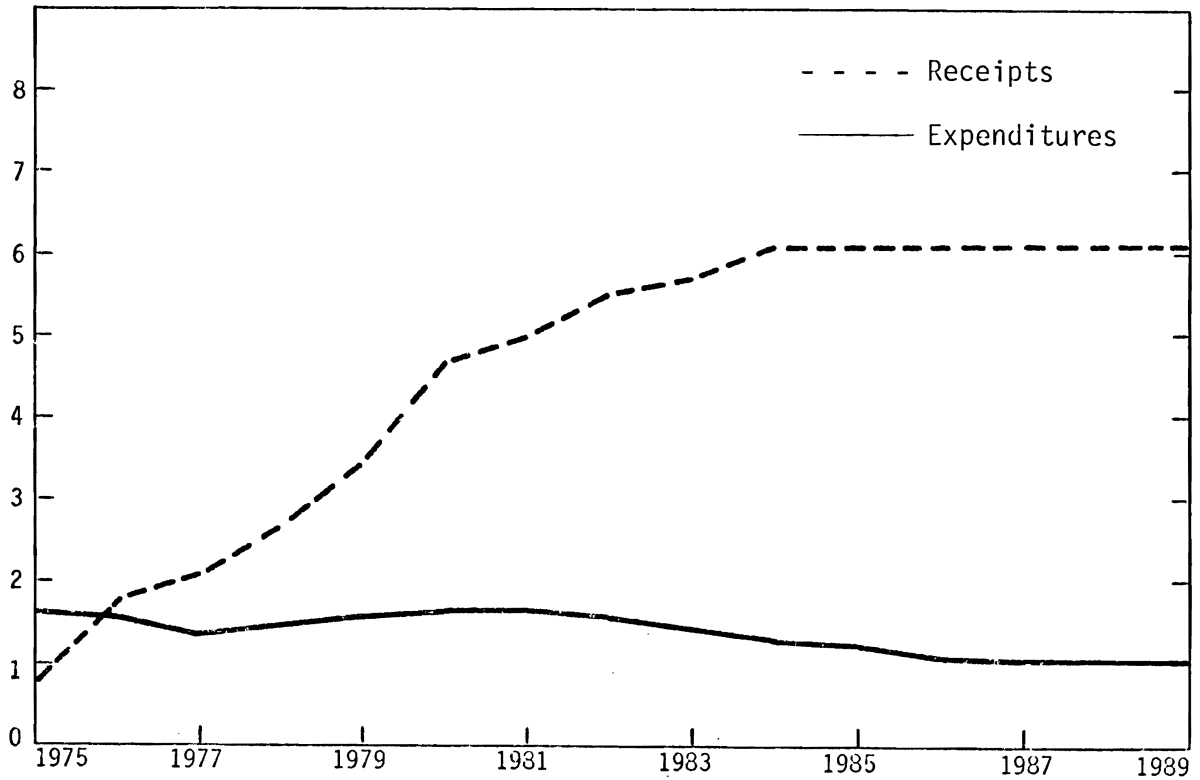
Appendix Figure 36. Rosebud County Educational Expenditures and Resources, Scenario II

Millions of Dollars



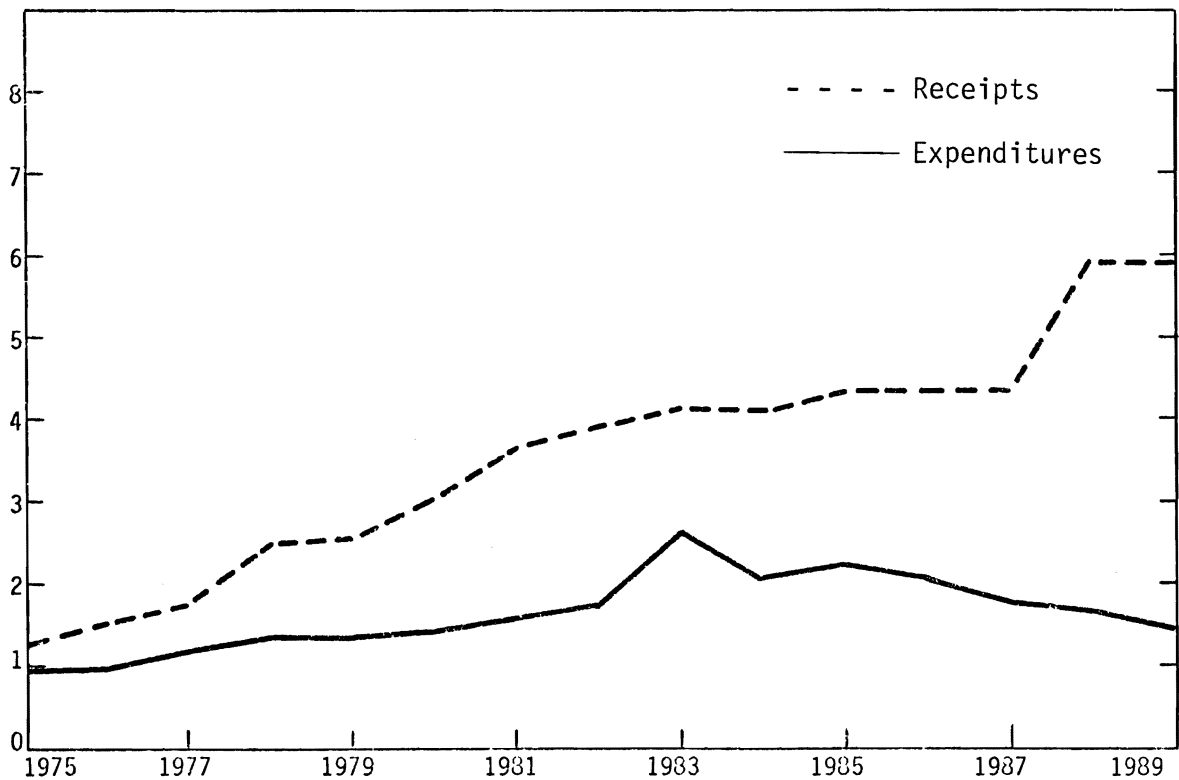
Appendix Figure 37. Big Horn County Educational Expenditures and Resources, Scenario III

Millions of Dollars



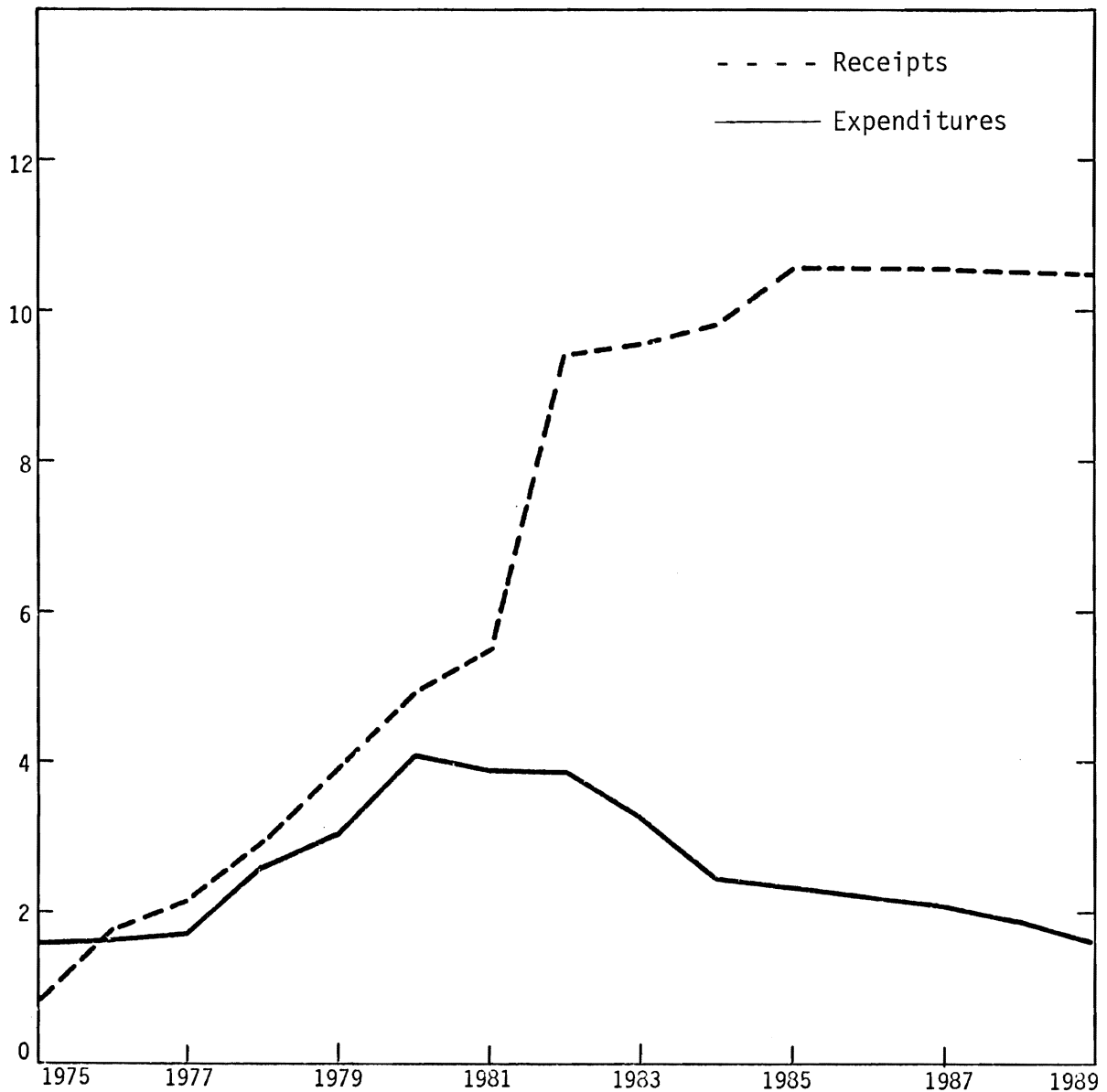
Appendix Figure 38. Rosebud County Educational Expenditures and Resources, Scenario III

Millions of Dollars



Appendix Figure 39. Big Horn County Educational Expenditures and Resources, Scenario IV

MILLIONS OF DOLLARS



Appendix Figure 40. Rosebud County Educational Expenditures and Resources, Scenario IV

LITERATURE CITED

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