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LOCAL ECONOMIC IMPACTS OF POWER PLANT SITING IN WISCONSIN

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COASTAL ZONE MANAGEMENT
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by the

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TABLE OF CONTENTS

ABSTRACT

The continuing growth of electricity use in Wisconsin means that new generating and transmission facilities will be built. Unless recent trends are reversed, these facilities will be larger and the environmental and economic impact greater than from past, smaller facilities. The coastlines of Lakes Michigan and Superior are attractive power plant sites with easy access to a large source of cold water and to all transportation facilities.

Under the recently enacted Power Plant Siting Law (Chapter 68, Laws of 1975), the utilities will suggest several possible power plant sites and will submit environmental impact information for each site. The PSC, DNR, and other governmental bodies will react to the utility proposals and approve or reject the proposed site. There are no state guidelines on power plant siting other than existing environmental laws and regulations.

While methods for predicting environmental impacts have been fairly well developed, no methods for predicting local economic impact of power plant construction existed when this study started. Local communities could expect an influx of 500-1500 workers with their families and the associated increased demand for housing, schools, roads, fire and police protection.

This study has quantified actual impacts on municipal budgets, property values, and school enrollments and tried to relate these impacts to power plant size, type and location. Specific data was gathered for seven recent (since 1954) sites for plants larger than 100 MWe.

The large utility tax payments to the nearest municipality have allowed reduction or elimination of the general property tax and increased municipal expenditures. The most significant increase in property values was for residential property in the township containing the plant site. Mercantile property values reflected changes in residential property. Manufacturing property values depended on the supply of labor and access to markets.Manufacturing property values increased in the secondary area (towns neighboring the site town). School enrollments in K-8th grades were affected more than 9-12th grades both during and after construction. The impact on grades K-8 was greater following construction than during construction.

The most important variable was plant size; plant type, and population and location (degree of urbanization) were also important. Location on the coast was associated with a greater reduction in property taxes than location off the coast.

While it is difficult to develop an accurate generalized predictive set of equations, it is expected that these equations applied to site specific information will narrow the measurement of expected impact to a range useful for local policy makers.

LOCAL ECONOMIC IMPACTS OF POWER PLANT SITING IN WISCONSIN

INTRODUCTION

BACKGROUND

Electricity use in Wisconsin is currently growing at the rate of about 5% per year, requiring the continuous expansion of electric generating capacity. At the same time there is a tendency towards larger and larger facilities for both nuclear and coal fired plants and hence greater and greater economic, environmental and social impacts on the communities surrounding the plants. If state and local policy makers are to make wise decisions with respect to power plant sitings, it thus becomes increasingly important to understand the nature and extent of the impacts from power plants.

THE PROBLEM- LOCAL ECONOMIC IMPACTS

This study focuses on several of the local economic impacts of power plants. It was felt that this focus was justified since there have already been several studies done on the environmental impacts of both nuclear and coal fired plants. Similiarly, the socio-economic impacts of power plants at the county-wide level have been studied extensively. See, The Evaluation of The Potential Socio-Economic Impacts of the Construction and Operation of Columbia Generating Station No. II, by Western Research Incorporated. Until now, however, the more localized economic impacts have not been examined in any detail. Yet these impacts can be quite substantial. The construction and operation of new power plants may mean an influx to the community of new workers, both temporary, (for construction of the plant), and permanent, (for the operation of the plant). These workers along with their families may overburden existing municipal facilities such as police, fire, water and roads. New workers and their families are also likely to impact on the local housing and commercial sectors.

The plant itself may also require additional police and fire protection and will perhaps place a greater strain on existing roads in order to accomodate heavy construction machinery and increased traffic loads.

An influx of workers may also strain school facilities and necessitate either increased expenditures or such accomodations as revisions in school bus routing or changes in curriculum to absorb students with dissimilar preparation.

The most important local impacts of power development are likely to be caused by the receipts of the shared utility tax.* In lieu of a local property tax, the utilities directly pay the state a utility tax, based on the assessed value of the utility property. To compensate them for their diminished tax base and for any costs incurred because of the utility, the state returns a large portion of the utility tax to the host counties and municipalities. (For a detailed discussion on the utility tax assessment and the utility tax distribution formula see Appendix I).

* The tax formulas of Appendix I have been substantially changed. Details will be in the next report and the final version of this report.

Historically the construction of a power generating facility has usually represented a very sizeable source of revenues for the community in which the plant is located. In the case of rural towns and villages the shared utility tax has often been significantly larger than the total annual budget of the municipality. With these tax rebates these small communities have been able to reduce and in some cases completely eliminate their local general property tax levy while at the same time maintain or significantly upgrade the level of public services.

The major effect of the utility tax rebate has thus been to create small tax islands whose residents were able to receive a very high level of public services at little or no direct cost to individual tax payers. This situation has the potential to create spinoff impacts on property values and development in the local community. Depending on the type of zoning which exists in the community, the low tax rate and/or the high level of services may serve to attract various types of development and drive property values up. If development is stimulated this in turn will lead to greater strain on local services and school systems.

Conversely the location of the power plants in the community may decrease property values and discourage development due to some of the environmental health related problems associated with the generation of electricity.

At any rate, while the magnitude of the above impacts is not known it seems likely the power plants will have significant local economic impacts on annual municipal receipts and expenditures, school enrollments and property values as well as on other factors not discussed.

In addition, all of the above impacts are likely to vary with the size of the plant, the type of plant, the location and the setting of the plant. A nuclear plant, for example, would be expected to bring in a much larger labor force from outside the region both during the construction and the operation stages than a fossil fueled plant due to the large, highly specialized work force required. This would likely result in greater repercussions in terms of municipal expenditures and school enrollments than a coal fired plant in a similar setting. Similiarly, an electric utility located in a small rural area would be expected to have greater repercussions than one located in a large, well developed metropolitan area. However, to this point the complexity of the impacts has not been clearly understood.

PURPOSE

This study evaluates the impacts of existing electricity generating facilities on annual municipal receipts and expenditures, school enrollments and aggregate market value of local property and compares these impacts with respect to plant size (large vs. small), plant type (fossil vs. nuclear fueled), plant location (on or off the coast) and plant site (rural, village, city, or metropolis). The purpose is to develop predictive capabilities for power plant impacts which may be used to assist in the formulation of specific policies concerning future site selection.

Unfortunately, the scope of the study was limited and there was no time to evaluate all the local economic impacts of power plants. Impacts on the commercial sector (other than assessed value),on specific land use changes and on the general population, as well as the economic impacts of environmental factors have all been omitted from this report. Likewise, equity considerations have not been considered. Hopefully these will be studied in follow up reports. (See Appendix II.)

It should be pointed out that impacts as they are described here refer to both primary and secondary effects of plant construction including added stimulus to economic developments. Thus the impact of the power plant on school enrollments, for example, will include not only changes in enrollment due to the additions of plant construction workers but also changes due to changes in land use patterns or levels of manufacturing which were influenced by the plant construction.

CHAPTER 2 THE STUDY - AREAS AND DATA

CHOICE OF AREAS

Seven power plant sites out of a possible 19 were chosen for the analysis. The plants were selected to represent a broad spectrum of various plants and site types in Wisconsin. In addition recently constructed plants were selected rather than older ones under the assumption that they would better represent the types of facilities to be built in the future. (Eleven of the 19 were begun before the 1954 or were smaller than 100 MW).

Because of the diffuse nature of some of the impacts and concentrated nature of others, the power plant study areas have been classified into two major sub-site divisions: (1) the primary area-the minor subdivision in which the plant is located, and (2) the secondary area- the towns, villages, and sites immediately surrounding the primary area, including any sizeable population centers within easy commuting distance. Characteristics of the seven plants and their locations are summarized in Table 2.1. More detailed descriptions and maps of the primary secondary site areas follow.

PLANT AND SITE DESCRIPTIONS

Point Beach

The Point Beach nuclear power plant is located on the Lake Michigan Coast in the northeast corner of Manitowoc County in the Town of Two Creeks. The plant consists of two units representing an aggregate base load capacity of approximately 1,000 MW. The facility is jointly owned by Wisconsin Electric Power Company and Wisconsin-Michigan Power Company. Construction of the plant began in November, 1966. The first unit (500 MW) began producing electrical power four years later in December , 1970. Unit II followed with an on-line date of September, 1972. The plant was constructed at the original cost of $176,266,800.

Located about 75 miles north of Milwaukee on the coast of Lake Michigan, Manitowoc County is characterized by a relatively high level of manufacturing and related employment including aluminum products, heavy construction machinery, and electrical equipment. The majority of the industry is located in the largest city, Manitowoc, which also serves as an active Great Lakes port, and its twin city, Two Rivers. Much of the rest of the county, including Two Creeks (population:

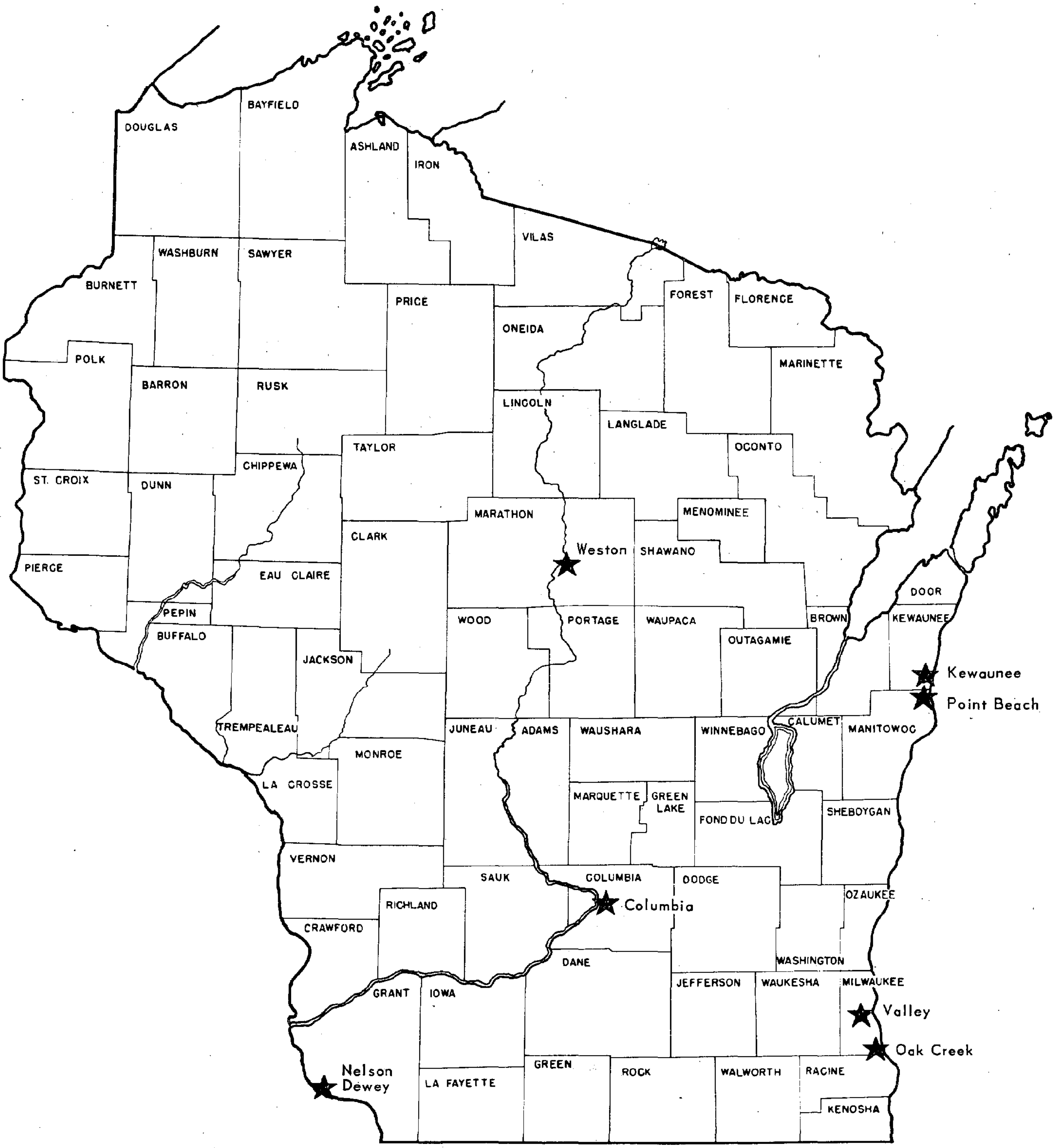
PLANT DATA

Plant Name & Operating Company (s)		Site Location	Location	Population (1970)	Plant Type	Total Plant Capacity (MW)	Per Unit Capacity (MW)	Start Construction	On Line	Data-Span
01 Point Beach	WEP WMP	On Coast	Town of Two Creeks Manitowoc County	580	Nuclear	1,000	1* 500 2* 500	1* 11/66 2*	12/70 9/72	1956- Present
02 Kewaunee	MGE WPL WPS	On Coast	Town of Carlton Kewaunee County	1,105	Nuclear	530	1* 530	1* 11/67	6/74	1957- Present
03 Nelson Dewey	WPL	Off Coast	Village of Cassville (Cluster) Grant County	1,343 (1,874)	Coal	227	1* 113 2* 113	1* 6/57 2* 8/60	12/59 12/62	1947- 1972
04 Oak Creek	WEP	On Coast	City of Oak Creek Milwaukee County	13,928	Coal	500 1170	N-1* 120 N-2* 120 N-3* 130 N-4* 130 S-5* 275 S-6* 275 S-7* 310 S-8* 310	N-1* 1/52 N-2* 2/53 N-3* 2/54 N-4* 1/56 S-5* 4/57 S-6* 6/59 S-7* 11/62 S-8* 3/65	9/53 10/54 12/55 10/57 12/59 12/61 3/65 10/67	1942- 1969
05 Weston	WPS	Off Coast	Town of Weston (Wausau) Marathon County	6,351 (59,508)	Coal	135	1* 60 2* 75	1* 6/52 2* 3/58	12/54 11/60	1942- 1970
07 Valley	WEP	On Coast	City of Milwaukee Milwaukee County	942,014	Coal	280	1* 140 2* 140	1* 9/65 2* 9/66	6/68 3/69	1955- Present
08 Columbia	WPL WPS MGE	Off Coast	Town of Pacific (Portage) Columbia County	756 (8,805)	Coal	527	1* 527	1* 3/71	4-5/75	1961- Present

*Designates Unit No.

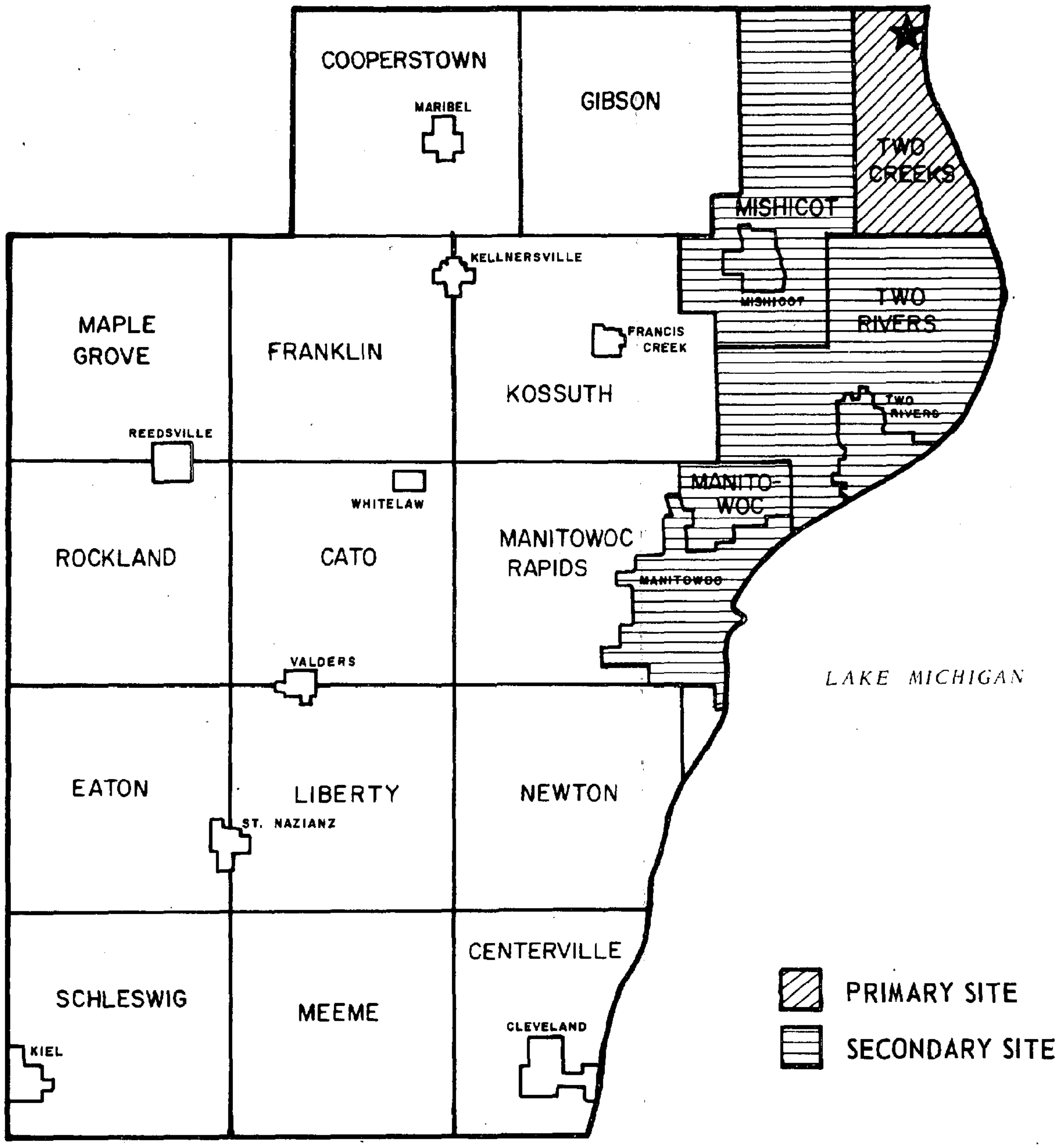
Table 2.1

Figure 3.1



POWER PLANT STUDY SITES

Figure 3.2



MANITOWOC CO.

POINT BEACH POWER PLANT

580), is rural in character with approximately 80% of the land area in farms. The major source of farm income is milk production - Manitowoc County being the state leader in the production of condensed and evaporated milk, and cheese.

The median family income is $9,879, fairly close to the state median; but population growth has been lower than statewide in recent years.

Kewaunee

The Kewaunee nuclear power plant is located on the coast in the southeastern corner of Kewaunee County in the Town of Carlton. The plant consists of one unit with a capacity of 530 MW. The facility is jointly owned by Wisconsin Public Service Corporation, Madison Gas and Electric Company, and Wisconsin Power & Light Company. Construction of the plant began in November 1967. The plant went on-line in June 1974. The original cost of construction was $202,193,453. Located about 100 miles north of Milwaukee on the coast of Lake Michigan, Kewaunee County has a relatively low level of manufacturing-related employment. The major industry in the county is woodworking and related products, followed by some industry in metals and machinery. Thirty-eight percent of the population is employed in some form of manufacturing but many of these individuals commute to outside the county. A substantial 91% of the land is in farms, with dairy products the largest single source of farm income. Nineteen percent of the population is engaged in farming. The town of Carlton (pop. 1105), where the plant is located, is essentially rural in character.

The medium family income is $9,340 compared to a state average of $10,068. Population growth has been lower than the state average in recent years.

Nelson Dewey

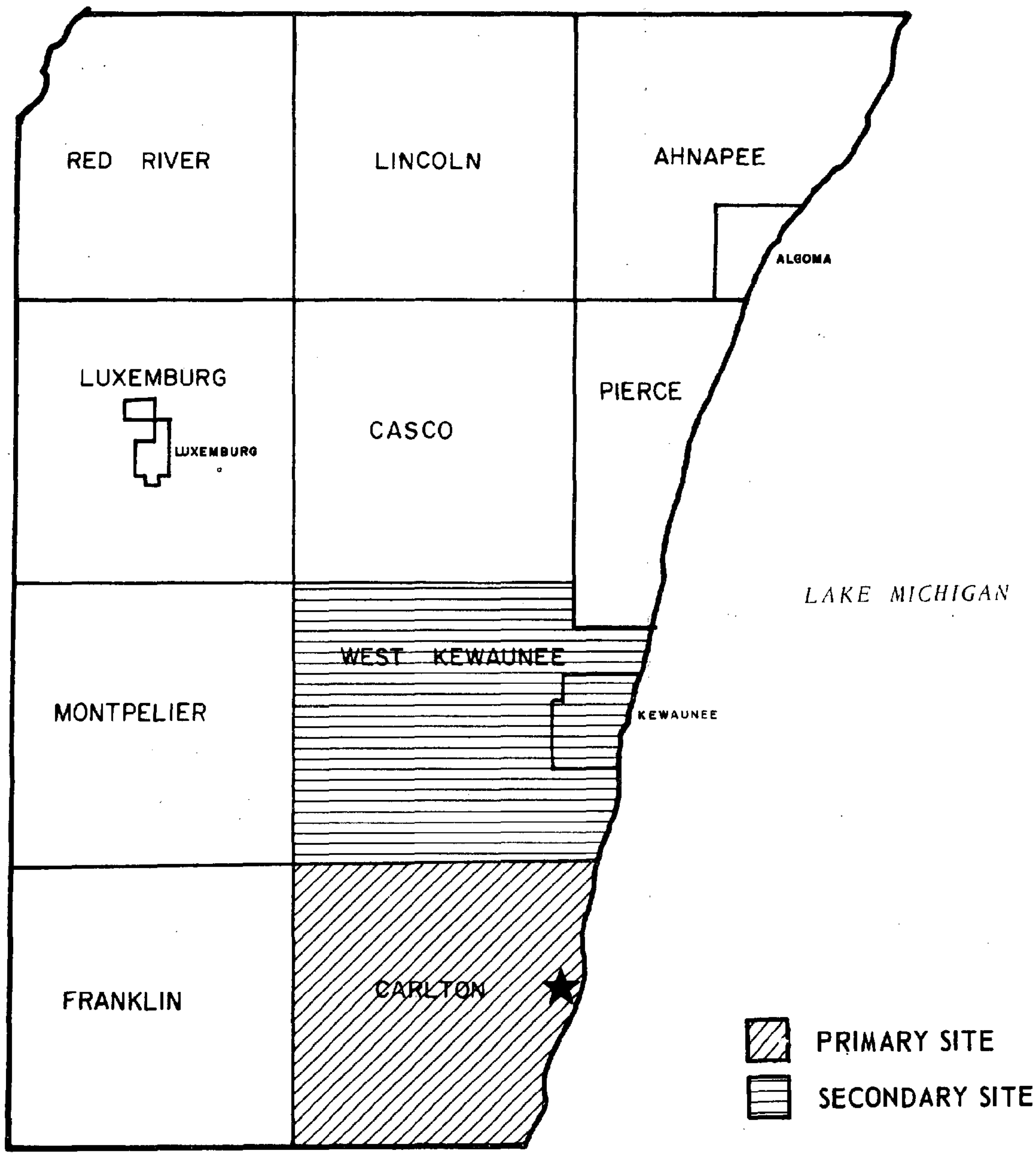
The Nelson Dewey coal-fired power plant is located in west-central Grant County along the Mississippi River in the Village of Cassville. The plant consists of two intermediate-to-base load units representing an aggregate capacity of 227.2 MW. The facility is owned by Wisconsin Power and Light Company. Plant construction began in June, 1957. The first unit went on-line in December, 1959, followed by Unit II in December 1962. The original cost of the power plant was $29,041,478. In the lower southwest corner of the state, Grant County is mainly agricultural, with corn, swine, and cattle predominating. The village of Cassville (pop. 1343) contains a barge company, and a company which produces radio equipment.

The median family income is $8,464 , considerably lower than the state average, which is not unusual for agriculturally-intensive areas. Grant County is one of few outside of southeastern Wisconsin which has experienced population growth within the last decade.

Oak Creek (North and South)

The Oak Creek (N&S) coal fired power plant is located on the Lake Michigan Coast in the City of Oak Creek (pop. 13,928), a suburb directly to the south of the City of Milwaukee, close to the Milwaukee County-Racine County line. The facility is actually made up of two plants, north and south, consisting of eight base load units and one peaking unit representing a total capacity of 1,670 MW (500 MW-North; 1170 MW-South). The plant is owned by Wisconsin Electric Power Company. Construction of the first unit of Oak Creek-North began in January, 1952; production from this unit began in September, 1953. The final unit of Oak Creek-South began construction in March, 1965; going on line in October, 1967. (Construction and on-line dates for units two through seven may be noted on Table 2.1.) The

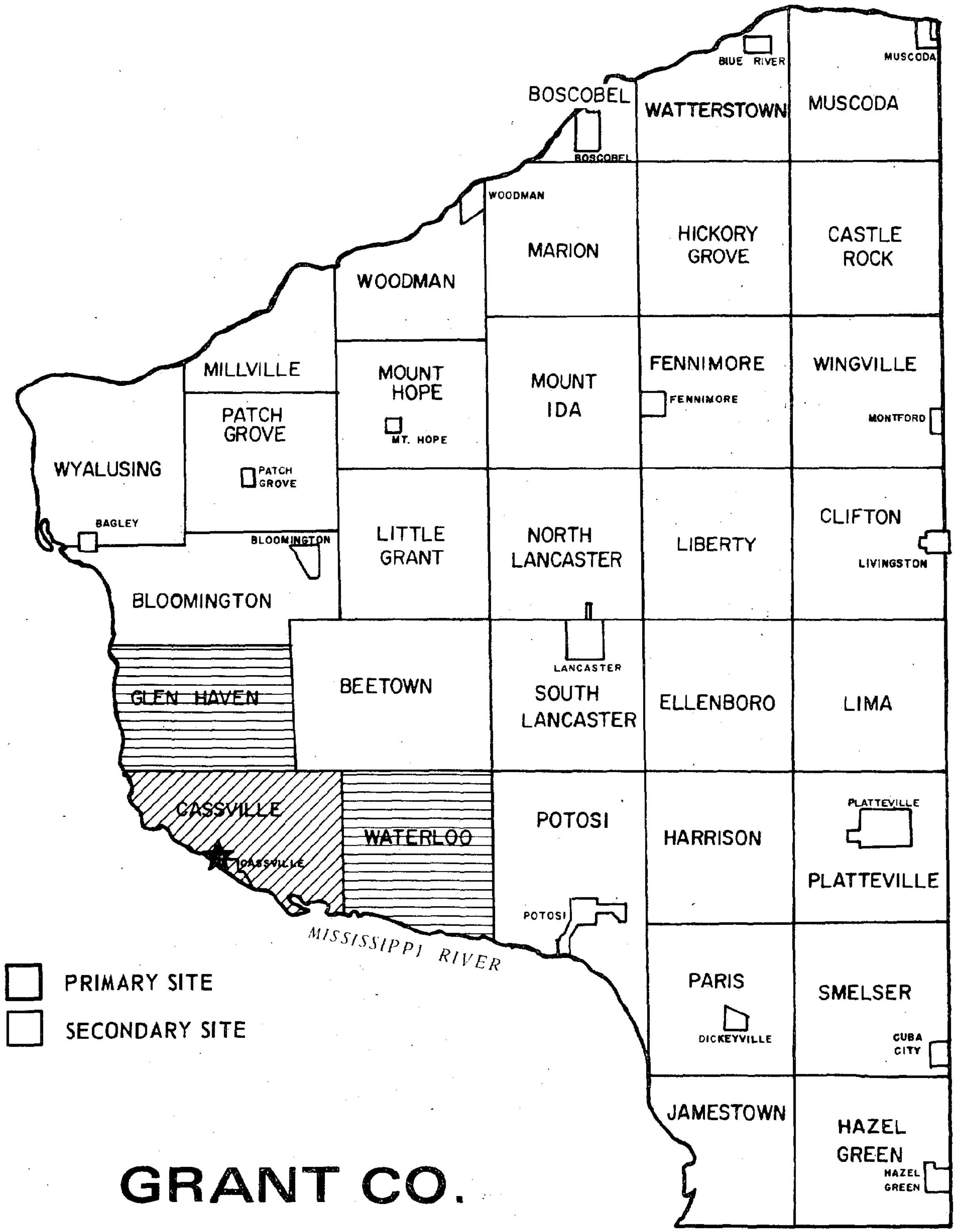
Figure 3.4



KEWAUNEE CO.

KEWAUNEE POWER PLANT

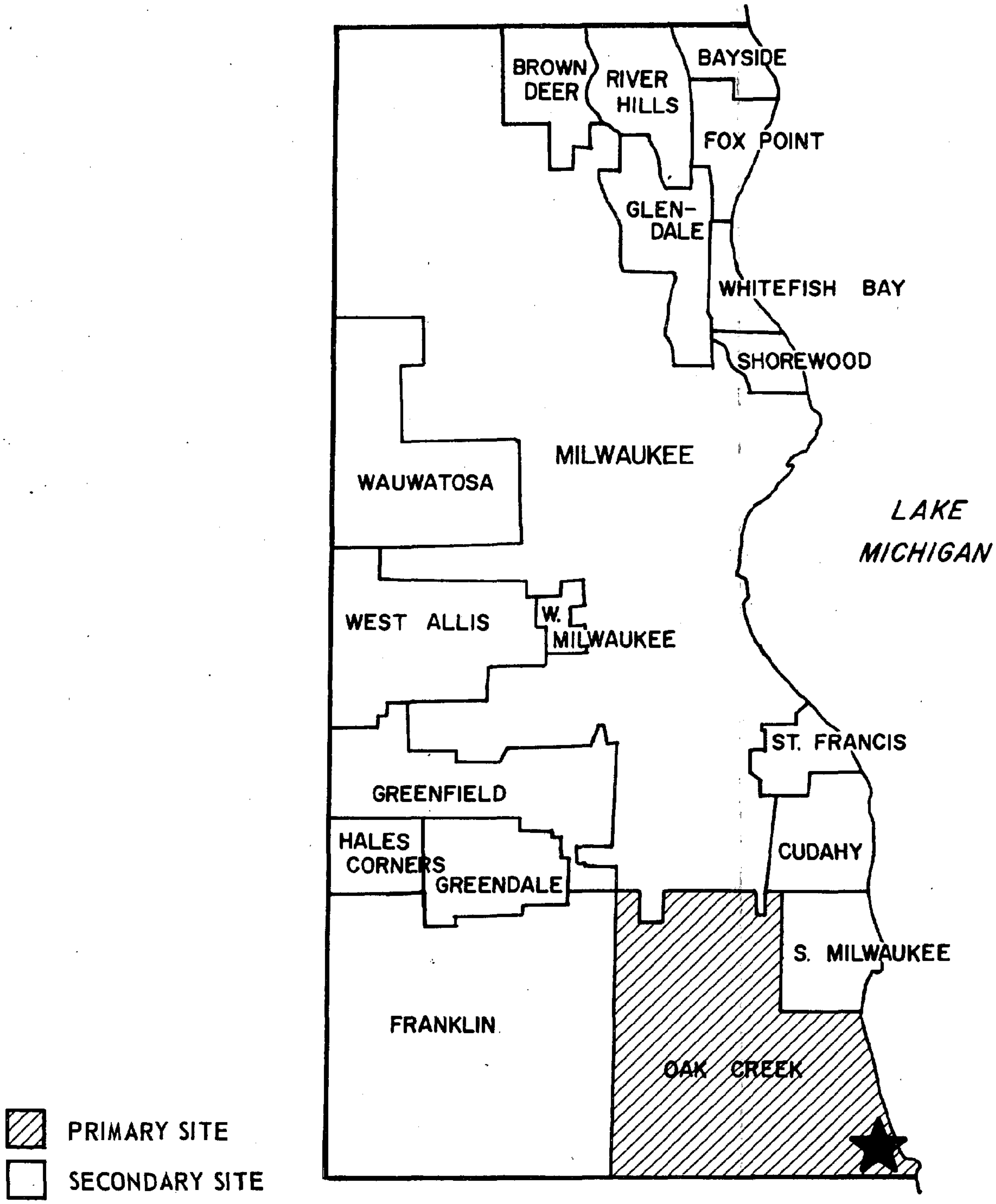
Figure 3.6



GRANT CO.

NELSON DEWEY POWER PLANT

Figure 3.8



OAK CREEK POWER PLANT
(North and South)

plant was constructed at a cost pf $215,353,259. Milwaukee, the twelfth largest city (population) in the United States has experienced the urban sprawl characteristic of large metropolitan areas in recent decades. As a result, the county is almost completely urban in nature; only 11.5% of the land is classified as agricultural-most of which is in truck-farms, greenhouses, etc. Milwaukee is one of the largest of Lake Michigan ports, and is characterized by a higher than average level of manufacturing and related employment-about 35% of all manufacturing jobs in the state. Major industries are beer-making and production of heavy machinery, including woodworking and forest-industry machinery, roadbuilding equipment, farm machinery, stripmining equipment, and heavy electrical machinery. Many of the persons employed in Milwaukee commute daily from surrounding counties. In the 1940's, the City of Oak Creek was almost entirely rural. Since then, the urban sprawl has made it very much a part of urban metropolitan Milwaukee.

Weston

The Weston coal-fired power plant is located close to the Wisconsin River in central Marathon County, in the Town of Weston (pop. 6351).

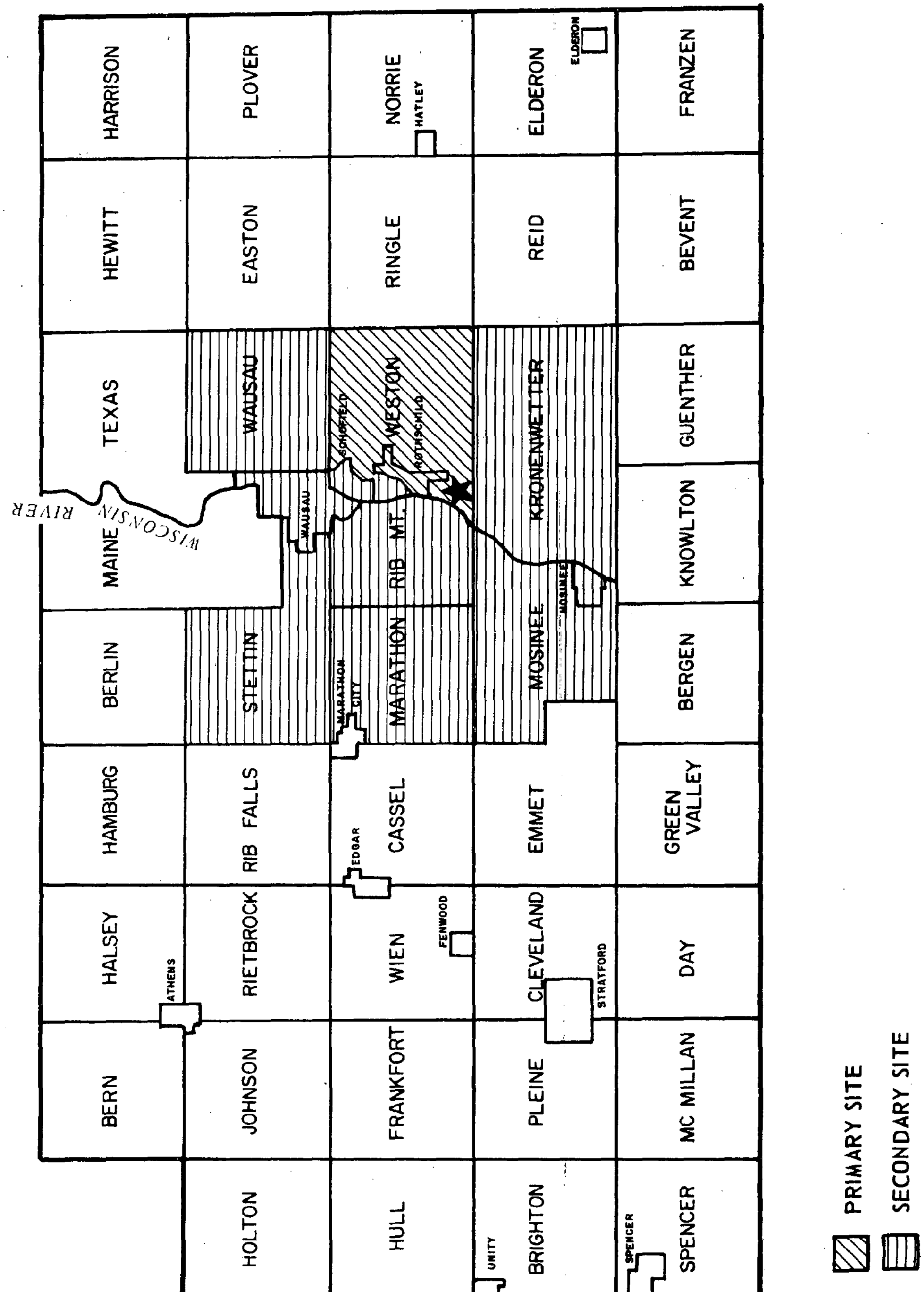
The plant consists of two units representing an aggregate capacity of about 135 MW. The facility is owned by Wisconsin Public Service Corporation. Construction of the first unit began in June, 1952, and was completed in December, 1954. Construction began on the second unit in March, 1958. The unit began operation in November 1960. The original cost of the plant was $25,163,747. Located in the center of the state, Marathon County is one of the more industrialized counties outside of southeastern Wisconsin. Paper products-related industries are strong, followed by electrical equipment, woodworking, and machinery manufacturing. Mineral resources are also notable. Dairying is the major source of farm income. About one-half of the population is rural; the majority of the urban sector reside in the Wausau City cluster. The Town of Weston is located on the southern fringes of the Wausau cluster.

Income levels are slightly below state averages, but high for the northern and western parts of the state. Population growth has been close to the state average.

Valley

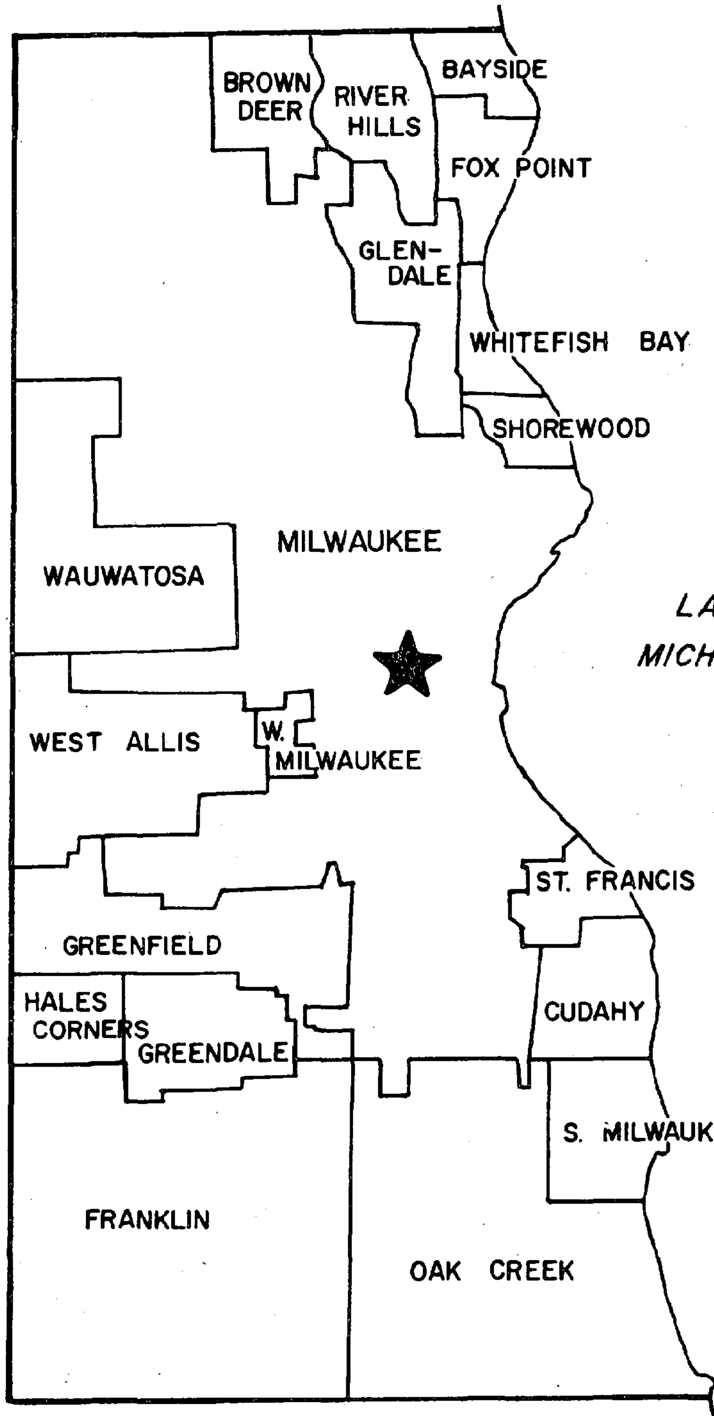
The Valley power plant is located in the east-central part of Milwaukee County. The plant consists of two base load units representing a aggregate capacity of 280 MW. The facility is owned by Wisconsin Electric Power Company. Construction on unit I began in September, 1965; the unit went on-line in June, 1968. The second unit was constructed in September 1966 and went on-line in March, 1969. The original cost of the plant was $41,310,147. Milwaukee (pop. 942,014), the 12th largest city in the United States, has experienced the urban sprawl characteristic of large metropolitan areas in recent decades. As a result, the

Figure 3.9



MARATHON CO.
WESTON POWER PLANT

Figure 3.13



VALLEY POWER PLANT

county is almost completely urban in nature; only 11.5% of the land is classified as agricultural-most of which is in truck farms, greenhouses etc. Milwaukee is one of the largest of Lake Michigan ports, and is characterized by a higher than average level of manufacturing and related employment- about 35% of all manufacturing jobs in the state. Major industries are beer-making and production of heavy machinery, including woodworking and forest-industry machinery, roadbuilding equipment, farm machinery and heavy electrical machinery. Many of the persons employed in Milwaukee commute daily from surrounding counties.

Columbia

The Columbia coal-fired power plant is located in central Columbia County south of Portage City Cluster in the town of Pacific (pop. 756). The plant consists of one unit with a capacity of 527.000 MW. The facility is jointly owned by Wisconsin Power and Light Company, Wisconsin Public Service Corporation, and Madison Gas and Electric Company. The plant is the newest in Wisconsin; construction began in March 1971 and the plant just recently went on-line in May 1975. The original cost of the plant is as yet undetermined. Construction of a second unit is underway. Located in the south-central part of Wisconsin, Colubmia County contains some of the richest farmland in the state and the nation. Vegetable production, dairying and livestock- cattle and swine-are the major sources of farm income. Manufacturing is very diverse, including foods, metalworking, textiles, apparel, shoes and wood products. Surrounding counties also are a good source of employment particulary the state capitol directly south in Dane County. The tourist industry is also a significant source of income.

The median family income is $9,668, versus $10,068 for the state. Population has grown somewhat in recent years.

DATA

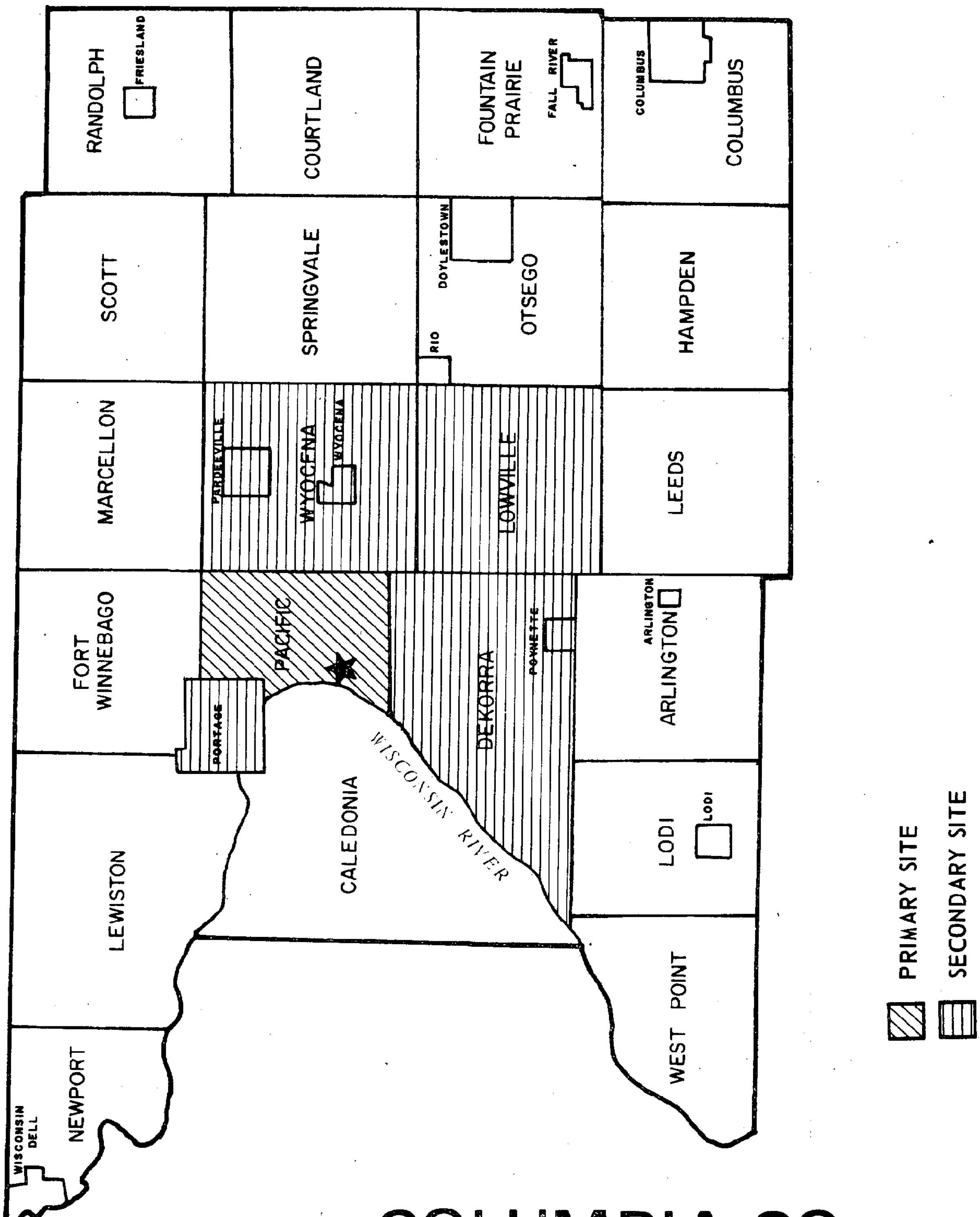
Aggregate data for annual receipts and expenditures, school enrollments, and real property values for residential, commercial, industrial and agricultural property were collected for each of the above primary and, where relevant, secondary sites for the period ten years prior to construction, the period during construction, and, where possible, the period ten years post-construction. These data were computerized, verified and plotted. The plotted results allowed for preliminary evaluation of the adequacy of the data, and data inconsistencies were corrected. A brief description of the data, along with possible problems or discrepancies follows.

Municipal Budgets

The source of data for municipal budgets until 1972 was <u>State Bureau of Municipal Audit: Report of the Clerks</u>, Wisconsin Department of Administration. From 1972 to the present, the data source was <u>Financial Report Form</u>, Wisconsin Department of Revenue. Municipal Budgets were collected for the primary area only, based on the assumption that this area received the most significant fiscal impacts during construction and operation of the power plant. Data was collected for total receipts, for the shared utility tax payments collected and for the general property tax.

It should be noted that where the utility tax payments are significant, the total revenue resources of the municipality are likely to be offset by subsequent decreases in other revenue sources such as school aids, etc., which are subject to need criteria. See Appendix I for description of the tax distribution formula.

Figure 3.14



COLUMBIA CO.

COLUMBIA POWER PLANT

Data on municipal expenditures were collected for police, fire and road expenditures. It was felt that these would reflect any other expenditures which the study area might incur because of the power plant.

School Enrollment

School enrollment data for the period prior to 1963 was provided by the Annual Report, Wisconsin Department of Administration. From 1963 to the present, the source was the Department of Public Instruction. School enrollment data was collected for the primary and secondary areas by local school districts rather than by minor civil divisions.[1] It was expected that new families would be widely dispersed and thus a broad study area was required to measure impacts.

Historical data did not exist for the individual school or grade levels, but only for school districts, aggregated by kindergarten through 8th grade and 9th through 12th grade. Thus, it was impossible to measure fluctuations in enrollment between schools within a single school district. It was also impossible to account for movements into and out of the school districts between tallies. It was therefore not possible to conduct the analysis at a level which might better enable the detection of the more subtle impacts likely to occur during power plant construction.

Property Values

The property value data for each of the residential, commercial, industrial and agricultural lands was taken from the Statistical Report of Property Values-by County, Wisconsin Department of Revenue (formerly Department of Taxation). Aggregate data was collected for both primary and secondary areas to measure both local and possible overflow effects. Property value data reflects the full market valuation of property as determined by the Department of Revenue. These values are based on (1) evidence of changes in dollar value by class of property on the basis of sales statistics; (2) changes in dollar value by property class based on mass appraisals by the Department of Revenue; (3) changes in dollar value due to new construction, loss by fire, changes in land use, annexation, etc.; and (4) the previous year's valuation.

There is some degree of error inherent in such a procedure. Statistical trends while useful as an indicator are not accurate determinants of the value of specific properties. In addition, the judgements inherent in the actual process of direct property assessment are subject to the personal biases and interpretations of the individuals conducting the assessment.

CHAPTER 3 OBSERVED IMPACTS

SUMMARY METHODOLOGY

The analysis was carried out in 2 stages:

1) First, the actual impacts of the seven power plants on each of the impact variables were quantified for both construction and post-construction period. This was accomplished by comparing the actual data to projections showing what might have happened had no plants been built. The difference between the projected data and the actual data was assumed to measure the impact of the plant construction and operation on the selected impact variables.

2) Impacts at the various sites were then compared to determine if they

1/ School enrollment data for 1964 has been extrapolated from previous years by the Department of Public Instruction due to the destruction by fire of the actual data.

varied in any systematic way, depending on the type of plant, size of plant, and location and characteristics of plant site, and predictive equations were developed.

Quantification of Impacts

Procedure

For each impact variable, data on the 10 year period prior to construction were trended using a least squares curve fit. Historical trends were then extrapolated through the construction and post-construction periods. Special techniques for each variable were developed to adjust for errors and to account for any anomalies in the data.

Once it was established that the trend lines accurately reflected reality, actual quantification of plant impacts was made by comparing the observed levels of the impact variables to those projected. The difference between the projection of preconstruction trends and the observed values during the construction and post-construction periods are the actual impacts. (See Figure 3.1.)

An average value was used for the construction and post-construction periods. This was necessary because different plants have had different construction times and with more recent plants post-construction data was not available for 10 years.

In addition, values of site characteristics varied by a factor of 10 or more. Thus, small errors in projected absolute values of large plants tended to distort the impacts of the smaller plants. To eliminate this shortcoming, percentages of change were used. The base for calculating the percentage change was an observed value, 2 years (in some cases 3 years) before the start of plant construction.

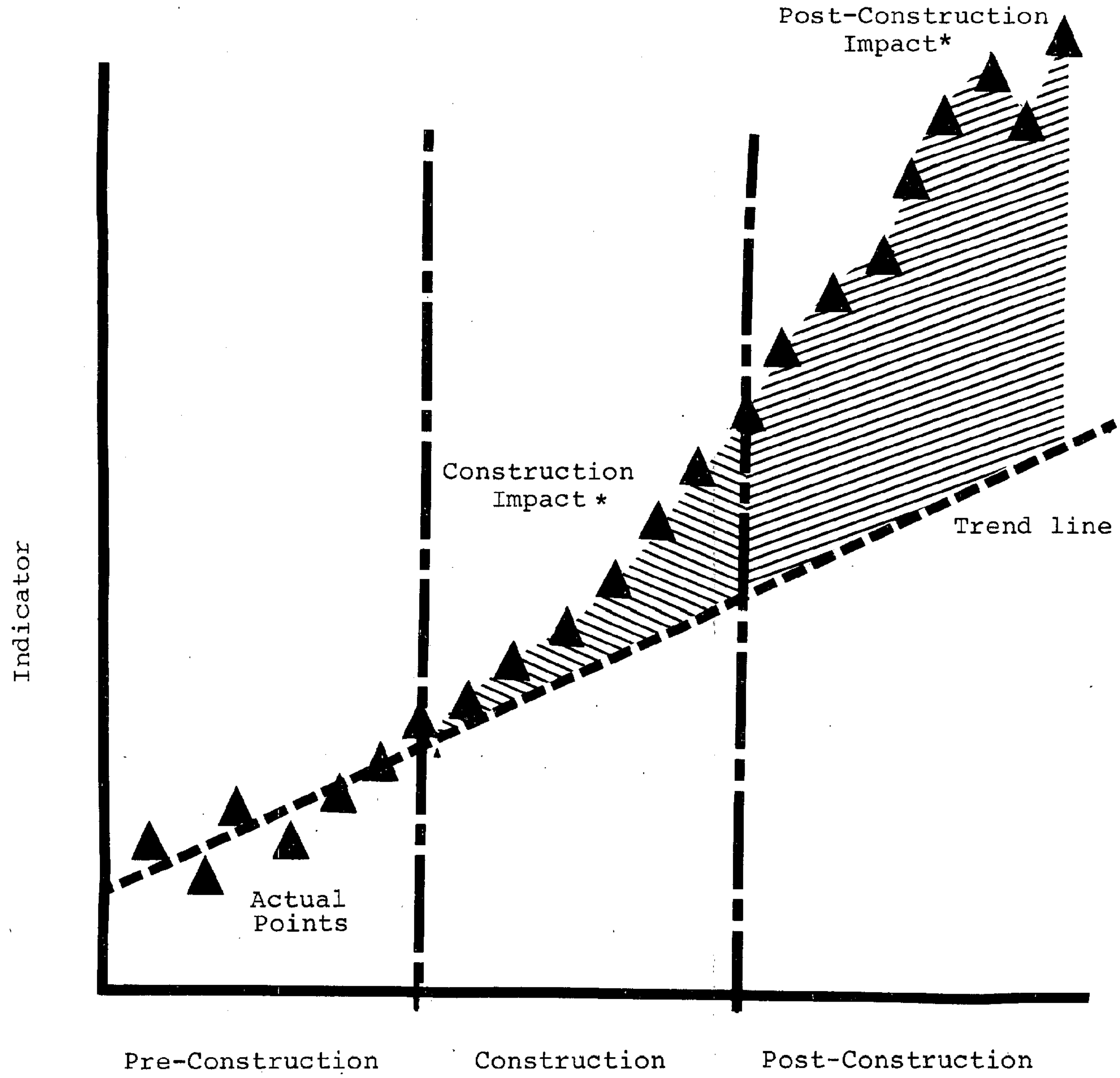
Finally aggregated values were used as the base, (total school enrollment, total land values in the primary area, etc.). This eliminated large percentage changes resulting from small initial base values. (Some areas have little commercial or manufacturing property and a small absolute change in assessed value results in a large distorted percentage change.)

Problems

The most significant problems encountered in trying to quantify the local economic impacts of power plants relate to isolating the post-plant impacts from what would have happened had no plant been built. Because of the lengthy time frame over which impacts can take place, any number of factors can cause changes within local municipal units of government, the secondary area, and the county. For example, a certain level of normal growth (which may be negative in northern Wisconsin) is expected over the 25-30 year period observed. This growth is further complicated by normal economic cycles and abnormal occurrences such as severe economic recession, major wars, etc.

Changes in state policy and/or attitudes may occur which can significantly alter normal economic activity in the area. Changes in taxing policies, for example, may change the amount of revenue returned to a particular area; zoning or land use plans may alter the expansion of the area under study; other policy changes such as the consolidation of schools could significantly affect school enrollment in smaller study areas; and new industries or the construction of new transportation facilities which are continually ongoing

Quantification of Observed Impacts



*Annual average of aggregate impact calculated.

Figure 3.1

within the study areas could all work to alter the historical growth patterns of the study area. Adjustments for these problems were made.

ADJUSTMENT FOR ERRORS

SCHOOL ENROLLMENT

To eliminate the effects of changing birth rates on school enrollments over the long time spans studied, the ratio of school enrollment in the study area to the state school enrollment was trended. This ratio was then extrapolated for the construction and post-construction periods. Using the state average school enrollment data the extrapolated ratio was then converted to actual numbers of students.

Property Values

To eliminate the effects of other variables on land use changes, the ratios of primary and secondary area land values to county values were calculated and extrapolated for the construction and post-construction periods. These ratios were then converted to actual dollar values by multiplying by the county values.

Municipal Budgets

Projections for municipal budgets were based entirely on extrapolations from the past trends.

Even with these adjustments, a certain amount of error in projections is inevitable. Wherever possible, it has been indicated what factors, other than power plant construction, may have influenced observed impacts.

ADDITIONAL PROBLEMS

Even after post-plant impacts have been isolated, there is a difficulty in assigning any causal relationships to plant construction and impacts. The extent to which a power plant will affect a local community depends to a large degree on local policy decisions. A municipality might or might not choose, for example, to zone strictly in order to control future development. Similarly, it may choose to invest all its added utility tax revenues or it may choose to use them to reduce property taxes or to fund the expansion of municipal services. If it does the latter, the increases in municipal expenditures might reflect increased consumption rather than any added costs associated with plant construction. In other words, a municipality may choose to spend more on services merely because it has more to spend; not because the power plant necessitated increased spending.

Given the choices open to a municipality, it is thus very difficult to discern to what extent perceived plant impacts are in direct response to the plant and related growth, and to what extend they reflect local policy. The most that can be said of the impacts then, is that they occurred in conjunction with plant sitings.

RESULTS

With these constraints in mind, here are the observed impacts of power plant siting.

MUNICIPAL BUDGETS

Receipts

With the exception of the City of Milwaukee (Valley) all plant sites received substantially larger municipal receipts then would be expected had no plant been built. Impacts were greatest during the post-construction period. (See Tables 3.1 and 3.2). As can be seen by looking at Figures 3.2-3.8 these increases in municipal receipts can be attributed almost entirely to the increases in utility tax payments. In fact, the utility taxes were far greater than the entire municipal budgets prior to power plant construction for all plant sites except Milwaukee.

The contribution of the utility tax to total receipts was so great that in several cases it permitted general property tax levies to be considerably less than expected had no plant been built. In the cases of Weston, Point Beach and Kewaunee, in fact, property taxes were eliminated altogether, for periods during their post-construction phases.

The City of Milwaukee is a unique case. Contrary to other study areas, the increased utility tax payment in Milwaukee represented only a small percent of the total annual receipts. Accordingly, the impact of the Valley plant on Milwaukee receipts was negligible.

Expenditures

All plant sites experienced considerably higher expenditures especially for roads both during the construction and post-construction periods than would be expected had no plant been built. Impacts were again greatest in the post-construction periods. The increased expenditures were more than offset by the increase in total receipts, however, and did not require increases in property tax receipts to fund them. The data during the construction period for the Point Beach and Columbia sites might seem to contradict this conclusion. It indicates that property tax receipts did go up after plant construction. However, in the case of Columbia these monies were not used to fund the municipal budget but rather were paid to the county to fund the county bridge (Darrell Franke, Department of Revenue). Similiarily it is believed that the Town of Pacific (Columbia) also distributed the utility payment against levies of other administrative jurisdictions rather than directly against the local budget since local expenditures did not rise sufficiently to consume the greatly increased receipts (total receipts: 731% increase verses total expenditures: 30.5% increase). Thus it seems that the power plant's contributions to municipal receipts in the form of a utility tax more than covers any expenditures resulting from the plants for all cases except the Valley plant both during and after construction.

It should be pointed out again that increases in expenditures do not necessarily indicate that power plants and related developments required additional services. Services may have been expanded simply because the community had more money at its disposal and decided to spend this money to upgrade local services. It is impossible, however, to tell what proportion of the spending was necessitated by plant construction and what proportion went towards upgrading existing services.

Summary

From the above data, it is concluded that except for plants in large metropolitan areas, power plants contribute to largely increased total municipal receipts both during the construction and post-construction periods.

Power plant construction and operation are also associated with increased municipal expenditures for police, fire and roads, but there is no way of knowing whether these expenditures were necessitated by the plant construction and operation. Power plant impacts on both municipal receipts and expenditures were greatest during the post-construction period.

Generally, the amount spent on municipal services was less than the amount

Figure 3.2
Annual Budget-Receipts-Primary
Point Beach

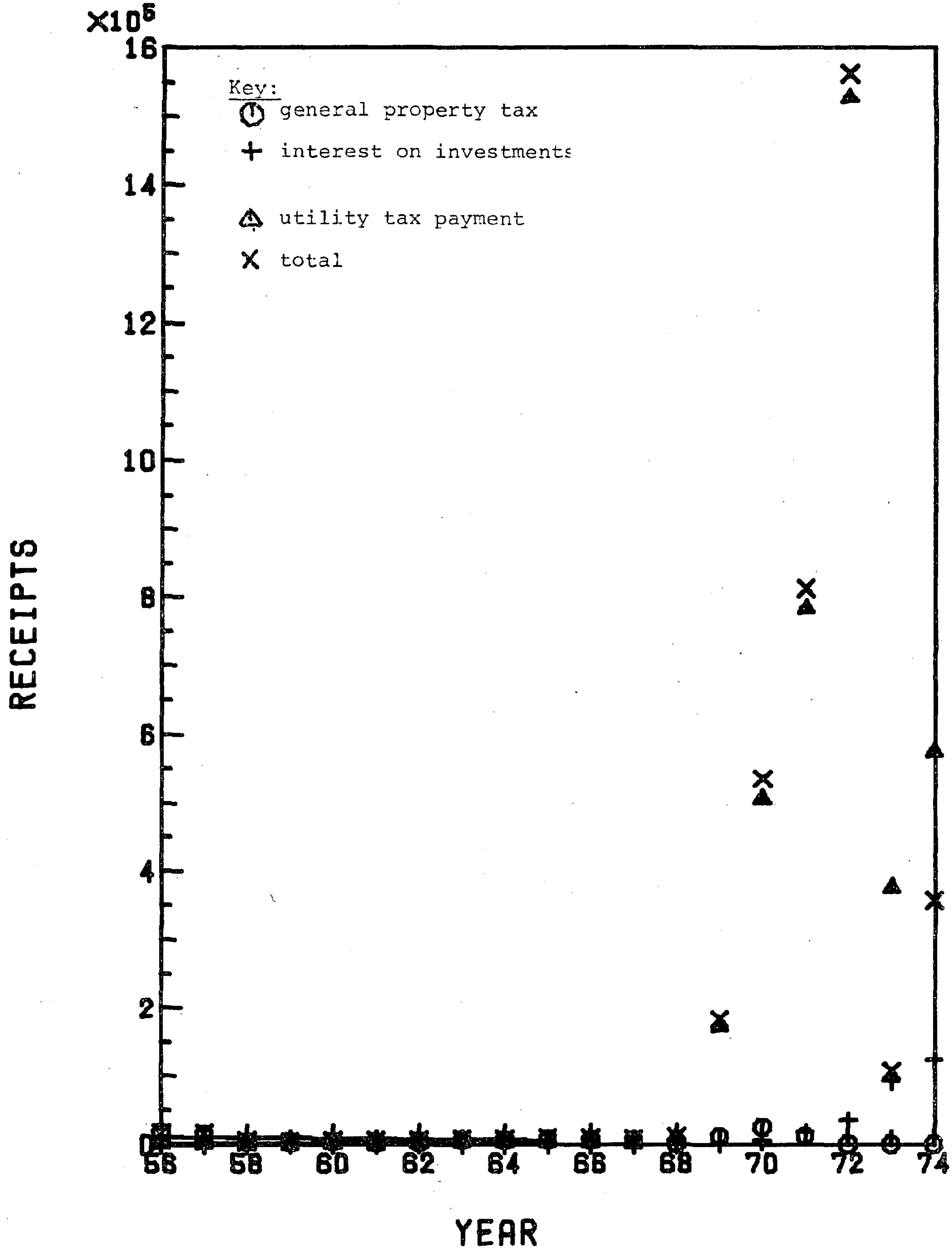


Figure 3.3
Annual Budget-Receipts-Primary
Kewaunee

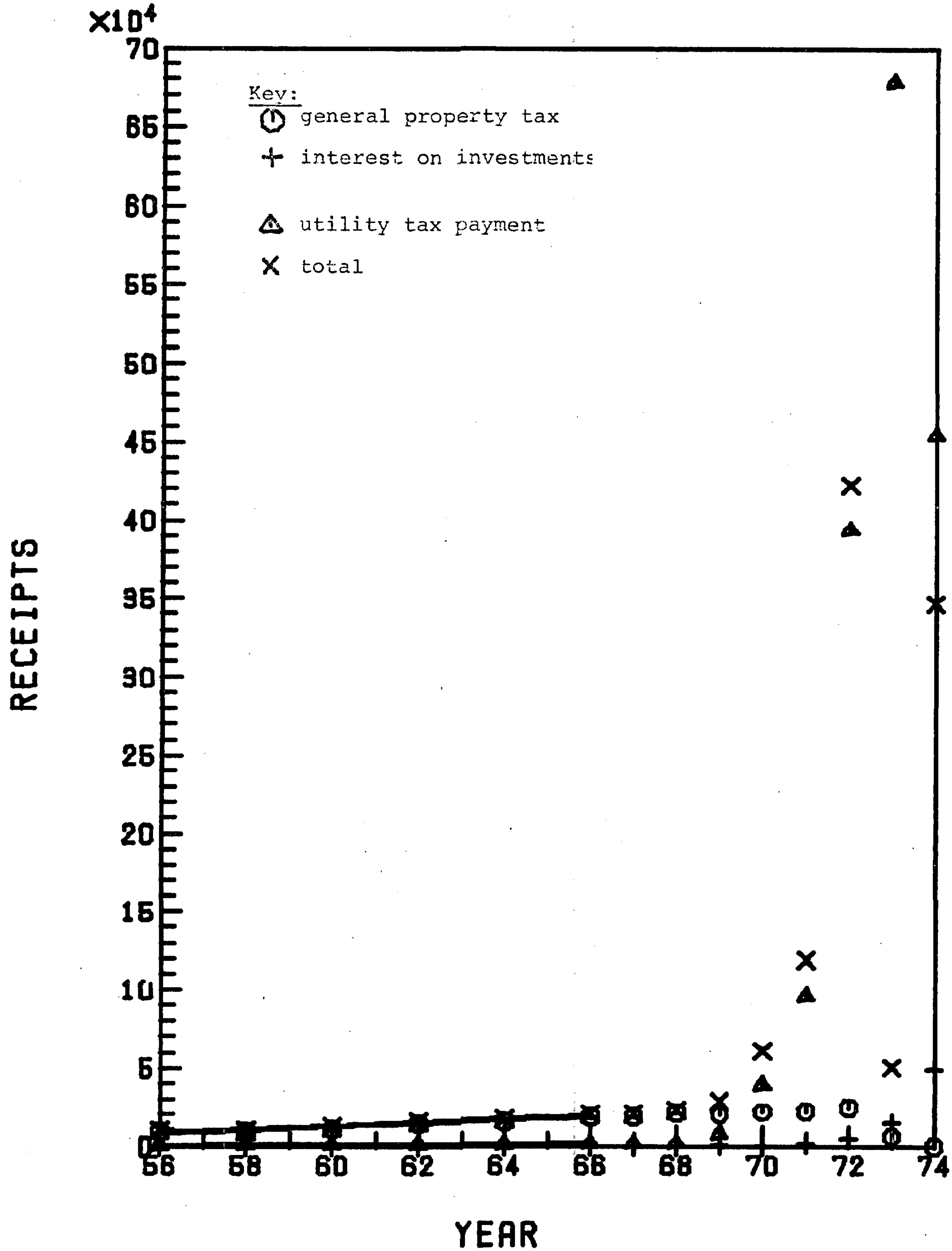


Figure 3.4
Annual Budget-Receipts Primary
Nelson Dewey

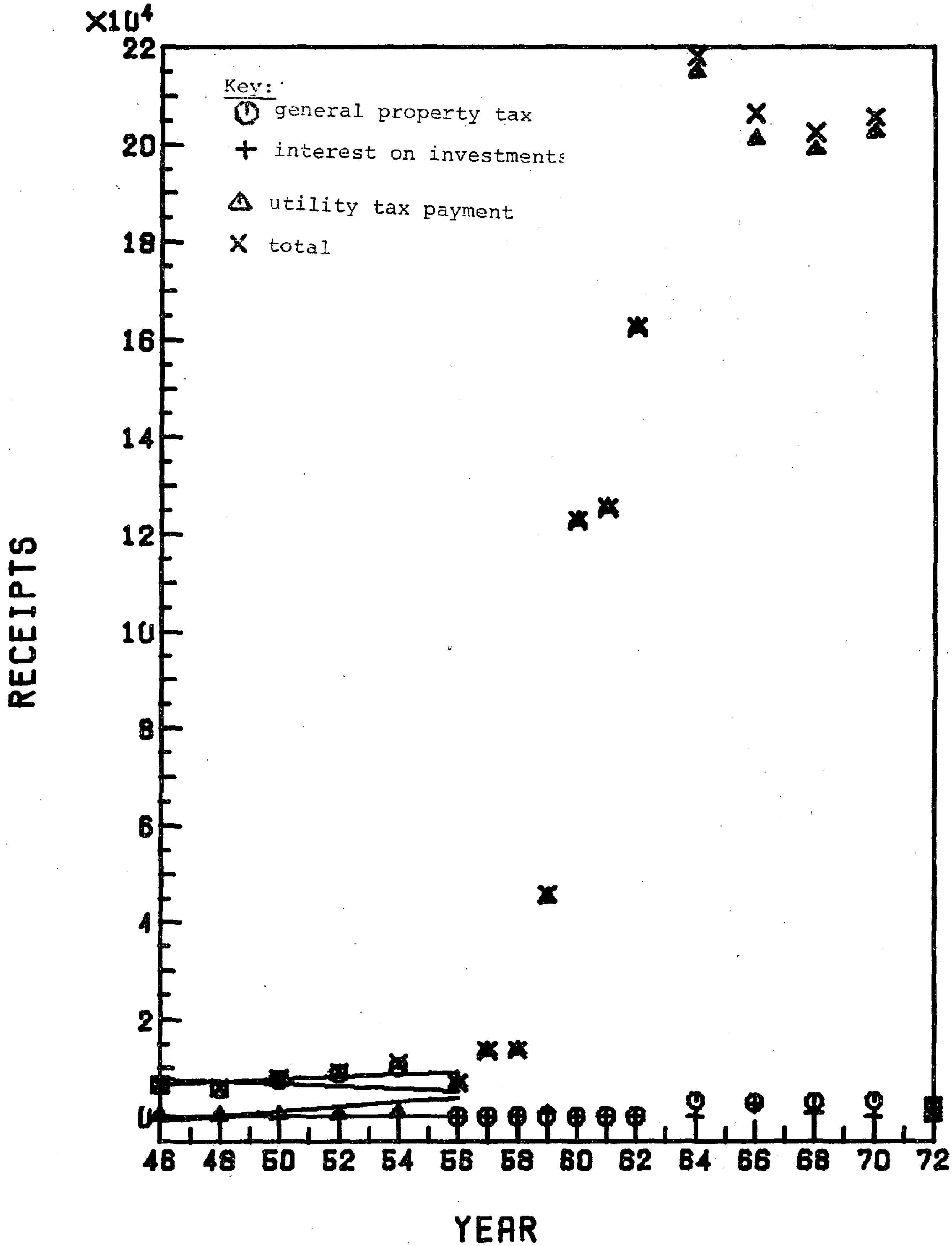


Figure 3.5
Annual Budget-Receipts-Primary
Oak Creek

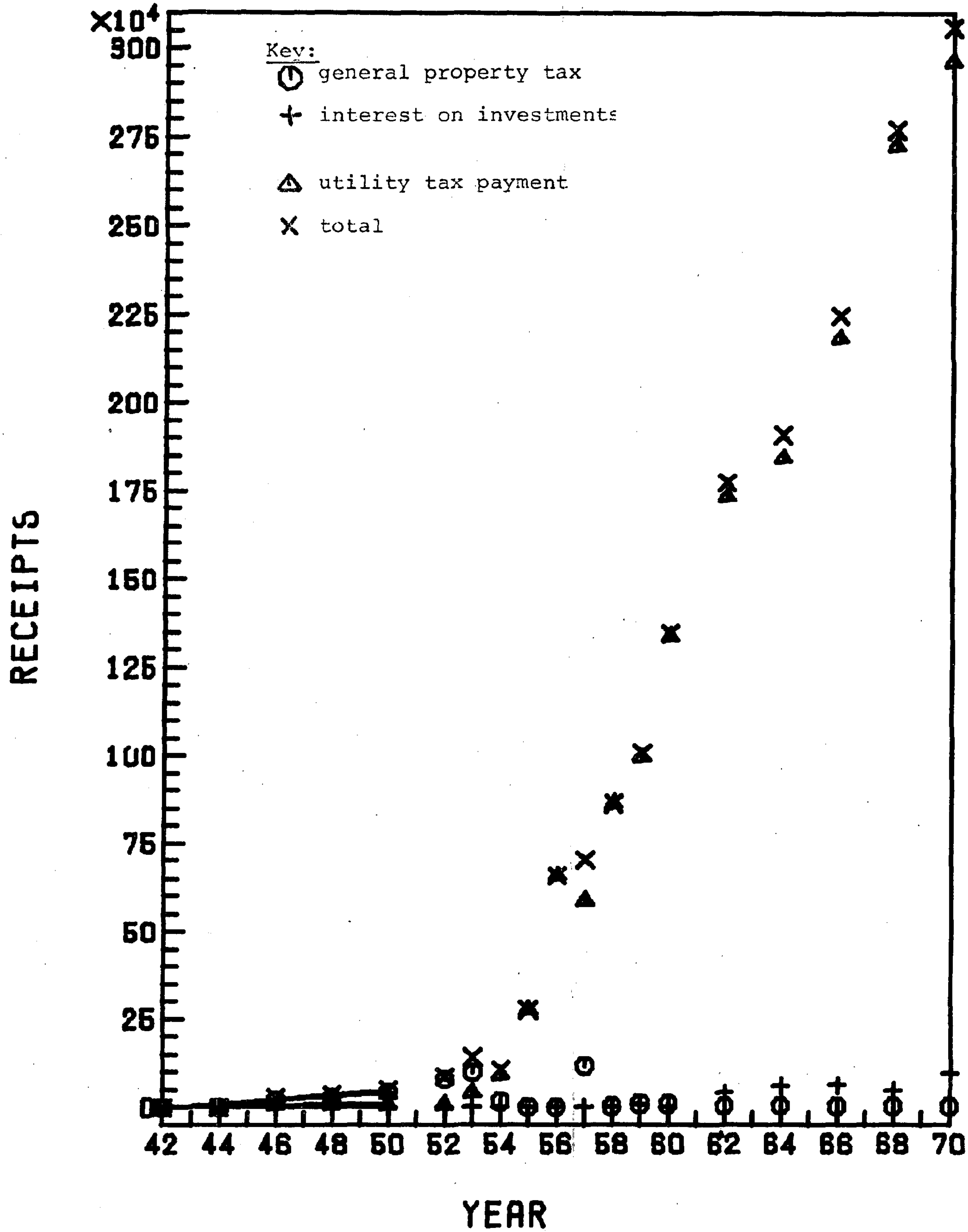


Figure 3.6
Annual Budget-Receipts- Primary
Weston

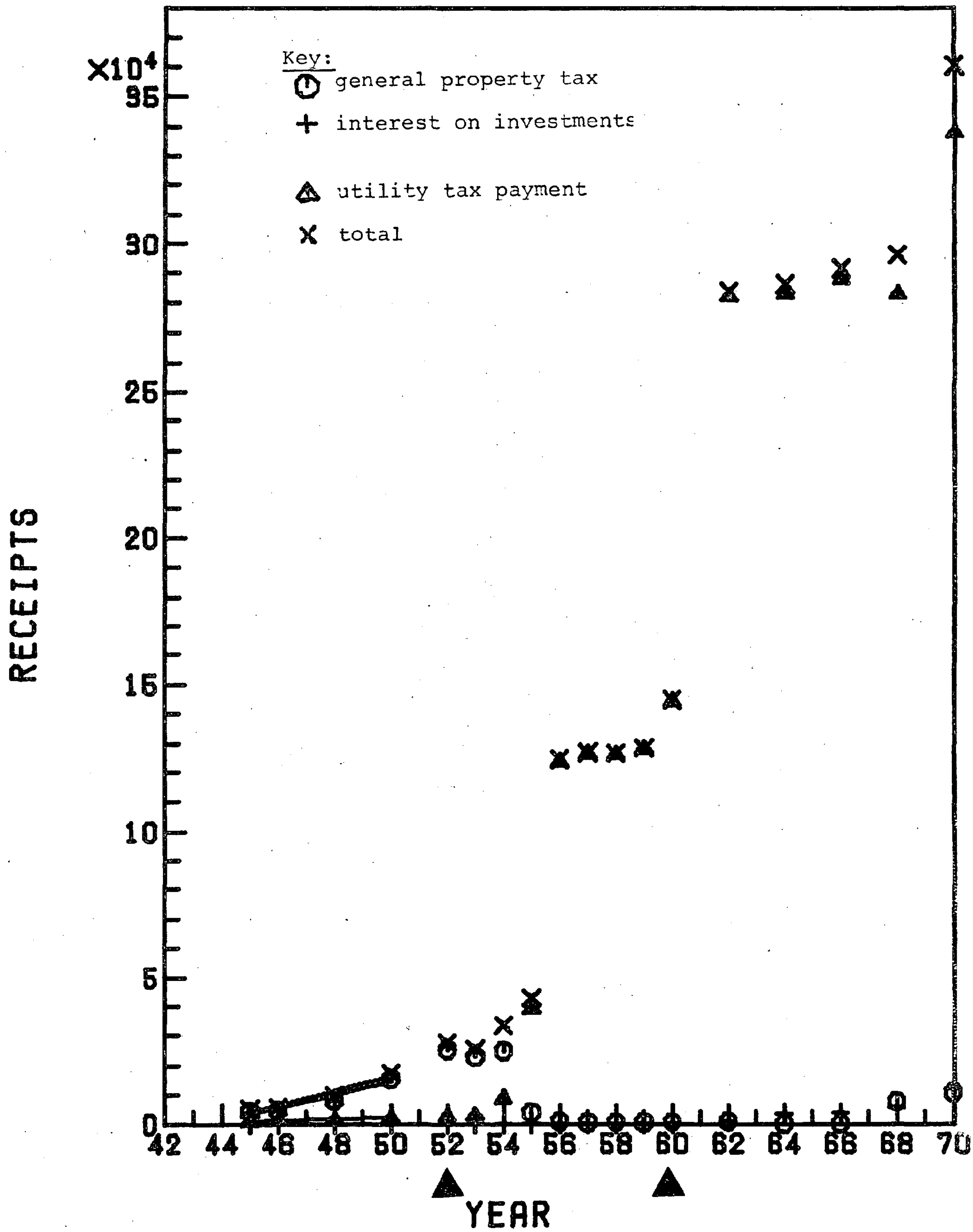


Figure 3.7
Annual Budget-Receipts-Primary
Valley

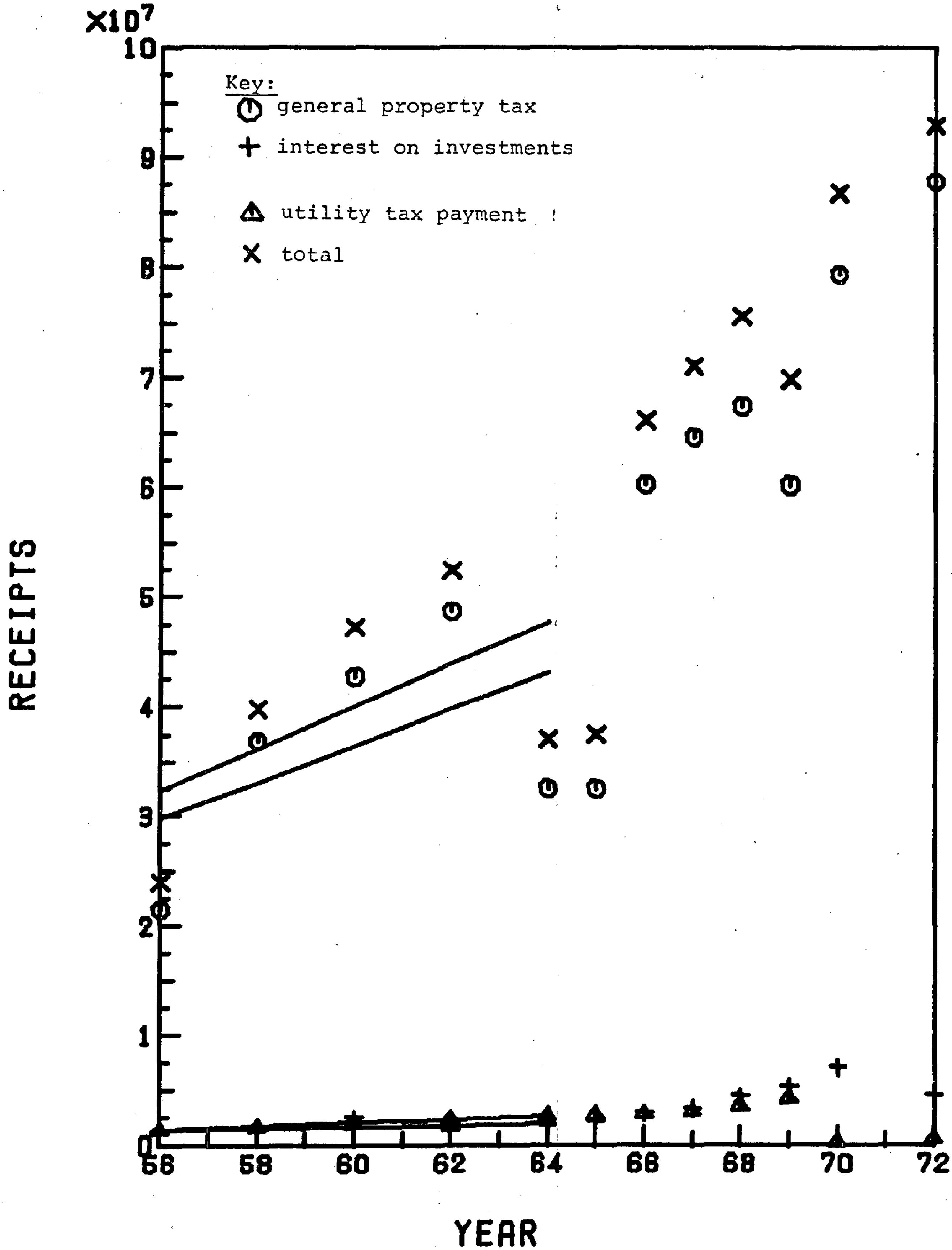


Figure 3.8
Annual Budget-Receipts-Primary
Columbia

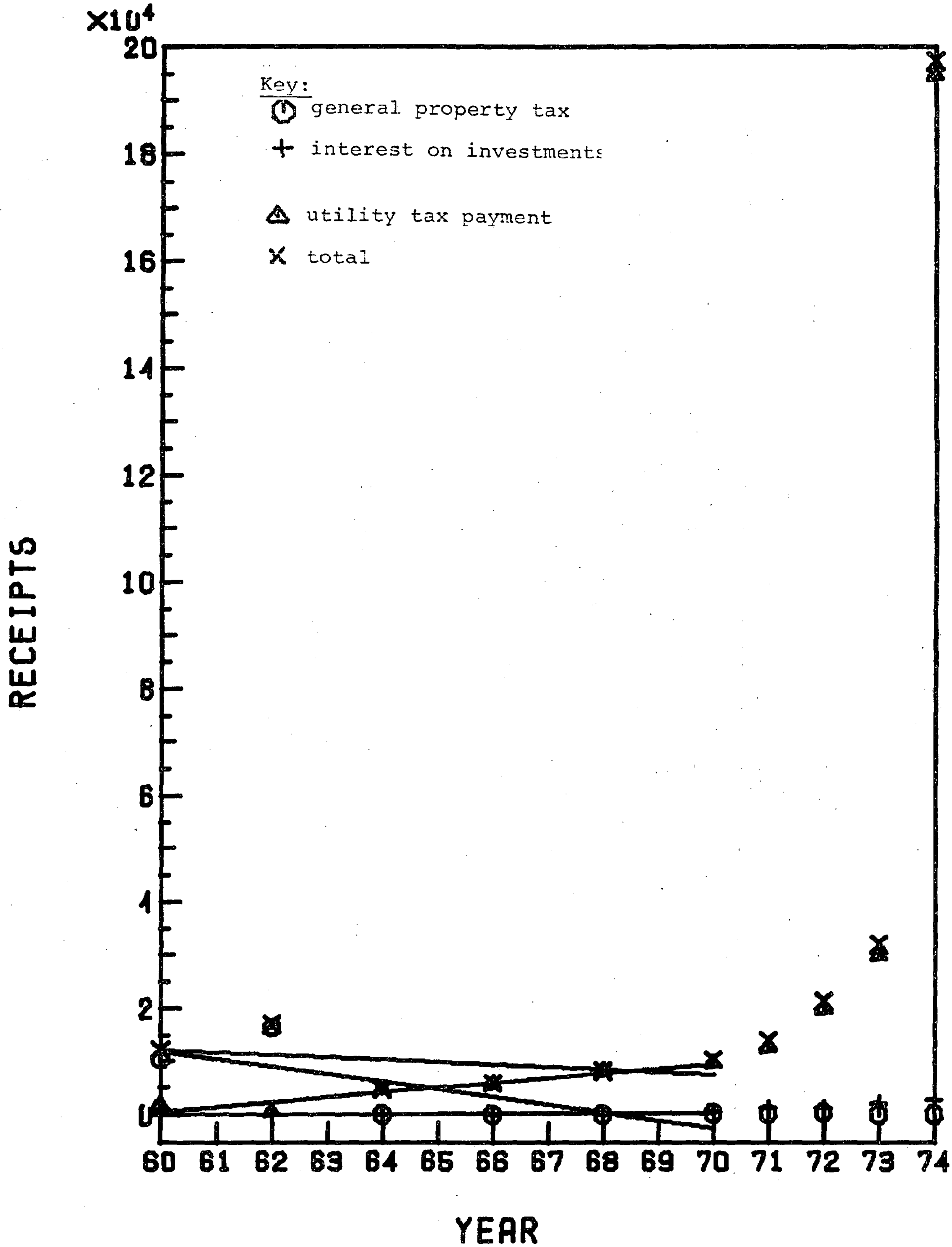


Table 3.1

MUNICIPAL BUDGET IMPACTS CONSTRUCTION

(Expressed as Percent Average Deviation from "no plant" Projections)

Plant	Receipts			Expenditures			
	General Property Tax	Utility Tax	Total Receipts	Police	Fire	Roads	Total
Point Beach	129.4	5305.9	5522.5		45.4	558.7	518.3
Kewaunee	-15.2	1218.9	644.9	0.1	6.9	325.8	332.9
Nelson Dewey	0.0	675.0	636.5	30.3	42.4	304.8	377.5
Oak Creek	-197.6	1765.6	1594.7	177.7	122.6	484.3	784.6
Weston	-148.0	423.3	275.3	3.5	5.0	286.5	294.9
Valley	16.0	0.2	19.8	3.3	0.1	14.5	17.9
Columbia	68.9	638.1	731.0	0.0	-8.3	38.7	30.5

Table 3.2

MUNICIPAL BUDGET IMPACTS- POST CONSTRUCTION

(Expressed as Percent Average Deviation from "no plant" Projections)

	Receipts			Expenditures			
Plant	General Property Tax	Utility Tax	Total Receipts	Police	Fire	Roads	Total
Point Beach	0.0	10245.1	8426.9		152.8	580.7	733.6
Kewaunee	0.0	2661.9	1874.9	0.8	23.6	949.0	973.3
Nelson Dewey	6.4	1685.3	1390.8	33.1	286.2	160.5	479.9
Oak Creek	-442.0	5480.0	5128.9	557.5	542.4	1400.3	2500.2
Weston	-322.3	1501.7	1194.0	137.3	4.4	968.0	1109.6
Valley	41.6	-4.0	43.9	13.2	1.1	38.5	52.8
Columbia*	0.0	0.0	0.0	0.0	0.0	0.0	0.0

*No Post-Construction data available.

received through the utility tax payment.

In some cases the receipt of the utility tax payment also led to reductions and even elimination of local property tax levies.

Thus, the ratio of public services per tax dollar collected increased with the construction and operation of power plants in non-metropolitan areas.

PROPERTY VALUES

The low property tax rates and high levels of services in power plant communities have been cited for increasing the actractiveness of such communities, leading to residential, commercial and industrial development. Results of the property value study, which measured aggregate deviations from "no plant" projections in the value of residential, commercial, industrial and agricultural property, follows. Results are given for both primary and secondary areas. See Table 3.3 and 3.4 for summaries.

Valley

The Valley plant in Milwaukee had no significant impact on the growth of any of the four property classes. This was expected since the plant also had little impact on the municipal budget. In addition, the metropolitan area is too large for any single development to have a significant impact.

The Valley data exhibits a general decline in the expected rate of growth. This decline can almost certainly be attributed to urban sprawl and the decline of the central city which is being experienced by all major American cities.

Kewaunee and Point Beach

Both the Kewaunee and Point Beach plants have been constructed too recently to allow for a complete assessment of their impacts. The rural towns of Two Creeks (Point Beach) and Carlton (Kewaunee) experienced sizeable impacts on residential property values. The secondary area of the Kewaunee site also experienced growth in the manufacturing sector. Agricultural land values are lower than "no plant" projections in Point Beach area (-1.5% during construction, down to -8.7% after construction). This is most likely due in part to the loss of agricultural land to purchase by the utility company and in part to a shift in land use due to the concurrent extension of the residential sector. It is postulated that the effects on the other property classes will remain small due to the almost completely rural nature of the two towns.

Weston

Weston experienced tremendous growth in the residential sector. It had a deviation in general property taxes of -197.6% during the construction period and -322.2% during the post-construction period. For the same time periods it exhibited +49.7% and +474.3% deviations in residential property values in the primary study area. Comparative figures for the secondary area were only +.54% and -.12%. respectively.

These huge deviations were probably due as much to favorable growth conditions as to property tax reductions, however. Wausau is an industrial city well connected to Minneapolis, St. Paul, Madison, Milwaukee and Chicago by a system of 4 lane highways. The Wausau city cluster has a population of about

Table 3.3

PROPERTY VALUES IMPACTS-CONSTRUCTION

(Expressed as Percent Average Deviations from "no plant" Projections)

Plant	Residential			Mercantile			Manufacturing			Agricultural		
	P	S	P&S	P	S	P&S	P	S	P&S	P	S	P&S
Point Beach	11.3%	-2.4%	-2.3%	-0.4%	0.1%	0.1%	0.1%	-1.5%	-1.5%	-1.5%	-%	0.0%
Kewaunee	3.9	.97	1.6	-1.2	3.1	2.2	0.5	10.8	8.6	2.6	-1.47	-0.6
Nelson Dewey	62.8	.61	14.2	7.3	.13	1.7	4.5	.15	1.1	-0.1	-1.12	-0.9
Oak Creek	5.7	-	-	0.8	-	-	7.1	-	-	0.6	-	-
Weston	49.7	.54	1.6	7.9	-.38	-0.2	0.0	-6.0	-6.0	-9.3	-	0.0
Valley	-6.6	-	-	-1.4	-	-	-10.9	-	-	-0.1	-	-
Columbia	3.2	-1.04	-0.8	2.6	-	0.0	12.9	3.36	3.9	6.3	0.04	0.4

P - Primary Study Area

S - Secondary Study Area

Table 3.4

PROPERTY VALUE IMPACTS - POST CONSTRUCTION

(Expressed as Percent Average Deviation from "no plant" Projections)

Plant	Residential			Mercantile			Manufacturing			Agricultural		
	P	S	P&S	P	S	P&S	P	S	P&S	P	S	P&S
Point Beach	20.18	(-5.9)	(-5.7)	(-1.1)	(-0.3)	(-0.3)	(-0.5)	(-1.5)	(-1.5)	(-8.7)	0.5	0.4
Kewaunee	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nelson Dewey	47.7	4.2	13.7	20.9	1.2	5.5	23.1	(-0.7)	4.5	0.0	13.4	13.4
Oak Creek	22.3	-	-	6.7	-	-	23.9	-	-	0.3	-	-
Weston	474.3	(-.12)	10.1	43.6	1.4	2.3	0.0	(-20.9)	(-20.9)	(-31.1)	(-.03)	(-1.0)
Valley	(-11.2)	-	-	(-1.7)	-	-	(-15.6)	-	-	(-0.1)	-	-
Columbia	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

P - Primary Study Area

S - Secondary Study Area

60,000 and is steadily growing. It is reasonable to expect that Weston, as a suburb of Wausau would be prime residential choice for persons moving into the Wausau area. Thus, it is likely that much of the growth would have occurred even without the power plant and our impact results over estimate the effect of the plant. The low property taxes induced by the plant, however, probably made Weston more attractive relative to other areas in the Wausau vicinity, and thus, speeded the growth of Weston.

The positive deviation of 43.6% in the mercantile sector in the primary area seems to indicate that mercantile growth responds to residential growth. The negative deviations of minus 31.1% in the agricultural land values reflects the transition of agricultural land into commercial and residential land.

The Weston plant seems to have little impact on the industrial sector.

Columbia

Sufficient data is not available for the Columbia site. The most significant impact noted today is a 12.9% expansion of industrial property values during construction.

Oak Creek

The same effect on residential property experienced by Weston occurred in Oak Creek concurrent with Milwaukee city sprawl. General property taxes in Oak Creek deviated by -148% during construction and -442% after construction while residential property values deviated by +5.7% and +22.3% for the same period. Manufacturing activity also increased substantially, especially in the post-construction period. When the construction of the Oak Creek plant began Oak Creek was classified as a town. It was reclassified as a city in 1956. The construction of the power plant and related effects no doubt hastened the rate of urban sprawl in the Oak Creek area, but again, it is difficult to say how much of the growth was due to the presence of the plant and property tax reductions and how much to the urban sprawl.

Nelson Dewey

The Nelson Dewey power plant is located in the village of Cassville and provides a prime example of power plant induced growth without the influence of the large city. Residential property values in the primary area rose to 62.8% above expected trends during plant construction and then slowed to an aggregate of 47.7% during the post-construction period. (Relative to a 4.2% increase in the secondary area). The mercantile and manufacturing sectors exhibit a time effect increasing 7.3% and 4.5% in the primary area during construction rising to 20.9% and 23.1% in the post-construction period. Impacts occurred mainly in the primary area.

Summary

It appears that there is a definite relationship between power plant construction and increasing property values. By far the most significant impacts of power plants on property values occurred within the residential sector. Positive deviations from "no plant" projections for residential property occurred at all sites except Valley both during and after plant construction. These impacts were consistently much greater in the primary than the secondary study areas. Analysis seems to indicate that while the tax advantage acts as a great incentive to increased demands for residential land the impacts also varied with the presence of other growth factors.

The mercantile sector generally reflected the changes in the residential sector. Expansion of the manufacturing sector seems to depend on the availability of the labor and accessibility to both materials and product markets. Agricultural land has traditionally been assigned the lowest per acre value of the 4 major classes and tends to be replaced by other uses as its potential economic value falls below the actual profit margin.

With a few exceptions impacts were greatest in the post construction period and in the primary area.

It should be noted that the data provided in this report reflects only gross property class value and not the per acre value of the land. Thus the data does not preceisely delineate the effects of land use verses land value changes. It likewise does not disaggregate speculation effects from actual land use changes. A more detailed analysis of zoning regulations and full per acre property value is desirable but was impossible due to the time constraints of this study.

SCHOOL ENROLLMENT

The school enrollment study reflects the impact of power plant related growth on local school systems for primary and secondary study areas. The data was divided in two sections. The first reflects power plant impacts on kindergarten through the 8th grade and the second reflects impacts on the 9th through the 12th grades. (See Tables 3.5 and 3.6).

Point Beach and Kewaunee

Both the Point Beach and Kewaunee plants exhibited notable deviations in the K-through 8th grade data. However, in Point Beach the deviations were positive and in Kewaunee, negative. No explanation for this discrepancy can be offered. Deviations exhibited in the 9th through 12th grade data were smaller indicating that the majority of children coming into or leaving the area during this period were younger.

Nuclear plants have relatively large labor forces during both the construction and operating periods compared to coal fired plants. It was thus expected that nuclear plants would have higher impacts on school enrollments than coal-fired plants. The fact that this expectation was not borne out probably reflects the fact that associated development is more important than the number of plant workers in determining impacts on school systems.

A careful analysis of the data by individual school districts indicates that the greatest increases in enrollment occurred in Manitowoc-Two Rivers areas. Some of the change in these areas is no doubt due to the general growth. However, the results support expectations that non-local labor would preferentially settle in nearby cities rather than rural towns because of more available housing, higher levels of municipal services, greater entertainment options, larger commercial sectors, etc.

Nelson Dewey and Weston

Nelson Dewey and Weston both exhibited substantial growth in the K-8 category (20.4% and 9.8% respectively) during construction and even greater growth (45% and 51.5% respectively) during the post-construction period. Both had reductions

Table 3.5

SCHOOL ENROLLMENT IMPACTS - CONSTRUCTION

(Expressed as Percent Average Deviation from "no plant" Projections)

Plant	K-8	9-12
Point Beach	18.3	-4.9
Kewaunee	-5.0	0.1
Nelson Dewey	20.4	-4.3
Oak Creek	-7.5	5.2
Weston	9.8	-2.4
Valley	-1.1	2.1
Columbia	-9.0	1.1

Table 3.6

SCHOOL ENROLLMENT IMPACTS-POST CONSTRUCTION

(Expressed as Percent Average Deviation from "No Plant" Projections)

Plant	K-8	9-12
Point Beach	13.2	-3.2
Kewaunee	-19.1	0.8
Nelson Dewey	45.0	-16.6
Oak Creek	-53.1	21.9
Weston	51.5	-13.6
Valley	-2.6	4.3
Columbia*	0.0	0.0

*No Post-Construction data available.

in the 9-12 category. Since the labor forces for coal-fired plants are characteristically smaller than those for nuclear plants, this growth in school enrollment can be attributed mostly to the expansive growth in the residential and commercial sectors which occurred in conjunction with power plant construction.

Oak Creek

The Oak Creek plant seems to have had a greater impact on the 9th through 12th grades both during construction and after construction. The impacts on the K-8 grade category were negative for both periods. The high negative impact of -51.3% during the post-construction period is difficult to explain.

Valley and Columbia

No significant impacts can be discerned from the enrollment data for either the Valley or Columbia plant sites.

Summary

The reported data reflects substantial deviations both during and after plant construction particularly in K through 8 categories. Deviations were greatest in the post-construction period. However, at this point, there seems to be no single pattern to the deviations. In most cases, where growth in K-8 was positive, growth in 9-12 was negative and vice versa. This is difficult to explain.

Because historical data did not exist at the individual school or grade level it was impossible to conduct the analysis at the level which might better enable the detection of more subtle impacts of power plant construction.

SUMMARY

The most important general conclusions we can draw from the above data are: 1) that power plants have little impact on large metropolitan areas; 2) impacts are greatest during the post-construction period. It was thought that the biggest influx of plantworkers occurs during the construction period and tapers off during the operating period, many of the impacts would be greatest during the construction period. However, it appears that the growth stimulating effects of power plants during the operation period offset any losses in temporary plant workers.

CHAPTER 4 COMPARISON OF IMPACTS AND PREDICTIVE EQUATIONS

PROCEDURE

OVERVIEW

With the observed impacts quantified the analysis was carried a step further. It is advantageous when making decisions on plant size and location to determine whether the power plant impacts varied in anyway according to plant size, type and site location and characteristics, and if so, to develop predictive equations based on the results. Standard multiple regression analysis was the tool used in this section of the study.

Briefly regression analysis correlates known values of the variable in question or dependent variable (in this case the impact variables) with selected independent variables (in this case plant size, type and site location and characteristics) to determine if the dependent variable changes in any systematic way as the values of the independent variables are changed. Regression analysis assumes a linear relationship between the dependent and independent variables.

This procedure provides an indication of the strength of the relation between the independent variables and the dependent variable and, once known relationships are quantified, provides an equation to predict the value of the dependent variable, given the values of the independent variable.

The analysis provides test statistics which measure the overall adequacy of the assumptions. The most important test statistics are:

1. The coefficient of determination (r^2), which indicates what percentage of the variance in the dependent variable is explained by the independent variables. The smaller the value the less valuable the equation as predictive tool.

2. The standard error of estimate, which provides the user with an error band within which calculated results can be expected to vary from actual results. There is 67 % certainty that the actual results will fall within plus or minus 1 standard error of estimate from the predicted results. A 95 % certainty that the actual results will fall within + or -2 standard errors from the predicted results and 99 percent certainty that the actual result will fall within + or -3 standard errors from the predicted results. The larger the standard error of estimate is relative to the size of the predicted results the less valuable the prediction.

3. The f-ratio indicates what chance there is that the results of the regression analysis occurred purely by chance, i.e. what chance is there that there really is no relationship between the dependent and independent variables. Naturally, the higher the percentage, the less valuable equation.

4. The t-value which is similiar to the f-ratio. However, the t-value examines each independent variable separately rather than looking at the entire regression equation. The t-value tells us what chance we run that the relationship established in the regression analysis between the dependent variable and each individual independent variable occurred merely by chance,i.e., what chance is there that there really is no relationship between the individual independent variable and the dependent variable.

If any or all of the above tests are beyond a certain accepted value it can be assumed 1) that the proper independent variables have not been chosen to explain the variance and the dependent variable 2) that there are no linear relationships between the dependent variable and the independent variables or 3) that the number of observations was indadequate to establish an relationship.

Dependent Variables

It was desirable to predict power plant impacts on:

1. Total municipal receipts.
2. Utility taxes.
3. Property taxes.
4. Total municipal expenditures.
5. Police expenditures.
6. Fire expenditures.
7. Road expenditures.
8. Residential property value.
9. Mercantile property value.
10. Manufacturing property value.

11. Agricultural property value.
12. School Enrollment impacts for K through 8th grades.
13. School Enrollment impacts for 9th through 12th grades.

INDEPENDENT VARIABLES

The independent variables representing plant size, type, and location and site characteristics were:

1. Plant size in megawatts, (MW).
2. Plant setting, (S): Rural, Village, City, Metropolitan, (For the sake of the equation these were assigned values of 1, 2, 3 and 4 respectively.)
3. Plant location, (L): Off or on the coast. (These were assigned values of 0 and 1 respectively.)
4. Plants type, (T): Coal or Nuclear. (These were assigned values of 0 and 1 respectively.)
5. Population, (P).
6. Plant size per capita, (MW/P).
7. Plant size divided by population times setting (MW/SxP).

REGRESSION ANALYSES

Regression analyses were carried out for each dependent variable for the primary, and where relevant, primary plus secondary study areas. The analyses were carried out separately for the construction and post construction periods.

Several regression analyses using different combinations of independent variables, or different models, were run for each dependent variable. If the test statistics were unsatisfactory associated models were discarded as invalid for predicting plant impacts on the particular impact variable involved. Where results were adequate predictive equations were derived from the most suitable regression models.

The general predictive equations are:

Construction Impact (i)= $a_{oi} + a_{1i}\ x_1 + a_{2i}\ x_2 \ldots\ldots\ a_{ni}\ x_n$

Operating Impact (i) $= b_{oi} + b_{1i}\ x\ 1 + b_{2i}\ x_2 \ldots\ldots\ b_{ni}\ x_n$

Where i is the particular impact variable and $a_{oi} - a_{ni}$ and $b_{oi} - b_{ni}$ are the regression coefficients.

PROBLEMS

Before proceeding, it seems only fair to warn readers of some of the possible problems with the regression analysis results.

1. The results of regression analysis are only as good as the data used in the analysis. Thus any problems with the observed impact data are reflected in the regression results. Extraneous factors in the impact data, i.e., deviations not associated with power impacts, tended to reduce the correlations and increase the standard errors of estimate of our results.

2. Plant construction varies over different time frames for different plants. Thus, plant impacts might vary with different time periods. Since these were not included in the models the discrepancies again tended to reduce the degree of correlation between dependent and independent variables, and increase the standard error estimate.

3. The number of observations, 7 plants, and in some regression models as few as 3 plants, is very small relative to the number of the independent

variables. As a result, there was little variability for the models to test and r^2's tended to be very high. They were high though not because the independent variables chosen for the model truly explained the variance in the dependent variable, but merely because there was not enough data to adequately test the strength of the relationship's established. A corrected r^2 statistic was used to compensate for this problem. However, even with this correction, the models should not be accepted at face value. Their value lies rather in the trends that they illuminate.

4. Regression analysis assumes linear relationship between dependent and independent variables. It may be the case that no such relationship exists and that a curvilinear regression model would have best fit the data.

5. Time was a severe limitation in this study. In some cases no time was available to run sufficient regression models to establish the best equations possible. Where results were inadequate, suggestions for more promising regression models are made.

CONCLUSIONS

It should be emphasized at this point that the correlation of impact with a particular variable does not necessarily imply a cause-effect relationship. The death rate, e.g. can be correlated with the overall hardness of asphalt roads. However, the hardness of asphalt roads has nothing to do with death rates, the significant variable is temperature. Increasing temperatures cause increasing death rates and also cause decreasing hardness of asphalt roads. Thus, care must be exercised in using any of the predictive equations to develop policies to alter the impact of electric generating facilities.

RESULTS

The results are expressed as percentage changes of the dependent variable from the total values of those variables two years prior to plant construction.

TOTAL MUNICIPAL RECEIPTS

Construction Period

Power plant impacts on total receipts during the construction period were a function of:

1. Plant size (MW).
2. Plant type (T).
3. Ratio of plant size to population times setting (MW/SxP).

Percent changes in total receipts increased with plant size, decreased with nuclear plants and decreased with increasing urbanization of plant size.

The equation for predicting construction impacts on total receipts as a percent of total receipts two years prior to construction is:

% Change in Total Receipts = 100 x (-.957944 + .008215 MW - 8.359345T + 25.43695 MW/SxP), with a corrected r^2 of .96, and f-ratio significant at the .004 level, and a standard error of estimate of 370%. This means that the above equation accounts for 96% of the variation in total receipt impacts among the plants studied, and there is only a .4% chance that these results occurred by chance. Thus, one can be very confident that this is a valid equation for predicting plant impact on total municipal receipts. The standard error or estimate however was 370%. This means that it can be said with 67% certainty that the actual impacts will fall between the predicted impact plus or minus 370 percentage points. Impacts predicted by this equation range from 13% to 5,444%. Thus, where the predicted impact is 15% we can be 67% sure that the actual barrier will be anywhere from minus 355% to plus 385%. For a predicted impact of 5,444% one can be 67% sure that the actual impact will be anywhere from 5,429% to 5,459%. For the larger impacts, the standard error of estimate is quite reasonable. However, for smaller impacts it is so large that it severely limits the usefulness of the equation as a predictive tool. Generally, the smaller the standard error of estimate is relative to the predicted value of the dependent variable the more useful the equation is as a predicting tool.

Post-Construction Period

Power Plant impacts on total municipal receipts during the post-construction period were a function of:

1. Plant size (MW).
2. Plant type (T).

Percent change in total receipt increase as plant size increased and increased with nuclear plants.

The equation for predicting post-construction impacts on total receipts as a percentage of total receipts two years prior to construction is:

% Change in Total Receipts = 100x (2.89024 + .02855 MW + 52.82554 T), with a corrected r^2 of .93, an f-ratio significant at the .03 level and a standard error of estimate of 887%. This means that 93% of the variation in total receipts among our study sites was explained by the above equation and there is a 3% chance that these results occurred merely by chance, thus again one can be fairly confident that this is a valid equation. The standard error of estimate was 887%. In this case the predicted impacts ranged from 674% to 8,426%. Again the equation is reasonable for predicting a larger impacts of power plants but not very useful for predicting smaller impacts.

UTILITY TAXES

Construction Period

The impact on utility tax receipts during the construction period was a function of:

1. Plant size (MW).
2. Plant size divided by setting x population. (MW/SxP).

The utility tax receipt tended to increase with increasing plant size and decrease with increasing urbanization, when considered along with plant type.

The equation for predicting construction impacts on the utility tax receipts as a percentage of total receipts two years prior to construction is:

% Change in Utility Tax = 100 x (-.429817 + .009102 MW - 1.239092T + 20.525040 MW/SxP).

This equation explains 95% of the variation in plant impacts, among plant studied, with an f-ratio significant at the .01 level and a standard error of estimate of 419%. Predicted results varied from 79.9% to 5,224.8%. (By now the reader should be familiar enough with these test statistics to need no further elaboration.) Plant type was included in the above equation. However, a better equation could have been generated leaving type out of the model.

Post-Construction Period

Post-construction impacts of power plants on utility receipts were a function of:

1. Plant size (MW).
2. Plant type (T).

Total receipts increased with plant size and with nuclear plants.

The equation for predicting post-construction impacts on utility tax receipts as percent of total receipts two years prior to construction is:

%Change in Utility Tax = 100 x(4.58324 + .02954 MW + 68.32752T)

This equation accounts for 93% of variation among plant sites with a f-ratio significant at the .03 level, and standard error of estimate of 1,094.4%. The predicted value for utility tax impact varies from 857% to 10,245.1%.

PROPERTY TAXES

Construction Period

The construction impacts of power plants on total property taxes were a function of:

1. Plant size (MW).
2. Setting (S).
3. Location (L).
4. Plant type (T).
5. Population (P).

Impacts on total property taxes increased as plant size increased, increased with nuclear plants, increased with population and decreased with coastal zone locations and with increased urbanization.

The equation for predicting actual impacts on total property taxes as a percent of total receipts 2 years prior to construction is:

% Change in Property Tax = 100 x(1.1012967 + .0029927 MW -.9951024S -4.6754147L + 2.7563551 T + .0001209 P).

This equation accounts for 98% of the variation in property tax impacts among plant sites, with a f-ratio significant at the .09 level, and a standard error of estimate of 15%. Predicted results varied from minus 197.6% to plus 123.5%.

Post-Construction Period

Post-construction impacts on total property values were a function of:

1. Plant size (MW).
2. Plant setting (S).
3. Population (P).

Percent change in total property tax decreased with increasing plant size, decreased with increasing urbanization and increased with increasing population.

The equation for predicting post-construction impacts on total property taxes as percent of total receipts 2 years prior to construction is:

% Change in Property Tax = 100 x(2.51478721 - .00049701 MW - 1.66781427S + .00008324 P).

This equation accounts for 71% of the variation in property tax impacts among plant sites with an f-ratio significant at the .34 level and a standard error of estimate of 120%. The predicted values ranged from -458.6% to +44.3%. These test statistics indicated that this is not a very good predictive equation. Plant size added very little to the equation and a better equation might have been derived by eliminating plant size from the model.

TOTAL MUNICIPAL EXPENDITURES

Construction Period

There was no adequate predictive equation for total expenditures during the construction period. There seems to be some relation between total expenditures and plant size and population but there was no equation run using these two variables.

Post-Construction Period

Power plant impacts on total expenditures for the post-construction period were a function of:

1. Plant size (MW).
2. Plant setting (S).
3. Population (P).

Total expenditures in the post-construction period increased with increasing plant size and increasing urbanization, and decreased with increasing population.

The equation for predicting post-construction impacts on total expenditures as a percentage of total expenditures two years prior to construction is:

$$\% \text{ Change in Total Expenditures P-C} = 100 \times (-5.2438147 + .0073990\,MW + 4.8534224S - .0002766P).$$

This equation accounts for 97% of the variation in total expenditure impacts among plants studied with a f-ratio significant at the .10 level and a standard error of estimate of 141%. The predicted values for total expenditure impacts ranged from 49.67% to 2,519.7%.

POLICE EXPENDITURES

Construction Period

Power plant impacts on police expenditures during the construction period were a function of:

1. Plant size (MW).
2. Plant type (T).
3. Plant size divided by setting x population. (MW/SxP).

Police expenditures increased with increasing plant size and decreased with nuclear plants and with increasing urbanization.

The equation for predicting construction period impacts on police expenditures as a percentage of total expenditures two years prior to construction is:

$$\% \text{ Change in Police Expenditures} = 100 \times (-.185043 + .001056MW - 1.427461T + 2.197259\,MW/SxP)$$

This equation accounts for 97.9% of the variation in police expenditure impacts amongst plant studies with an f-ratio significant at the .09 level and a standard error of estimate of 11.2%. The predicted values for police expenditure impacts ranged from -4.2% to + 176.9%.

Post-Construction Period

Police expenditure impacts during the post-construction period were a function of:

1. Plant size (MW).

As plant size increased so did expenditures for police protection.

The equation for predicting post-construction impacts on police expenditures as a percentage of total expenditures 2 years prior to construction is:

% Change in Police Expenditures P-C = 100 (-.069734 + .003326 MW)

This equation accounts for 87% of the variation in police expenditure impacts among plant studies with an f-ratio significant at the .04 level and a standard error of estimate of 90.9%. The predicted values for police expenditure impacts ranged from +37.9% to +548%.

FIRE EXPENDITURES

Construction Period

Fire expenditure impacts during the construction period were a function of:

1. Plant size (MW).
2. Plant type (T).
3. Plant size divided by setting x population (MW/SxP).

Fire expenditure impacts during the construction period also seemed to be a function of population but this variable was not run in our model. According to our equation fire expenditure impacts during the construction period increase with increasing plant size when considered along with plant type and plant size divided by setting x population.

The equation for predicting construction period impacts on fire expenditures as a percentage of total expenditures two years prior to construction is:

% Change in Fire Expenditures$_C$ = 100 x (-.1015767 + .0007562 MW -.1645326T- .0382432 MW/SxP)

This equation accounts for only 54% of the variation in fire expenditure impacts among plants studied with an f-ratio significant at the .17 level and a standard error of estimate of 30.9%. The predicted values for fire expenditure impacts ranged from +.05% to +115%. The standard error of estimate is very high in relation to predicted values unless it is difficult to accurately predict fire expenditure. A better equation might be derived if plant type and plant size divided by setting times the population were eliminated from the model and population was added to the model.

Post-Construction Period

No satisfactory relationship could be found to explain fire expenditure impacts during the post-construction period.

ROAD EXPENDITURES

Construction Period

No satisfactory relationship could be found to explain road expenditure impacts during the construction period.

Post-Construction Period

Again no satisfactory relationship could be found to explain post-construction impacts on road expenditures. Expenditures are generally policy variables and thus very difficult to predict accurately.

RESIDENTIAL PROPERTY VALUES

Construction Period

Although there were significant impacts on residential property values, no significant relationships could be found to explain these impacts either for the primary or the primary plus secondary study areas. They were not a function of any of the independent variables examined in this study. It appears that the existence of a power plant and not the physical character of the plant or its location affects the total value of residential property.

Post-Construction Period

a) Primary Study Area

Again no significant relationships could be found between power plant impacts on residential property and any of our independent variables.

b) Primary Plus Secondary Study Area.

Power plant impacts on residential property values for the secondary study area were a function of:

1. Plant size (MW).

Residential property value increased with increasing plant size in the secondary study area up to a point and then decreased, however, the magnitude of this increase lessened as plant size increased.

The equation for predicting operating impacts on residential property values in the primary plus secondary study area as a percentage of total property values in this area two years prior to construction is:

% Change in Residential Property Value PC = 100 x(.1553160 - .0002092 MW)

This equation accounts for 85.5% of the variation in residential property value impacts among plants studied with a f-ratio significant at the .17 level and a standard error of estimate of 3.9%. The predicted values for residential property values impacts ranged from -.3% to +12.7%.

MERCANTILE PROPERTY VALUE

Construction Period

a) Primary Study Area

No significant relationships were found between construction impacts on mercantile property value and any of our independent variables.

b) Primary Plus Secondary Study Area

Impacts on mercantile property value for the primary plus secondary study areas during the construction period were a function of:

1. Plant setting (S).
2. Plant type (T).
3. The ratio of plant size to population. (MW/P).

Mercantile property values increased with increasing urbanization, increased for nuclear plants and increased as the ratio of plant size to population increased.

The equation for predicting impact on mercantile property value due to plant construction, as a percentage of total property value two years to prior to construction is:

$$\%\ \text{Change in Mercantile Property Value}_c = 100 \times (-.016790 + .004678S + .006321T + .283954\ MW/P).$$

This equation accounts for 90.8% of the variation and mercantile value impacts among plant studies with a f-ratio significant at the .19 level and a standard error of estimate of .34%. The predicted value for mercantile property value impacts ranged from -.01% to +2.3%.

Post-Construction Period

a) Primary Study Area.

Post-construction impacts on mercantile property value for the primary study area were a function of:

1. Plant size (MW).
2. Plant setting (S).
3. Population (P).

Mercantile property value impacts decrease with increasing plant size, increasing population and increased with increasing urbanization.

The equation for predicting operating period impacts on mercantile property value at a percentage of total property value two years prior to construction is:

$$\%\text{ Change in Mercantile Property Value}_{P-C} = 100 \times (.116769168 - .000251050\ MW + .104987388S - .000008519P).$$

This equation accounts for 86.8% of the variation in mercantile property value impacts among plant sites with an f-ratio significant at the .23 level and a standard error of estimate of 6.9%. The predicted values for mercantile property value impact ranged from - 3.3% to +39.8%.

b) Primary Plus Secondary Study Area

No satisfactory relationships could be found to predict post-construction period impacts on mercantile property value in the primary plus secondary study area.

MANFUFACTURING PROPERTY VALUE

Construction Period

a) Primary Study Area

No satisfactory relationships could be found to predict construction period impacts on manufacturing property values in the primary study area,

b) Primary Plus Secondary Study Area

Construction period impacts on manufacturing property value in the primary plus secondary study area were a function of:

1. Plant size (MW).
2. Plant type (T).
3. Plant size divided by setting x population MW/SxP.

Manufacturing property value impacts increased with increasing plant size and decreased with nuclear plants and with increasing urbanization.

The equation for predicting impacts on manufacturing property value in the primary plus secondary study area during plant construction as a percentage of total property values two years prior to construction is:

$$\%\text{ Change in Manufacturing Property Value}_{C} = 100 \times (-.0888131 + .0001594\ MW - .1202053\ T + 2.0134617\ MW/SxP).$$

This equation accounts for 85.7% of the variation in manufacturing property value impacts among plants studied with a f-ratio significant at the .24 level and a standard error of estimate of 2.1%. Predicted values for mercantile property value impacts range from -6.6% to +8.1%.

Post-Construction Period

a) Primary Study Area

Impacts on manufacturing property value during the post-construction period in the primary study area were a function of:

1. Plant type (T).
2. Plant size divided by setting x population. (MW/SxP).

Manufacturing property values impacts decreased with nuclear plants and with increasing urbanization.

The equation to predict post-construction period impacts on manufacturing property value as a percentage of total property value two years prior to plant construction is:

$$\%\text{ Change in Manufacturing Property Value}_{P-C} = 100 \times (-.1444 - 7.882\ T + 3.674\ MW/SxP).$$

This equation accounts for 81.8% of the variation in manufacturing property value impacts among plants studied with an f-ratio singificant at the .25 level and a standard error of estimate of 8.2%. Predicted values for manufacturing property value impacts range from -14% to +27.9%.

b) Primary Plus Secondary Study Area

No satisfactory relationship could be found to predict impacts in manufacturing property value due to plant operation for the primary plus secondary study area.

AGRICULTURAL PROPERTY VALUE

Construction Period

No satisfactory relationships could be found to predict impacts on agricultural property value due to plant operation for either the primary or primary plus secondary study area.

Post-Construction Period

No satisfactory relationships could be found to explain power plant impact on agricultural values during the post-construction period on either the primary or the primary plus secondary study area. This is to be expected since there was little impact on agricultural land value during the post-construction period.

SCHOOL ENROLLMENT K-8TH GRADES

School enrollment impacts were studied by school districts rather than by primary or secondary study areas.

Construction Period

Although there seems to be a significant impact on school enrollment the impact is not a function of the independent variables used in this study.

Post-Construction Period

Impacts on school enrollment in the K through 8th grade during the post-construction period were a function of:

1. Plant size (MW).
2. Population (P).

When considered along with plant setting school enrollments decreased with increasing plant size and with increasing population.

The equation for predicting impacts on school enrollment for the K-8th grades due to plant operations as a percentage of total school enrollments two years prior to construction is:

$$\%\text{ Change K-8}_{P-C} = 100 \times (.585152 - .00044096\ MW - .002071S - .00000047P).$$

This equation accounts for 99.% of the variation among plant studies with an f-ratio significant at the .06 level and a standard error of estimate of 3.8%. The predicted values for school enrollment impacts ranged from -52.5% to +49.6%. Plant setting was not a significant variable, however, and a better equation could be derived by removing this variable from the model.

School Enrollment 9th-12th Grades

Construction Period

No satisfactory relationships could be found to explain impacts on school enrollments for the 9th through 12th grade during the construction period.

Post-Construction Period

Impacts on enrollment in 9th through 12th grade due to power plant operation were a function of:

1. Plant size (MW).
2. Population (P).
3. Setting (S).

For the plants studied, changes in enrollment in grades 9 through 12 increased with increasing plant size, increasing urbanization and increasing population.

The equation to predict percent change in enrollments for grades 9 through 12 as a percentage of total school enrollments two years prior to plant construction is:

$$\%\ \text{Change}\ 9\text{-}12_{P-C} = 100 \times (-.217338 + .000157\ MW + .0145026S + .0000001515P).$$

This equation accounted for 98.7% of the variation among the plants studied with an f-ratio significant at the .07 level and a standard error of estimate of 1.78%. The predicted values ranged from minus 16.2% to plus 22.2%.

Summary

Although the rate of growth of electrical energy consumption has slowed in recent years due to rising costs, the use of various institutionalized restrictions, and a heightened awareness of the limits of national-international energy resources, the growth rate still indicates the need for construction of additional electrical generating facilities. This study does not attempt to judge the wisdom or validity of expanding energy capacity; rather it attempts to identify and estimate some of the past impacts of power plant construction and operation, and uses this information to develop models to predict the impact of future plants.

This study has analyzed the impacts of construction and operations as reflected in deviations from expected growth trends for municipal receipts and expenditures, property values and school enrollments. These impacts were then assessed as they varied with plant size, type and site location and characteristics.

It was found that while sizeable impacts were detected in some of the impact indicators both during and after plant construction, many of these deviations could not be directly correlated to the various independent plant and site variables. This was true partly because many of the impact variables depended on local policy decisions and were not influenced by any of our independent variables. The decision to build roads, lower property taxes, or improve local services, are all policy decisions and these in turn affect changes in property values and changes in school enrollments. It is, therefore, impossible to create a model which will accurately anticipate the actual impact of increased revenues.

In addition it was found that power plant impacts were a function of site specific factors which were not included in our model. For example, the presence of other growth oriented factors such as access to well developed transportation systems , markets for both raw materials and products, labor supplies etc., all seem to intensify the impacts of power plants. Impacts diminished for very rural non-growth oriented areas and were negilible in metropolitan areas where per capita financial impacts were very minimal.

The most important variable for predicting power plant impact turned out to be plant size. Plant type, and population and setting of the plant site were also important. Whether a power plant was located on or off the coastal zone made very little difference for all impact variables except construction period property taxes. Location on the coast was associated with a greater reduction in property taxes than location off the coast.

While it is difficult to develop an accurate generalized predictive model it is expected that the predictive capabilities of the models provided used in conjunction with site specific information will narrow the measurement of expected impact to a range which will be useful to local policy makers.

Appendix I

TAX DISTRIBUTION EFFECTS

Municipalities are the basic units of property tax administration, responsible not only for levying and collecting city, village or town taxes; but for collecting and distributing property tax levies charged by the overlapping governmental jurisdictions: state, county, school, 1/ and vocational 2/ district (s), in which the municipality is located.

Therefore, each property can be subject to taxation by five distinct governmental jurisdictions; but never by more than one government of the same type. This becomes more clearly evident upon consideration of the state as a whole, defined in terms of each of the five separate taxing jurisdictions. Property in the State of Wisconsin is taxed by:

1 - State government
17 - VTAED governments
72 - County governments
444 - ESSD governments
1839 - Municipal governments, including:
    1270 towns
    383 villages
    186 cities

To further complicate matters, not all of the jurisdictional boundaries necessarily coincide.

Because of the extensive overlap of the several governmental jurisdictions, an entire municipality is rarely contained within the same five taxing jurisdictions. In the case of intra-municipal divisions, each fraction of the municipality subject to a different taxing jurisdiction will be liable in proporation to its relative percentage of the total property valuation of the taxing district. A brief explanation of property assessment is necessary to clarify the appropriation of tax liability.

ASSESSMENT

The State of Wisconsin operates a system of dual property assessment: property is valued once by a local assessor, and again by a State Department of Revenue appraiser. Land, or "real" property is valued separately from improvements.

Although the statutes require local property assessment at 100% of full market value, local assessment rates have varied from a low of 9% to a high of over 100%. The statewide average level of assessment in 1973 was 61% of full value.

1/ Henceforth referred to as ESSD; "School district" refers to a single elementary and secondary school district. A single "union high school" district government will overlap a number of smaller elementary school districts. A separate property tax is levied for each district.

2/ Henceforth referred to as VTAED; "Vocational district" refers to Vocational, Technical and Adult Education District. Each VTAED typically overlaps several union high school districts.

However, it is typical for different classes 3/ of property within the same tax administration district to be assessed at different ratios, according to differences in value established for each class by local and state assessors. Deviations from the ascribed 100% assessment rate have been declared acceptable by the courts, provided that all property in the municipality is appraised at a uniform rate or percent. The local tax rate, tax levy, and total property valuation are the three inter-dependent variables which determine the individual property tax liability.

$$\text{Rate of Taxation} = \frac{\text{Total tax levy}}{\text{Total property value}}$$

The local rate of assessment is presumed to reflect the judgment of value by the local appraiser(s). However, in many cases, it has come to vary in relation to the political exigency of achieving a designated tax rate.

The rate of taxation (normally expressed in terms of dollars/$1,000 of value) can vary in proportion to the total tax levy and total property value. Because of the variances in psychological impact, there are times when it is judged politically advantageous to increase the appraised value of property rather than to raise tax rates in order to fill increased revenue requirements.

DETERMINATION OF TAX RATE

Politics aside, the entire tax process begins essentially with the compilation of the annual municipal budget. Local officials compute the annual budget by estimating total annual expenditures and receipts.4/ Proposed expenditures are balanced against expected receipts to compute the amount of revenues to be raised through the local property tax levy.

(Anticipated expenditures) - (Anticipated revenue) = Total tax levy

Before the tax rate can be computed, the taxes levied against the municipality by other jurisdictions must be considered. In order to apportion state, county, ESSD, and VTAED taxes and aids, some uniform determination of property values is needed. The State Department of Revenue is responsible for the valuation of property at this equalized rate. This assessment ratio has been officially set at 100% of full market value.

The equalized value of property is determined by a number of factors derived through consideration of local and state trends, including: (1) evidence of changes in dollar value by classes of property on the basis of sales statistics; (2) changes in dollar value by property class based on mass appraisals by the Department of Revenue; (3) changes in dollar value due to new construction, losses by fire, changes in land use, annexation, etc.; and (4) the previous year's valuation. Actual field re-appraisals are required every six years by the Department of Revenue.

3/ In the State of Wisconsin, property is separated into seven major classifications or"classes": (1) residential, (2) mercantile, (3) manufacturing, (4) agricultural, (5) swamp and waste land, (6) commercial forest, and (7) non-commercial forest..

4/ Federal and state payments, state shared taxes and aids, fines, fees, and other non-tax sources.

The equalized value is then used to establish relative value comparisons between the multiple local units within each larger governmental jurisdiction. Each governmental unit charges each municipality or fraction thereof under its jurisdiction, a percentage of its local tax levy which reflects that municipality's relative proportion of the governmental unit's total property valuation. Thus, the percentages of tax liability apportioned to a single municipality will vary according to the overlapping boundaries of various taxing jurisdictions. These percentages will also vary over time; since the total amount of value within a jurisdiction will not grow or decline evenly in all municipalities within a single jurisdiction, each municipality's percentage of the total value within the same jurisdiction may change from year to year.

Wisconsin has set the state property tax rate at a statewide standard of 0.20 mills of assessed valuation. Counties, ESSD and VTAED districts apportion their revenue requirements 5/ to each municipality or fraction thereof, on the basis of the ratio of that municipality's (or fraction thereof) aggregated equalized property value to the total property valuation of the entire taxing jurisdiction. The town, village, or city clerks then compile all levies apportioned by the various overlapping tax jurisdictions, and compute a gross tax rate for the municipality, or fractions thereof; under uniform jurisdictions. This tax rate is basically computed by dividing the total of the apportioned property tax levies by the aggregated assessed property value of the uniformly governed district. For each fraction of a municipality under uniform jurisdiction:

$$\text{"Gross" tax rate} = \frac{(\text{PTL mun.}) + (\text{PTL state}) + (\text{PTL county}) + (\text{PTL ESSD}) + (\text{PTL VTAED})}{\text{PVeq}}$$

PTL - property tax levy

PVeq -equalized property value

A general property tax credit 6/ paid from general state revenue sources to each tax administration district is apportioned to each uniformly governed sector of the municipality in proportion to its percent of total property value. A "tax credit" rate is computed and applied to the "gross" tax rate to effect a reduction in the individual tax liabilities. This "net" tax rate is applied to the assessed value of each taxpayer's property to determine individual property tax levies.

(TR net) (PV assessed) = individual tax liability

SHARED TAX DISTRIBUTION

The general policy of the State of Wisconsin is to delegate the administration of a large number of government services to local jurisdictional units. Because of this concentration at the local level, close to 80% of total state and local revenues are spent at the local level. The primary source of local revenue had traditionally been the municipal property tax and special state funds, resulting in highly inequitable levels of services which reflected to some extent the relative "wealth" of each community. In recognition of these inequities, alternative policies of revenue distributions were considered. The Task

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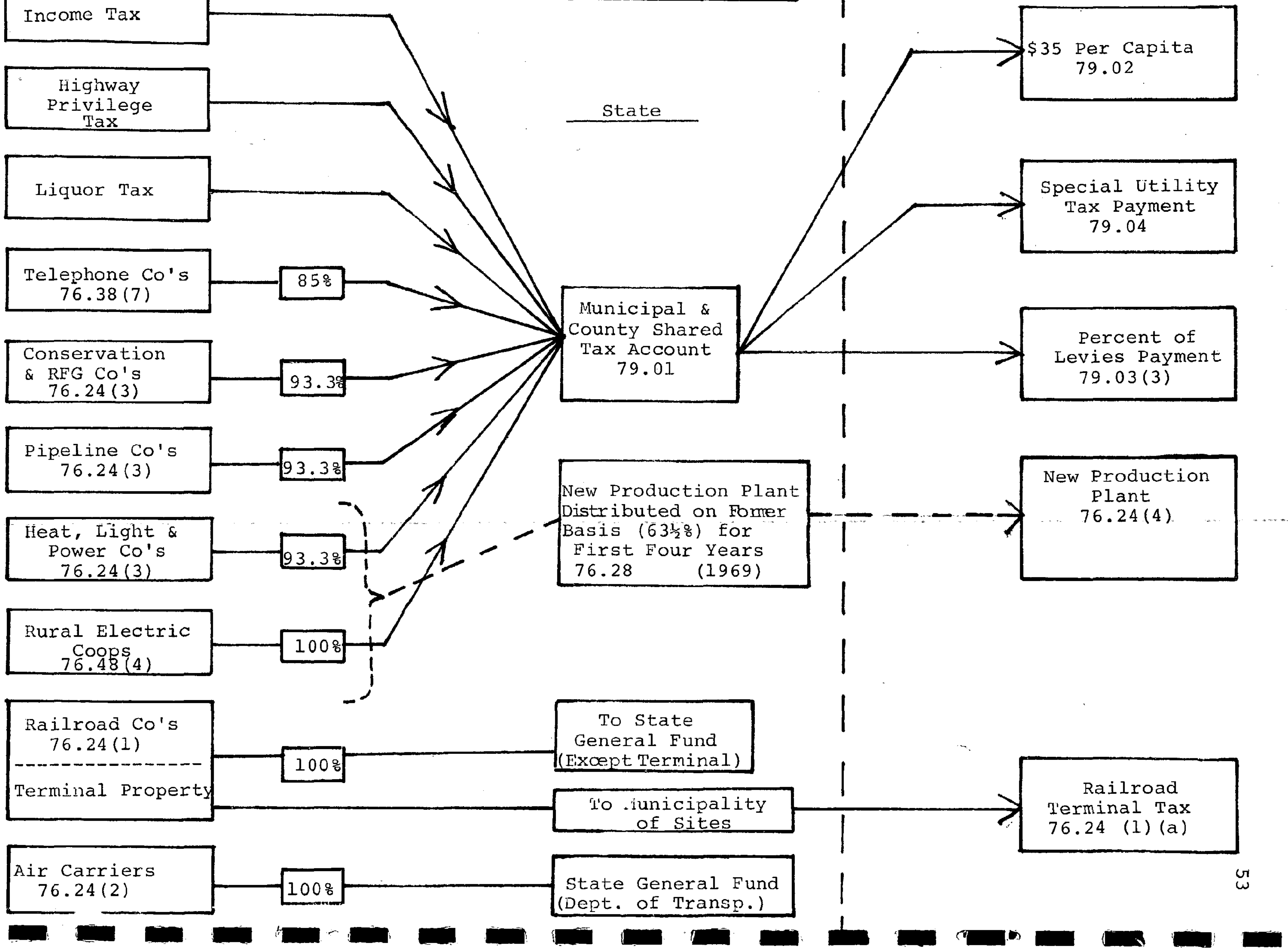
5/ Determined through a budgetary process similar to that previously defined for the municipal government.

6/ See Appendix "The Property Tax Credit".

DISTRIBUTION OF CENTRALLY COLLECTED TAXES TO LOCAL UNITS OF GOVERNMENT IN WISCONSIN



Force on Local Government Finance and Organization, more commonly known as the Tarr Task Force, conducted several years of research into the Wisconsin tax system, culminating in the passage of legislation in November of 1971 which created a "Municipal and County Shared Tax Account". The latest edition of the Shared Tax legislation can be found in the 1973 statutes, Chapter 79.

If local units of government were forced to rely strictly on the property tax as the major source of local revenue, it would be reasonable to expect that levels of public services would rougly correspond to the local property tax base. For example: the amount of full value per capita in Wisconsin communities in a recent year varied from a $1,343 low to a high of $43,221; the average was $5,601.

The state shared taxes and aids program is designed to redistribute state-imposed and collected tax monies to counties and municipalities in order to effect more equitable levels of public services throughout Wisconsin. Certain percentages of the taxes levied on personal and corporate income, utilities, liquor, and motor vehicles have been designated by law to be deposited in a "Municipal and County Shared Tax Account" to be distributed according to a complex formula.

The shared tax distribution formula consists basically of three parts: a per capita-based payment, a property tax burden-based payment, and a special utility-based payment; all to be distributed <u>without</u> restriction on spending. The source and subsequent distributions of the account are clarified in diagram.

Per Capita Payment

The preliminary distribution occurring on July 31 of each year consists of a straightforward payment of $35 for each individual legally a resident of that tax administration district. Of this amount, 16.25% is allocated directly to the county (79.02). 7/

Property Tax Burden Payment

The property tax burden-based payment is the major equilibrating factor in the tax-sharing formula. Because of the wide variance in the local property tax base, certain low tax base municipalities would be forced to bear an overwhelming tax burden per capita relative to other "wealthier" tax districts in order to achieve a comparable level of public services. It is doubtful whether uniform statewide levels of service would be practical or even desirable because of the broad differences in local needs and demands. Since local tax rates (based on full value) reflect the level of services to a great extent, the municipal full value tax rate is used as a relative measure of the per capita tax burden.

Distribution of these monies occurs on November 15 of each year. Participation in the distribution is dependent on the status of the municipal full value tax rate relative to the statewide average rate. Specifically, a statewide average full value property tax rate is computed. 8/ A tax rate 9/ is then computed

7/ If sufficient monies are not available in fund, proportionate amounts per capita shall be distributed, less 16.25% of these to the county.

8/ Total gross general property tax levied statewide divided by full value of property statewide.

9/ Total gross general property tax levied in the tax administration district divided by full value of property in that tax district.

for each tax administration district in the state. This rate includes, in addition to general property taxes, all state, county, local and school taxes, occupational taxes, special assessments and sewer service charges, and forest crop and woodlands tax levied and extended by the tax district. The sum of these various levies is divided by the full value of property in the municipality to derive the "computed full value rate". A "computed rate" greater than one-half the statewide average rate will qualify a municipality to participate in this distribution. The amount that the "computed rate" exceeds the statewide average rate is commonly referred to as the "excess rate".

In order to minimize year-by-year fluctuations, excess rates are computed for each of three years preceding the year in question, and an average excess rate is computed.

This average excess rate is then multiplied by the total full value in the district during the recent year to measure the "excess tax burden".

The ratio of total monies remaining in the shared tax fund (after per capita and utility tax distributions) divided by the total statewide excess tax burden is computed. This factor is then multiplied by each municipality's excess tax burden to determine its share of the distribution. This gross share is reduced by 16.27% allocated by law to the county.

Utility Tax Payment Justification

According to state law, utility property is exempt from local property taxation, instead being assessed and taxed directly by the state. The inference of this policy is that the potential revenues from that land, previously part of the local tax base, are lost to the municipality once this land becomes owned or used by a utility. Thus, the purchase or use of land by a power company immediately increases the per capita tax burden. There is less property to which the municipal revenue requirement can be applied; so each taxpayer of the district must bear an additional burden. The rationale of "just compensation" serves as the primary justification for the utility tax payment portion of the shared tax formula.

Secondary arguments of the utility tax payment proponents are centered around two basic issues, both of which are related to the principal of compensation.

One argument, perhaps more applicable to cities and large metropolitan areas, is the concept commonly referred to as "industry favors equivalence".

This rationale is essentially concerned with alternative land usage. The assumption is that the occupation of this land by a private firm or industry, in lieu of the electric-generating facility, would have significantly augmented the total valuation of the local tax base. This assumes that : (1) a private firm or industry would have located on the property if the utility had not; and (2) the increased costs of, or services demanded by the firm would not absorb or offset the subsequent gain in the tax base.

Utility tax revenue return has been further rationalized on the basis of compensation for the various direct and indirect costs that a municipality is forced to absorb during the construction and continued operation of a sizable electric-generating facility.

While many of these costs may not transfer to the post-construction period - when the smaller number of permanent operational personnel will essentially "pay their own way" through local taxes, etc., the issue of environmental "costs" is often cited in reference to tax compensation for the post-construction period. While the "state of the art" does not yet permit the quantification of the effects of environmental degradation- which in most cases is site-specific, there is no doubt that electric generating facilities, like other industries, do contribute to environmental damage.

Participation in this distribution is strictly limited to those municipalities which have under construction or operating within their boundaries, a production plant (including substations), or a general structure used by a heat, light, and power company. Monies are distributed according to a complex formula essentially based on the amount of taxes paid by the utility - hence, on the net valuation of the utility property.

Utility Property Assessment

The distinct properties of a regulated industry, together with the broadly dispersed nature of utility property holdings (substations, transmission lines, etc.) require unique methods of assessment and taxation. The Wisconsin Department of Revenue has statutory authority and responsibility for the annual assessment of all property owned or used by electric utilities within the State of Wisconsin for the purpose of levying and collecting taxes. An annual assessment is conducted, based on (1) the market value of outstanding stock and debt; (2) the full value of all real and personal property; and (3) the productivity of the property. The final valuation is made on all of the property used in the operation of the utility, as evidenced through its productivity, referred to as the "unit assessment". This assessment is categorized as "personal property" because it is based on the concept that the property is made valuable by reason of its earnings.

More specifically, the property that is taxable by law includes all franchises, real estate, rights-of-way, poles, wire, conduits, cables, devices, appliances, instruments and all other real and personal property of the company used or employed in the operation of its business. The list of taxable property also includes all titles and interests of the company. For that property which is jointly owned by two or more companies, the "unit assessment" shall include and cover a proportional share of that portion of the property jointly used. It is important to note that treatment plants and pollution abatement equipment are exempted from taxation by law. The actual assessment is based on data from the system of accounts established by the Public Service Commission.

Utility Tax Levy

The individual tax liability payable by each power company in the state is determined by multiplying the sum of the average value of the prior three years' assessed full values of all company properties by the statewide average full value tax rate. 10/ These taxes are paid by the company to the state treasurer -6.7% are retained in the state general fund, while the majority, 93.7%, are allocated to the

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10/ Determined by dividing all general property taxes levied by all local units of government in the state by the full value of all taxable general property.

Municipal and Shared Tax Account.

The special utility tax payment is thus designed to provide just compensation to local units of government, (hence the individual taxpayer) for the negative effects of power plant construction and operation.

History

While the statutory basis of the special utility tax payment has typically undergone numerous amendments, only a few of these have involved any major change. Since the study examines the impacts of existing electric generating facilities, with data spanning from 1930 to the present, an historical summary will precede the explanation of the present distribution formula.

The original utility tax payment legislation, enacted in 1905, (Chapter 493), apportioned revenues derived from utility taxation at a rate of 15% to the state, and 85% to the municipality. In 1917, (Chapter 667), the apportionment ratio was changed to: 15% to the state, 20% to the county, and 65% to the municipality. This distribution ratio remained in effect until 1963 (Chapter 76.28), at which time it was very slightly changed to: 17% to the state, 18½% to the county, and 63½% to the municipality (76.28).

These funds were distributed according to the following: 19½% of the total taxes paid by the utility would be apportioned to all counties containing and/or serviced by that utility property on the basis of the total net book value of utility property located in that county, and the value of total business transacted in that county by the utility in question. The 63½% allocated to municipalities were allocated accordingly to all towns, villages and cities containing and/or serviced by that utility.

The municipalities which contained the actual production facilities thus received a much greater amount of revenues due to the high valuation of the property.

The utility tax revenues returning to local units of government were of such magnitude that the net effect was the creation of virtual "tax islands" for those municipalities containing sizable power-generating facilities. As early as 1943, the Interim Commission of Legislation on State Aids and Income Taxes stated: "This allocation of utility taxes is a complex and grievous problem and the legislature should do something to make the allocation more equitable."

Despite substantial dissatisfaction with existing distribution ratios, not until 1967 was action taken to develop an alternative.

The distribution formula described below represents an attempt to equalize these ratios.

Utility Tax Distribution Formula

The revised utility distribution is essentially divided into two separate formulas; the first (based on the old distribution formula) applies only during the first four years of construction; the second covers the period after the first four years.

The First Four Years

To attenuate some of the negative effects of electric-generating facilities and to provide certain incentives to promote a favorable local reaction to the siting and construction of proposed power facilities, the 17/19½/63½ distribution formula was retained, in part, in the new distribution. Specifically, Chapter 79.04(3) directs that taxes collected on a new production plant (not within one mile of an existing plant used by the same company) during the first four years of its construction are to be distributed according to the old distribution formula (76.28, 1969). Thus, 17% of the monies are retained by the state, while 83% are returned to the counties and municipalities who have utility property within their jurisdictional boundaries. Of this total, 63½% is distributed to municipalities in proporation to the net book value of (1) the utility property located within the tax administration district, and (2) the retail business transacted within each tax district (negligible for a plant under construction.) The county proportion is based on 19½% of aggregate net book value for all tax districts within that county. The four year time limit was chosen, in part, because of the three year time-lag involved in the tax burden payment part of the formula.

School District Allotment

Under the revised distribution formulas, a municipality receiving utility tax revenues is required to share 50% of its payment with the school district, or districts, in which it is located, if the population of the county in which it is located totaled less than 50,000. If the county population was greater than 50,000, or if there is a city within the boundaries of the receiving civil division, sharing by the municipality is not required.

The general trend of the past two to three decades has been toward sizable increases in plant size and capacity and corresponding increases in net book valuation. The growth in individual plant capacities has accompanied a trend toward the siting of these facilities in more rural areas. The net effect has been the allocation of revenues of sufficient magnitude to completely eliminate the need to levy a local property tax in some cases. 11/

The primary goal of the revised distribution formulas (Chapter 79) was to attenuate the size and number of these "tax islands" which would inevitably develop around any sizable power-generating facility. The formula below addresses itself to all power plants beyond the first four years of construction.

Utility Tax Payment Formulas

The final payment to the municipality will be the lesser of the following amounts:

(1) The amount determined by multiplying 11 mills times the net book valuation of all power plant property 12/ exclusive of land

(2) a. If the average per capita value of a municipality is less than 140% of the statewide average per capita full value:

The amount determined by multiplying 5 mills times the full value of all taxable property in the municipality, including the plant.

11/ In 1966, the City of Port Washington received $448,066 in shared utility taxes; this amounted to 46% of the total property tax levy of the city in that year. The Village of Cassville received $214,714, or 446% of its entire property tax levy during the same year, 50% of which was required to be given to the school district.

12/ Power plant property used to determine this total includes general structures, production plant (including substations) and leased property.

(2) b. If the average per capita full value of a municipality is greater than 140% of the statewide average per capita full value:

The amount determined by multiplying 3 mills times the full value of all taxable property in the municipality, including the plant.

School Portion

The municipality is required to pay 4/11's of these utility tax revenues to the school district(s) which apportion school tax levies to that municipality. If the municipality includes a union high school district, the amount allocated shall be divided equally between the union high school district and elementary districts. If there is more than one elementary district, the monies shall be divided proportionately.

County Portion

The county utility tax payment is determined by multiplying 6 mills times the net book value of all power plant property, exclusive of land.

The Guaranteed Make-Up

The revised formula caused such a sizable reduction in the amount of utility tax revenues apportioned under the old formula that an immediate shift to the new distribution would have created tremendous budgetary difficulties for the affected municipalities. To minimize the fiscal impact, a special payment, commonly referred to as the "guaranteed make-up payment" was devised to provide an intermediary adjustment period.

Section 79.06 (1973) provides that a municipality will receive no less than 90% of the revenues received the previous year for both state shared aids and general property tax relief, subject to a per capita limitation of $600. (Section 79.05, 1973)

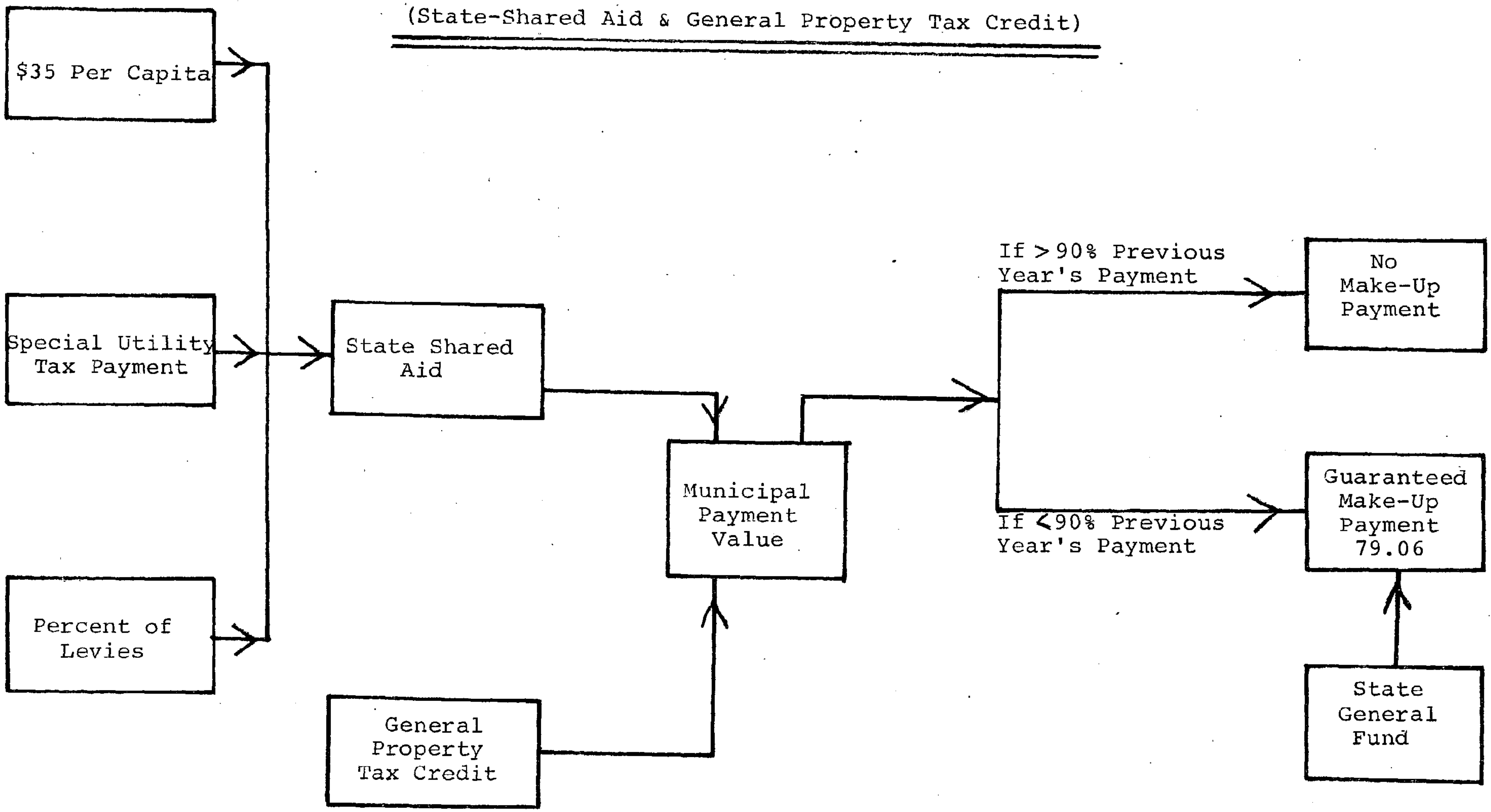
Example: (For purposes of clarification, all other shared taxes and aids will be ignored.) A municipality which received $1,000,000 in the form of utility payments in 1971, but only $300,000 under the revised distributional formula, would be guaranteed 90% of its previous year's payment, and would, therefore, receive $600,000 in the form of a guarantee payment, or $900,000 total.

However, this guarantee payment is subject to the $600 per capita limitation. Thus, if the town had a population of only 500, it would receive the $300,000 through the guaranteed make-up (rather than $600,000), making its total payment for that year $600,000.

The next year's payment, however, will not be based on 90% of the $600,000 received the previous year, as might be expected. Rather, expected "gross" receipts (without population restrictions) will be computed ($900,000), and 90% of that amount, or $810,000, minus the actual utility tax payment made that year will equal the "gross" guaranteed make-up payment. This sum will then be adjusted for the $600 per capita limitations again limiting the make-up payment

GUARANTEED MAKE-UP PAYMENT

(State-Shared Aid & General Property Tax Credit)



Explanation:
The purpose of the guaranteed make-up payment is to assure a municipality a somewhat stabilized source of revenue. The guaranteed make-up payment guarantees a municipality that the present year's "payment" will be equivalent to at least 90% of the previous year's payment. If a guaranteed payment is required it will be drawn from the State's General Fund.

to $300,000. Total revenues received will thus continue to be equal to the utility tax payment (determined by mill-formula) plus $600 per capita, until such a time that the guaranteed make-up payment is less than $600 per capita.

School Guaranteed Make-Up Payment

School districts shall receive 30% of the guaranteed-make-up payment if such a payment is to be made.

While devised specifically to cushion the drop in utility tax payments, any municipality which receives less than 90% of the previous year's revenues - for whatever reason - is qualified to receive a guaranteed make-up payment.

It should be noted that other state aids may be reduced, or eliminated with increased revenues from the utility tax payments - due to "demonstration of need" restrictions.

Appendix Ia

STATE PROPERTY TAX CREDIT (79.10)

The property tax credits are designed specifically to reduce the property tax burden of the individual property owner. These tax relief funds are drawn from a general State fund and distributed in accordance with the complex formula explained below.

Step 1. A. The preliminary step involves the computation of a three-year average full value rate. The sum of general taxes, woodland taxes, forest crop taxes, occupational taxes, and total of all new special assessments of each municipality is determined for each of the three years preceding the year in question.

B. Each yearly aggregated tax total is then divided by the total equalized value of all real and personal property in the taxation district for that year to determine a "computed full value rate".

C. The "computed full value rates" for the three years are then averaged. The rate of 17 mills is then subtracted to compute the three year average full value rate over 17 mills.

$$\frac{(CFVR_{t-1}) + (CFVR_{t-2}) + (CFVR_{t-3})}{3} - 17 \text{ mills} = \text{3-yr. avg. } CFVR > 17 \text{ mills}$$

t = present year
CFVR = computer full value rate

Step 2. A "net" equalized value is determined by adding the sums of real estate and personal property, exclusive of livestock, merchants' inventories, and manufacturers' materials and supplies, as computed by the Department of Revenue.

Step 3. The three year average full value rate over 17 mills (Step 1) is multiplied by the "net" equalized value determined in Step 2 to compute the "levy over 17 mills".

$$\left(\begin{matrix}\text{3-yr. average} \\ CFVR > 17 \text{ mills}\end{matrix}\right) (\text{"net" equalized value}) = \text{levy over 17 mills}$$

Step 4. The percent of each "levy over 17 mills" relative to the statewide total levy over 17 mills will be that tax administration district's percentage of the total tax relief fund - or its tax credit.

$$\frac{(\text{levy over 17 mills})}{(\text{statewide levy over 17 mills})} = \%\text{ State Tax Relief Fund}$$

$$(\%\text{ tax relief fund})(\text{total fund}) = \text{Total Tax Credit}$$

Step 5. This tax credit is then applied to each property tax levy by the district's clerk at a rate commensurate with each taxpayer's relative percent of total district valuation.

Appendix Ib

TAX TERMINOLOGY

Assessed Value: the value of property as assessed at the discretion of local assessors, at some uniform percentage of equalized value.

Assessment: the valuation of property reflecting potential-use* value.

* by Wisconsin Statute; as opposed to "classified" or "preferential", assessment based on circumstances of ownership or use.

Assessment Ratio: the taxable assessed value of property expressed as a percentage of the equalized value.

Effective Mill Rate: the annual tax liability assigned to the property, expressed as a percentage of the taxable fair market (equalized) value of the property (effective rate).

municipal tax liability = (effective mill rate) (equalized valuation of property)

Equalized Value: value of property assessed at a uniform rate throughout the state; generally used to refer to 100% rate* of assessment, or full value.

"s. 70.57, Wis. Statutes, 1969

Fair Market Value: expressed in monetary terms; value agreed upon by a willing buyer and a willing seller.

Full Value: the value of property as assessed by the State Department of Revenue reflecting full potential-use value.

General Property Tax: a fee charged by a municipality against all classes of property in a uniform manner, based on the assessed valuation of property and local property tax rate(s).

(tax rate) (aggregate full value of municipality's property) = total municipal tax levy

(tax rate) (assessed property "x") = gross tax paid by "x"

Mill: 1/1000 of a dollar

Mill Rate: tax rate expressed in mills-per-dollar terms.

Nominal Mill Rate: the annual tax liability assigned to the property, expressed as a percentage of the taxable assessed value of the property (nominal rate).

$$\frac{\text{municipal tax liability}}{\text{assessed municipal valuation of property}} = \text{nominal mill rate}$$

Real Property: consists of land and structures or permanent improvements on the land. Realty.

Realty: real property

Tax Base: the sum of all property, real and personal, within jurisdictional boundaries.

Tax Rate: the ratio of the tax levy of the jurisdiction over the full value of property in the jurisdiction.

$$\frac{\text{total taxes levied}}{\text{aggregate full value of property}} = \text{tax rate}$$

Net Book Balue: real worth, or value of real or personal property as determined by the Department of Revenue; the depreciated value.

Includes:

G - general structures
L - leased property
P - production plant including substations, exclusive of land

$NBV_{G,P,L}$

"Work in Progress": used in reference to value of property under construction (production plant and general structures)

NBV_{WP}

"Used": in reference to property being leased, rented, or otherwise utilized by an individual or corporation other than the proprietor.

Municipality: refers to any town, village, or city in the state. Where a municipality is located in more than one county, the portion thereof in each county shall be considered a separate municipality for all tax purposes.

Population: refers to the number of persons residing in each municipality and county of the state as last determined by the Department of Administration under s. 16.96.

Appendix II

PSC-CZM Work for December 15, 1975 to May 31, 1976

Extend the study begun in the first year by applying the equations from that study to 14 possible power plant sites in the coastal zone. The 14 sites have been chosen to include different degrees of urbanization. Both coal and nuclear power plants will be considered. The effects of four power plant sizes will be predicted for each site -300,500,1000, and 5000 MWe.

The equations predict economic and social effects of power plant construction in the townships near the site both during the construction period and during the first ten years of plant operation.

During the construction period, equations will be used to predict the following: property tax, police expenditures, mercantile and manufacturing property values in both the primary and secondary areas.* For the first 10 years of plant operation (post-construction), residential, mercantile and manufacturing property values in the primary area, residential property values in the secondary area, and school enrollments in both areas will be predicted. Utility tax payments to the municipalities, counties, and school districts near each site both during and after construction will be calculated using the new (1975 budget) formula. Values will be calculated for two possible costs per MW and for all four sizes of both coal and nuclear power.

* Primary area- the township(s) containing the power plant site.
Secondary area- townships adjacent to the primary area, including those containing the nearest large villages or city.

From the results of this analysis, the possible social and economic impact of building power plants within the coastal zone will better defined. The effects of choosing coal vs. nuclear and of choosing large vs. small power plants should be clear. The relative impact of power plant construction and operation on rural communities, villages, cities, or metropolitan areas will be noted.

The possible sites are:

Barksdale, Bayfield Co.
Ashland, Ashland Co.
Pensaukee, Oconto Co.
Little Suamico, Oconto Co.
Holland, Brown Co.
Manitowoc, Manitowoc Co.
Herman, border between Sheboygan and Manitowoc Cos.
Sheboygan (Edgewater), Sheboygan Co.
Belgium, Ozaukee Co.
Port Washington, Ozaukee Co.
Germantown, Washington Co.
Lakeside (St. Francis), Milwaukee Co.
Raymond, Racine Co.
Pleasant Prairie, Kenosha Co.

Of these 14 sites, only Lakeside, Sheboygan, Pensaukee, Little Suamico, and Barksdale are on or very close to the shoreline. All other sites are 1-10 miles inland.

If it takes longer to gather and evaluate data than now expected, the Raymond, Manitowoc, Ashland and Pensaukee sites may be dropped.

The report of this work will include a brief discussion of the meaning of changes in property values. Increased non-agricultural property values measure community growth. Whether the pattern of growth is sprawl or is contained near the communities neighboring the power plant site was not examined in the previous work. Local communities may want to exercise control over this growth.

Environmental impact of power plant construction will not be discussed. The first set of long range plans is due from the utilities July 1, 1976 (under the new Power Plant Siting Law). The PSC must write an Environmental Assessment of these plans by January 1, 1977. Since the plans include all sites at which construction is expected to commence during the next 10 years, and since some of the proposed sites will be in the coastal zone, a separate discussion of environmental impact is not necessary.

The report will put coastal zone power plant siting in the context of available water supplies (from the Great Lakes and inland rivers & lakes) and projected growth in demand for electric power. The additional cost of moving power plants back 1-2 miles from the shoreline will be considered.

SJ:sa

Barksdale
Ashland
Pensaukee
Little Suamico
Holland
Manitowoc
Herman
Sheboygan
Belgium
Port Washington
Germantown
Lakeside
Raymond
Pleasant Prairie
DOUGLAS
BAYFIELD
ASHLAND
IRON
VILAS
WASHBURN
SAWYER
BURNETT
PRICE
FOREST
FLORENCE
ONEIDA
POLK
BARRON
RUSK
MARINETTE
LINCOLN
LANGLADE
TAYLOR
OCONTO
CHIPPEWA
ST. CROIX
DUNN
MARATHON
MENOMINEE
CLARK
SHAWANO
PIERCE
EAU CLAIRE
DOOR
PEPIN
WOOD
PORTAGE
WAUPACA
BROWN
KEWAUNEE
BUFFALO
OUTAGAMIE
JACKSON
CALUMET
TREMPEALEAU
JUNEAU
ADAMS
WAUSHARA
WINNEBAGO
MANITOWOC
MONROE
LA CROSSE
MARQUETTE
GREEN LAKE
SHEBOYGAN
FOND DU LAC
VERNON
SAUK
COLUMBIA
DODGE
OZAUKEE
RICHLAND
CRAWFORD
WASHINGTON
DANE
GRANT
IOWA
JEFFERSON
WAUKESHA
MILWAUKEE
GREEN
ROCK
WALWORTH
RACINE
LA FAYETTE
KENOSHA

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