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A COMPARISON OF DECISION MAKING AND ADMINISTRATIVE ORGANIZATION FOR MUNICIPAL WATER SUPPLIES IN MEDIUM-SIZED AND SMALL ILLINOIS MUNICIPALITIES

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ABSTRACT

A COMPARISON OF DECISION MAKING AND ADMINISTRATIVE ORGANIZATION FOR MUNICIPAL WATER SUPPLIES IN MEDIUM-SIZED AND SMALL ILLINOIS MUNICIPALITIES

The study was designed to provide information on the decision making and organizational characteristics of municipally owned water systems in small and medium-sized Illinois municipalities, and to relate these characteristics to municipal as well as other water system characteristics. Data on the municipal water systems of 228 Illinois incorporated municipalities were gathered through mail and telephone surveys, as well as from secondary sources. The municipalities were chosen as part of a 50-percent sample, stratified by size, of all incorporated municipalities in Illinois with populations between 1,000 and 50,000. In addition to selected descriptive informtion on the water systems, the data are reported under water system decision making; planning and financial management; and technical management. Attempts to determine the relationships between the dependent variables and municipal and water system characteristics indicated a general weakness or absence of such relationships. While the quality of the data cannot be ruled out with certainty as the reason for the absence of the relationships, it is suggested that the relative lack of active interest on the part of municipalities in their water systems may account for the findings. The historical absence of the necessity to actively manage the water system other than in a routine fashion may have left these water systems quite unprepared to meet future sudden challenges.

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TABLE OF CONTENTS

LIST OF TABLES

I. Introduction

The present report deals with municipal public drinking water systems in small and medium sized cities in Illinois. The concern is not primarily with the technical, financial, and engineering aspects of the water system, but with the social and organizational factors which are related to provision of such a local service as public water. Specifically we will set out to determine what relationship exists between the provision of water services and characteristics of the municipality.

Most Illinois citizens expect to have access to high quality water for home consumption or industrial usage whenever they so desire. In a general sense public water supplies are probably one of the least controversial public services supplied by local governments. At a time of continuous crises in the provision of local public services this is a remarkable state of events. However, all is not totally well with drinking water supplies. Recent national tests by the Federal EPA have indicated that pollutants may be present at higher levels and more frequently than commonly assumed. Tunley (1975) states that throughout the decade of the 1960's there were 128 outbreaks of illness linked to water. In these instances 46,374 persons became ill and 20 persons died. It is noteworthy that these statistics are concerned with only <u>reported</u> outbreaks.

In addition to water quality, the ways in which the systems operate also have been of concern. In Illinois a study of the economics of local water systems indicated wide variations in the efficiency and quality of the fiscal management of water systems (Afifi and Bassie, 1969).

Local public water systems are clearly not homogeneous in the degree to which they are able to provide services, nor are the services expected of the same nature in all municipalities.

> "Each small community has its own configuration of problems in managing water services due to special conditions of resource availability, age and serviceability of plant and equipment, and water service demands." (B. U. Dall and Hsiu-Hsiung Chen, 1975:32).

Solutions to problems also cannot be uniform throughout the state. Still policy makers at the state and federal level find themselves frequently in a position of making decisions affecting many units of government at the same time. Such decisions may range from determining water quality and public health enforcement standards to granting funds for designing new facilities.

Rising per capita consumption and urban population growth can be considered to be the main contributors affecting the future requirements for municipal water systems. The Department of Health, Education and Welfare projects (for medium-range population projections) that Illinois will consume 2,107 million gallons of water a day in 1980, and 3,208 million gallons in the year 2000. According to these projections Illinois will rank third of all the states in 1980 and fourth in the year 2000 for water consumption (U.S. Senate, Select Commission on Natural Water Resources, 1959 and 1960).

The last few decades have been characterized by changes in both the structure and the function of American communities. There has been an apparent reduction in the contrasts between urban and rural social organizations. The smaller communities have been increasingly embarking upon avenues of activity which mark them as being more "citified." Along with this we have seen the phenomenal growth of the communities which surround the central cities. In many instances tracts of land which were formerly agricultural in use have now become residential neighborhoods, while, in other cases, small, already-existing communities have grown from small town shopping areas to become the downtown of an expanding city. Often these growing communities have become satellites of a nearby metropolis, and can be seen in reality as suburbs of that city.

Several analysts (Sjoberg, 1964; Berry and Horton, 1970; Fuguitt, 1971) have recently spoken of metropolitan dominance as being a most important factor in any analysis of non-metropolitan communities. Metropolitan dominance is the influence exerted within a metropolitan system by the center city over the other population centers. The center city not only affects the economic activities in the secondary cities, but also affects their social organization and community activities. While the large metropolitan centers affect the surrounding cities, their influence is restricted in space and farther outlying municipalities will display increasing degrees of local autonomy.

Rice and Beegle (1972) point out that metropolitan dominance should not be treated as a fixed attribute, but as a variable. In other words, a metropolitan region's control over the communities of the surrounding hinterland can vary according to the size of the metropolis and the accessibility (distance) of the dominating center to these hinterland communities.

For our Illinois study, it was then necessary to construct a variable with which we could classify the communities in question in accordance with the twin influences of size and distance. Accordingly we called our variable "metro" and the responding towns were divided into three categories. Into the first category (metro 1) fell those towns of a more rural type, which were neither close to a medium sized SMSA (Standard Metropolitan Statistical Area), nor to a large SMSA. The second category contains those communities which were within 25 miles of a medium sized SMSA.[1/] The final category (metro 3) contains the communities located within a fifty-mile radius of the large Illinois SMSA centers of Chicago and East Saint Louis.

Within each category of metropolitan dominance we will relate water system characteristics and municipal characteristics to the measures of the dependent variables: decision making concerning water, planning and financial management, and technical management of the water system.

The present study will delineate characteristics of municipal water systems for Illinois' cities of between 1,000 and 50,000 inhabitants, and determine how these characteristics relate to other characteristics of the municipalities. The sample for this study

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1/ The medium sized SMSAs within and outside Illinois were: Peoria, Bloomington, Decatur, Champaign, Springfield, Rockford, Rock Island, Evansville, Ind., Dubuque, Iowa, and Terre Haute, Ind.

was drawn during the summer of 1973 from all Illinois municipalities with a population of 1,000 to 50,000, according to the 1970 Census. A stratified sample was derived by selecting every other municipality in descending order of size. A total sample of 291 communities was drawn. The mayor and the chief sewage treatment operator were chosen as the key respondents for each community in the sample.

The main survey was conducted in the period from June until October, 1974. Mailed questionnaires were sent to all the mayors in the sample. If the mayor did not reply, telephone interviews were conducted. If the mayor refused to cooperate, the municipality was dropped from the sample and was replaced with another of approximately the same population.

Two hundred eighty-four mayors were ultimately interviewed. Since the interviewing of other key respondents depended on the mayor, the total sample for water systems was reduced to 284 municipalities. Of the 284 municipalities, 8 were located in large metropolitan water systems. For the 276 remaining municipalities, 251 water operators were interviewed, 21 refused and 4 could not be contacted. Of the 251 systems, 228 were municipally owned. The data presented in this study will be based on the responses which were given by those municipally owned systems.

The remainder of this report will be organized in six chapters. In the next chapter we will report the data gathering and offer methodological information. In chapter three we will provide general background information on the water systems in our sample. Chapters four, five, and six will report the development of indicators of the main characteristics of the water systems to be dealt with in this study: decision making, planning and financial management; and technical management, respectively. These chapters will also determine how other municipal characteristics such as population size, location, resource structure, and local government organization relate to the characteristics of the water system. Finally in chapter seven we will discuss some implications of the findings for the operation of the Illinois municipal water systems.

II. THE DATA

The sample for the present study was drawn from a universe of all municipalties with a population of 1,000 to 50,000 according to the 1970 Census (University of Illinois, College of Agriculture, 1971). A total of 583 municipalities fell within this population range. A stratified sample was derived through the selection of every other municipality listed in descending order of size. The total sample included 291 or 50 percent of all Illinois municipalities with a population between 1,000 and 50,000. The sample was chosen during the summer of 1973. 1/

The mayor and the chief water plant operator were chosen as the key respondents for each municipality in the sample. The names, addresses, and telephone numbers of the key respondents were gathered in January of 1974. If the municipality was served by a separate water or sewage district or private company, the appropriate plant was contacted.

In addition to the water system respondent we interviewed mayors. If the community had a city manager or village administrator,

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1/ The data were gathered in conjunction with a larger study on the provision of environmental quality in Illinois cities.

that individual was the selected respondent.[1/]

A second sample was drawn from the 292 towns remaining after the community sample had been selected. The communities were listed in descending order of size and divided into groups of five. The third community from each group of five was chosen for inclusion in the second sample, yielding a total of 57 communities. The 57 communities were then listed in descending order of size and divided into groups of five, the second community from each group of five being chosen for a pre-test sample.

The interview schedules were constructed after interviews with approximately a dozen experts in the field of water systems. In addition the research staff traveled to a number of Illinois municipalities for extensive interviews with local officials. Intermediate versions of the interview schedule were repeatedly tested in personal interviews and revised.

A final pre-test was conducted in February-March of 1974 by the Survey Research Laboratory (SRL) of the University of Illinois in Urbana. On the basis of the pre-test results, further modifications in the schedules were made. The SRL pre-test sample consisted of 12 communities, leaving a total of 45 communities for the replacement sample.

1/ In the event that the community had a city manager or a village president, the questionnaire was directed to them. For the sake of brevity, we will henceforth call all of these administrative officers by the title of "mayor."

The main survey was conducted by SRL beginning in June of 1974 and lasting through September. Mailed questionnaires were sent to all the mayors in the community sample. If the mayors did not reply, telephone interviews were conducted. If the mayor refused to cooperate, the community was dropped from the sample and was replaced with a municipality of approximately the same population. This action was based on the stipulation that the mayor's interview was required before the water system respondent was contacted.

The replacement municipalities were chosen from the replacement sample of 45 communities derived from the second sample previously discussed. Replacement was discontinued on August 14, 1974. Therefore, those remaining municipalities in which the mayors could not be contacted, or refused, were excluded from the rest of the survey.

From the original sample of 291 municipalities, 20 were replaced. Thus, altogether, 311 communities were selected. In 7 cases the mayor refused to cooperate; in 16 cases he or she could not be contacted. For 4 municipalities the interview schedules were determined not to be usable.

The data from the interviews were coded and prepared for computer processing. At that point they were combined with selected data relating to city characteristics such as size, location, population growth, and economic resources, from the ISEIRD system (Illinois Social and Economic Indicators for Rural Development).

For the water system operator, 284 telephone interviews were attempted. In 8 communities, the water operator could not be found.

This included municipalities being served by a large scale water company such as the East St. Louis Interurban Company. In the 276 remaining communities, 251 water operators were interviewed, yielding a response rate of 91%; 21 operators refused and 4 could not be contacted.

Tables 1 through 3 provided some information on the water system operators. In these we show whether or not the respondent was certified by the State of Illinois as a water plant operator; if so, their class of certification; and finally, the level of formal education they had completed. In the first table we see that 77% were certified and 22% were not. Of those who were certified, 71 operators (40%) were in Class A. Class B certification was held by another 40 operators; 56 respondents were included in Class C. And 10 operators (or 5.6%) were certified Class D. In regard to the highest level of formal education attained by the water operators, 20 said they had a grammar school education or less; 28 had received some high school. Over 40% (93 operators) had graduated from high school, and 63 operators had had some college. Twenty-two had graduated from college. One operator has a post-graduate degree, and one did not reply.

Table 1. Illinois Water Plant Operator Certification (N = 228)[a/]

Response	Frequency	Percent
Yes	177	77.6
No	51	22.4

a/ For various reasons the number of municipalities from which observations are available varies between tables. The number of municipalities included in each table is indicated at the close of the table heading.

Table 2. Class of Illinois Certification (N = 177)

Class	Frequency	Percent
Class A	71	40.1
Class B.	40	22.6
Class C	56	31.6
Class D	10	5.6

Table 3. Highest Level of Formal Education Obtained by the Water Operator (N = 228)

Level	Frequency	Percent
Grammar school or less	20	8.8
Some high school	28	12.3
High school graduate	93	40.8
Some college	63	27.6
College graduate	22	9.6
Postgraduate degree	1	0.4
No reply	1	0.4

III. TYPES OF WATER SYSTEMS

The water systems which are included in this study are quite diverse in terms of organizational arrangements, size, and operating characteristics. In this section of the report we will provide some background material necessary to place the findings in a proper context. The variables to be considered in this section relate to: ownership of the water system; its size; water usage; and work force characteristics. An examination of these variables will show the diversity of Illinois water systems in regard to ownership, levels and demand of production, resources available, and finally the composition of water usage.

A. Ownership

Table 4 presents the division of ownership of the water systems in our sample of 251 cities. Private corporations owned the water systems for 15 communities, while 8 communities reported small regional arrangements.[1/] The bulk of the systems (228), nearly 91 percent, were classified as municipally owned systems. As indicated in chapter one, the present analysis is restricted to municipally owned systems.

B. Size

One indicator of the size of the municipal systems is the number of gallons of water produced in 1973, the year preceding the time of data gathering. This information is presented in Table 5. We divided all water systems into four categories of equal numbers (quartiles)

1/ Another 8 municipalities received their water from large metropolitan systems. No data were gathered for those municipalities.

Table 4. Ownership of Water Systems for Total Sample (N = 251)

Type of ownership	Private	Regional	Municipal
Frequency	15	8	228
Percent	6.0%	3.2%	90.8%

Table 5. Number of Gallons of Water Produced in 1973 (N = 186)

Ranking	Gallons produced (in millions)
First quartile	less than 43 million
Second quartile	44 to 201
Third quartile	204 to 897
Fourth quartile	900 or more

Table 6. Percentile Ranking for Daily Rated Capacity, Average, and the Maximum Number of Gallons in a 24-Hour Period

Ranking	Daily rated capacity	Average in a 24-hour period	Maximum in 24 hours
First quartile	10,000- 320,000	10,000- 140,000	10,000- 220,000
Second quartile	350,000-1,130,000	150,000- 410,000	230,000- 710,000
Third quartile	1,150,000-3,260,000	420,000-1,500,000	750,000-3,000,000
Fourth quartile	3,270,000-50,000,000	1,600,000-20,000,000	3,100,000-29,000,000
(N)	(208)	(216)	(214)

after ranking them according to increasing size. In 1973 the first quartile (the 25 percent of the water systems which were smallest) produced from less than a million gallons to 43 million gallons of water. Those systems that fell into the second quartile produced from 44 million gallons to 201 million gallons. The third quartile ranged from 204 million gallons to 897 million gallons of water. The 25 percent of the water system which included the largest ones produced more than 900 million gallons. There is quite a diversity in the capacity of the systems under study; output ranged from less than 1 million gallons to more than 1 billion gallons!

Another way of looking at the size of the systems is to analyze its daily output. In Table 6 we listed the daily rated capacity of the water system (the engineering rating on the amount of water the system can provide on a daily basis for a sustained period, not reflecting actual usage, but potential usage), the average production in a 24-hour period, and the maximum water output reported for a 24-hour period during the preceding year. The data are again summarized by ranking the systems from small to large in four numerically equal groupings.

The data in Table 6 again illustrate that systems differed widely in regard to their daily rated capacity, average production in a 24-hour period, and the maximum amount produced in a 24-hour period. The first quartile reported between 10,000 and 320,000 gallons as their rated daily capacity; the average number of gallons for this quartile is between 10,000 and 140,000; the maximum is from 10,000 to 220,000 gallons. The next quartile ranges from 350,000 to 1,130,000 as daily rated capacity, producing between 150,000 to 410,000 gallons per day on the average, and from 230,000 to 710,000 as the maximum. The third quartile has 1,150,000 to 3,260,000 gallons as the daily rated capacity; 420,000 to 1,500,000 gallons were reported as the average for a 24-hour period, and 750,000 to 3,000,000 gallons were given as the maximum for the same period. The last quartile has between 3,270,000 and 50,000,000 gallons as daily rated capacity; 1,600,000 to 20,000,000 for the average, and 3,100,000 to 29,000,000 for the maximum amount produced in 1973.

C. Sources

In addition to differences in size, the water systems are also characterized by the ways in which they obtain water. Essentially three types of water sources are available to Illinois water systems: groundwater (wells or springs), surface water (lakes, rivers, etc.), or water purchased from another system. In the latter case, the buying system does not control the original source of the water. Groundwater is the most frequent source of water used by the water systems; Table 7 shows that around 70 percent of the systems obtain at least some water from groundwater sources. Just over 20 percent of the systems obtain at least some water from surface sources, and about 15 percent of the water systems bought part or all of their water from another water system. Table 7 also indicates that few water systems rely on more than one type of water source.

Of those communities which use groundwater, 97.5 percent receive their water from wells, and only 2.5 percent use springs. It is generally considered necessary for a system to have access to several wells in order to guard against sudden interruptions of the water flow. Only nine water systems (5.8 percent of those using wells) reported having only one well. Of those nine, three reported having access to surface water or purchased

Table 7. Types of Water Sources Used by Illinois Municipalities (N = 227)

	N	%
Groundwater exclusively	147	64.5
Surface water exclusively	43	18.9
Purchased water exclusively	28	12.3
Ground and surface water	4	1.8
Ground and purchased	5	2.2

Table 8. Water Usage in 1973 by Percent (N = 198)

Ranking	Residential	Commercial	Industrial
1st quartile	20-60%	0-1%	0 %
2nd quartile	65-80%	2-5%	0- 1 %
3rd quartile	85-90%	6-15%	2-17 %
4th quartile	95-97%	16-70%	20-75%

Table 9. Ratios of Employees as Full Time, College Graduates, and Those Having Attended College, to the Total Number Employees in the Water System

Percent employed	Fulltime employees		College graduates and some college		College graduates	
	Frequency	%	Frequency	%	Frequency	%
0	16	7.0	102	46.6	185	83.7
1-50	11	4.9	81	37.0	32	14.5
50-99	79	34.7	29	13.2	3	1.4
100	121	53.4	7	3.2	1	0.5
	(N = 227)		(N = 219)		(N = 221)	

water as well. Approximately 70 percent of the systems reporting wells had between two and four wells for their water source.

D. Usage

While the amount of water and the sources of water indicate considerable variation in Illinois municipal water systems, the usage of the water also varies considerably. Table 8 indicates the allocation of water usage by residential, commercial, and industrial consumption.

Residential usage is predominant; more than half of the systems use 80 percent or more of their water for residential consumption. On the other hand, half of the systems used five percent or less of their water for commercial or industrial usage. The overwhelming usage of water for residential purposes should not obscure the fact, however, that commercial and industrial usage is quite important in many systems.

E. Work Force

Tables 9 and 10 provide us with some information on the type of work force employed by the water systems. The first column in Table 9 shows the ratio of full time employees to the total number of employees. Sixteen communities had no full-time people in their water system. About 5 percent of the towns had half or fewer of their employees half time; and about 35 percent of the water systems had more than half but not all employees as full time. Finally, 121 systems (over 50% of those responding) had 100 percent of their water employees working full time.

The second column shows the ratio of the water system employees who have either had some college or are college graduates, to the total number employed in the system. Over 46 percent reported having no employees in this category. Eight-one towns fell into the 0-50 percent range. Twenty-nine towns were included in the 50-99 percent range. Seven systems responded that all of their employees had at least some college education.

The third column shows the ratio of employees who were college graduates to the total number employed. Over 83 percent of the respondents reported having no college graduates employes in their water systems. Thirty-two replied that they had been 1 and 50 percent college graduates on their work force. Only 3 systems (1.4%) fell into the category of 50 percent to 99 percent. One town reported 100 percent of its water system employees as being graduated from college!

Table 10 shows the breakdown into the different levels of certification which was held by the water system employees. The index was computed such that a town was recorded at its highest level of certification. For instance, if a town had someone in Class A it was recorded, if it did not we moved to Class B, and so forth. Over 44 percent (102 towns) responded that they had an employee certified at the Class A level. Class B certification was the highest, found in 47 communities. Over 25 percent of the respondents (60 towns) had employees at the Class level, and 10 respondents had some employees certified in Class D. Nine communities reported having none of their employees certified.

F. <u>Summary of Characteristics</u>

In conclusion, we have seen a large diversity of characteristics among Illinois water systems. The majority of the communities examined have municipally owned systems. There is great variation in the size of the water systems in this sample: the number of gallons of water produced in 1973 ranged from less than one million to more than one billion. Groundwater, especially wells, is the most frequent source of water for this sample. However, other sources were not so infrequent as to be discounted. Finally, the outstanding water usage for the systems in this sample is residential, but commercial and industrial usage should not be considered unimportant.

Table 10. Towns by Level of Water Systems' Employees Certification (N = 228)

Level of certification	Frequency	Percent
Not certified	9	3.9
Class A	102	44.7
Class B	47	20.6
Class C	60	26.3
Class D	10	4.4

G. Selection of Independent Variables

As we indicated in chapter one, the objectives of the present analysis are to determine the relationships between the provision of water services and characteristics of the water system as well as characteristics of the municipality. Our independent variables were chosen in an attempt to touch upon those characteristics of both the water and municipal systems that could be related to the areas of decision making, planning and financial management, and technical management. As such, two sets of five variables were selected. The variables used to test the effects of the water system characteristics were composed of, first, the number of gallons of water produced in 1973. This variable was used to classify the systems in regard to their position on the hierarchies of large to small producers and large to small demands.

The next variable used is the percent of the water supply that is used for industrial purposes. Industrial usage of the water supply differs from residential usage in that the former almost always involves relatively few users of large quantities. These users frequently are in a position to insist that the water system deal with them in an economically rational and efficient way. The last three variables in this set were chosen in order to control for the human element in the water systems. In one way or another they are related to professionalism and therefore to the efficiency of the system. The first of the three is a ratio of the number of full time employees to the total number of water system employees. If one is employed full time, he (or she) is likely to be more professionally inclined, and perhaps more concerned and interested with one's job, thereby affecting the system. Next, a ratio of employees graduated from, or having some college education to total water system employees was seen as a further indication of the professionalization of the system. The final variable in this set was one which classified the water system's employees according to the level of certification by the State of Illinois, with the assumption that the higher the level of certification, the greater the degree of professionalization.

The second set of five variables was concerned with municipal characteristics. The first of these dealt with the size of the community's population, in an effort to determine if large communities differed from small communities in the areas of decision making, planning and financial management, and technical management. The next variable measured the community's growth in the decade 1960 to 1970. This was done to see if perhaps not only the absolute size but also the rate of growth had effects in these areas.

The third variable treated the per capita municipal expenditures in the year 1970, in order to ascertain the importance of large and small per capita municipal expenditures. A variable concerned with median house value was included to establish the relationships of existing tax structures and the economic composition of the communities' inhabitants to the formerly described areas of study. The final variable ascertained the presence of a city manager. It has been generally conceded that city managers denote a greater orientation toward business, efficiency, and professionalization in municipal affairs.

IV. WATER SYSTEM DECISION MAKING

In order to understand the nature and operation of municipal water systems, it is necessary to understand how the decisions affecting the water system are made. In the decision making process allocations are made of scarce resources of capital and manpower. The decisions affect the long-run and short-run adequacy of the system, are important to the current benefits to be derived from it, and they greatly affect how well future needs of the community will be met.

The position of the municipal government with regard to the water system is of necessity an ambiguous one. On the one hand the municipal government has the responsibility to see that the functions of the water system are properly carried out. This necessitates a certain amount of detailed knowledge concerning the day to day operations of the water system. At the same time the main task of municipal government is to integrate and coordinate the various service functions within the municipality and to mediate and reconcile the various demands on available resources.

In this chapter we will analyze various aspects of the role of local government officials, especially mayors, in the decision making process regarding water. First, we will consider the position of the mayor specifically with regard to the water system. We will ascertain if the mayors act as if they are well-informed, and if the mayor and the water system operator appear to share the same information.

In the second part of chapter four we will briefly discuss the relationship of the mayor to the rest of the municipality in matters of decisions regarding the municipal water system.

Finally, we will address the question of the degree of control by political functionaries over the decisions affecting the water system.

A. The Mayor and the Water System

One important aspect of water system decision making is the nature of the communication between the mayor and the employees of the water system. The mayor has many demands upon his time which compete with the attention that can be given to the water system. However, in order to effectively oversee the operation of the water system, the mayor will need to be well informed.

We decided, therefore, first to calculate a simple knowledge scale which records how frequently mayors were not in a position to answer questions concerning basic aspects of the water system. This knowledge scale is based on the ability of the mayors to provide information regarding the water system. Six questions were asked of the mayors: whether the water system had a written plan; whether the water was tested for nitrogen; for iron; and for coliform; whether there was a set of procedures to follow for severe low water pressure; and what procedure was followed in the event of low pressure. Only when the mayors responded that they did not know did they receive one point. The scores ran from zero to six, with a score of zero indicating that the mayors reported high knowledge of the system and a score of six representing a lack of knowledge about this aspect of the water system.[1/] Two-thirds of the mayors reported having complete knowledge in these areas. Another 14 percent expressed a lack of knowledge in only one

1/ It should be pointed out that the accuracy of the mayor's knowledge is not measured, only his admitted lack of information.

area. Just under 20 percent of the mayors reported that they did not know the answers to two or more of the six questions.

A better measure of the communication regarding the water system is based on the degree to which the mayor and the water system operator share the same knowledge. Efficient operation of a system in the absence of shared information becomes very difficult. To test the degree of shared knowledge, we measured the extent of discrepancy in the separate responses of the mayor and the water system operator to seven identical questions. The following questions were selected: What percent of your water has as its source surface water, groundwater, and purchased water;[1/] is the water tested for nitrogen, for iron, and for coliform; and are there procedures to be followed for severe low water pressure.

Table 11 shows that more than 90 percent of the mayors and watermen agreed on the percent of the water source which was surface water, groundwater, or purchased water. Only around 44 percent of the respondents were in agreement on whether the water was tested for nitrogen. The results were little better in regard to testing for iron: 61 percent agreement. On coliform: 71 percent agreement. Finally, 63 percent agreed on whether the system had a set of procedures for severe low water pressure.

Table 12 provides a score on the number of times agreement exists between the mayor and the water superintendent on five issues regarding

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1/ The percents were given a 5% leeway on either side to be considered in agreement.

Table 11. Agreements Between Mayors and Water Superintendents in Selected Areas of the Water System (N = 228)

Item from questionnaire	Agreement	
	Frequency	Percent
What % water source equals surface water	208	91.2
What % water source equals groundwater	213	93.4
What % water source equals purchased water	210	92.1
Is water tested for nitrogen	100	43.9
Is water tested for iron	140	61.4
Is water tested for coliform	162	71.1
Is there a set of procedures for low water pressure	144	63.2

Table 12. Index of Discrepancy of Information between the Mayor and the Water System Operator (N = 228)

Score	Frequency	Percent
0	48	21.1
1	61	26.8
2	51	22.4
3	45	19.7
4	19	8.3
5	4	1.8

the water system. Both respondents were asked a number of questions. The scores in Table 12 are determined by the degree of agreement between the mayor and the water system supervisor on: the percent of the water source that was either ground-, surface or purchased water (once again allowing a 10 percent margin of error); the testing program includes tests for nitrogen, iron, and coliform; and the existence of procedures in the event of low water pressure. Complete agreement scored zero and complete disagreement between these two officials scored five. Over 20 percent scored zero. Another 26 percent agreed on all except one of the questions. Fifty-one sets of mayors and watermen concurred in all but two instances. Almost twenty percent disagreed in three out of the five. Nineteen pairs did not concur on four of the five questions, and four sets disagreed in all instances.

While considerable differences exist between municipalities on the matter of information shared between the mayor and the water system operator, the information in Tables 11 and 12 appears to indicate that in many municipalities the lines of communication between the mayor and the water system operator leave much to be desired. It also reflects the fact that in the competition for the mayor's attention, the water systems frequently are not faring very well.

B. The Context of Municipal Decision Making on Water

In this section, we investigate what forces other than municipal government have a bearing on the decision making process. The respondents were asked: "How important are the following groups in influencing the water rate schedule in your municipality?" An identically phrased additional question related to major capital expenditures.

The respondents were given a list of possible sources of influence and asked to identify their opinions of these as "not," "somewhat," or "very" important. The responses were then summarized under the following headings: municipal government; the public--made up of residential users and citizens' groups; special interest groups--made up of large volume users, community development corporation or Chamber of Commerce, or large real estate developers; and outside forces--representing interests from outside the community such as bond holders or financial underwriters for bonds, water boards, commissions, etc. The responses were weighted, ranging from not important (weight = 0) to very important (weight = 2) and the mean scores are summarized in Table 13. The mayors rated municipal government as most important, the general public was second most often rated as influential, but outside groups were almost as frequently listed as influential, reflecting the regulatory powers of state agencies like the EPA, and the constraints that may come with providing financing for a system.

In order to gain further perspective on municipal decision making, we asked which group was the single most important in determining water rates. Municipal governments are rated as most influential by over half of the mayors in determining water rates and capital expenditures (Table 14). But the influence of outside groups and the public is considered as most important by more than one-third of the respondents. The data in this section confirm the impression that while municipal governments are primarily responsible for the managerial decisions affecting water systems, they operate by no means in a vacuum and they frequently have to contend with the presence of other interests when making such decisions.

Table 13. Mean Scores of Measures of the Relative Influence of Others in Water System Decisions (N = 228)

	Influence of water rates	Influence of capital expenditures
Municipal administration	1.47	1.64
The public	.68	.68
Outside groups	.62	.61
Special interest groups	.39	.47

Table 14. The Most Important Group Affecting Water Rates and Major Capital Expenditures (N = 219)

	Water rates		Major capital expenditures	
	Absolute frequency	Adjusted frequency	Absolute frequency	Adjusted frequency
Municipal government	128	58.4	132	60.3
Outside groups	43	19.6	53	24.2
The public	39	17.8	33	15.1
Special interest groups	9	4.1	1	0.5

C. Political Control of Water System Decision Making

Political control over the water system is a measure of the degree to which the decisions regarding the water system are made by local government, elected or appointed, officials and to what extent the decisions are left to people who operate the system on a day-to-day basis.

To measure the political control of the decision-making process, a series of indices was created to determine the various parties who have the major responsibility for certain decisions concerning water. A plant operator may be allowed to purchase chemicals and authorize repairs in a decentralized system, whereas these items would be authorized only by the city council, for example, in a highly centralized system. The designated decision makers were divided into four categories: local government officials (comprising such authorities as the municipal head, mayor, manager, city council, aldermen, city clerk, etc.); water system management (superintendent, water commission, water chairman, treasurer of water board, trustees, etc.); local government employees (city treasurer, purchasing agent, director of management services, etc.); and the water system employees (plant operator, department comptroller, manager, engineer, foremen, bookkeeper, etc.).

It was expected that the roles of the various decision makers would differ according to the nature of the decisions. Municipal governments representing the citizenry would certainly be expected to play an active role in the fiscal management of the water system. At the same time municipal governments would also be expected to take an active interest in other decisions affecting the water system. We are concerned with the nature of the sharing of decision-making power.

The following question was asked: "What is the title of the person or group who has the authority for the following items: purchasing materials, contracting for system services; capital expenditures; and collecting revenue, billing, or suggesting rate changes. Table 15 shows the considerable variability in decision makers which exists for these four activities. Capital expenditure matters are overwhelmingly (87 percent of the municipalities) decided by local government officials, and matters pertaining to revenue collection are predominantly (two-thirds of the municipalities) decided by local government officials.

Matters pertaining to the day-to-day operation of the system are more likely left to water system management personnel. Contracting for services is decided upon by local government officials in only about one-fourth of the municipalities, and the purchasing of materials is done by the local government officials in only one-tenth of the municipalities.

Lower level general municipal employees are rarely in a position to make any decision. Employees, other than management level, specifically assigned to the water system are more frequently in a decision-making position.

Two other questions are also of interest in determining political control of decision making. We asked who determines the water rate schedule, and who approves trunk lines. Local government officials (mayor, city manager, city council) were found to be overwhelmingly (more than 80 percent of the municipalities) in charge of these decisions.

Table 15. Authority for Four Types of Decisions Affecting Water Systems Operation

Item	Local government officials		Water system management		Local government employees		Water system employees	
	N	%	N	%	N	%	N	%
Capital expenditures	196	87.1	25	11.1	0	0.0	4	1.8
Collecting revenue, billing, water charges	149	66.2	46	20.4	8	3.6	22	9.8
Contracting for system services	53	23.3	48	65.2	6	2.6	20	8.8
Purchasing materials	31	13.7	162	71.4	6	2.6	28	12.3

In the remaining 20 percent of the cases the decisions were made by persons directly associated with the water system.

The six items described in the previous paragraphs were combined in an index of political control. The index was computed by assigning a score of "1" for each instance where local government officials were named as the decision makers. The scores can vary between zero, when the local government officials make no decisions, and six in cases where local government officials make all decisions. Table 16 shows the results obtained on this index.

In about 20 percent of the cases, the municipal government makes two or fewer decisions. The majority of the cases (approximately 60 percent) fall in the middle range of three and four decisions. For the remaining approximately 20 percent of the municipalities, respondents declared that the municipal administration made five or all of the six possible decisions. In terms of centralization then, around 20 percent of the cases fell at each end of the spectrum, or the extremes of little or no centralization and almost complete centralization.

We suspected that the degree of local political control over the water system would be a function of the type of municipality within which the water system is found. It was anticipated that larger water systems, and especially those in larger municipalities, would develop a larger degree of autonomy from the political decision-making structure, due to increased internal differentiation and the availability of expertise within the municipality, that is normally associated with size.

Table 17 provides the results of an analysis of the relationship between political control and a set of variables measuring certain water system or municipal characteristics.

Table 16. Composite Index of Political Control (N = 228)

	Absolute frequency	Adjusted frequency (percent)
0	6	2.6
1	12	5.3
2	28	12.3
3	60	26.3
4	80	35.1
5	20	8.8
6	22	9.6

Table 17. Zero-order Pearsonian Correlation Coefficients for Relationships between Political Control over Water System Decision Making and Selected Water System and Municipal Characteristics

	METRO[a/]		
	1	2	3
Water System			
Number of gallons used in 1973	.30*	0.01	.07
Percent of water for industrial use in 1973	-.08	.09	.15*
Ratio of full-time to total employees	.00	.07	.13
Ratio of college employees to total employees	-.13	.14	-.02
Certification of water system employees	-.07	-.18	-.17*
Municipality			
Population size	-.30*	.05	-.16*
Population change 1960-1970	-.13	-.12	.03
Municipal expenditures in 1970	-.19*	.01	.07
Median housing value 1970	-.23*	-.05	-.01
Presence of city manager	-.15*	-.02	-.06

* Significance P ≤ .10) (Note: While most studies choose a significance level of less than or equal to .05%, we have not done this. The .05 level is generally chosen in order not to commit the type I error, which is rejecting a hypothesis which is true. Since our study has a greater degree of known representativeness and non-randomness (due to the fact

that our study is based on half of a universe), we have therefore chosen a significance level of less than or equal to the .10 level, since the problem of committing a type I error has been decreased.

a/ METRO denotes: a three-category variable of the influences of size and distance. Metro 1 is comprised of towns which are not close to either a medium or large SMSA. Metro 2 includes towns within 25 miles of a medium sized SMSA, and Metro 3 consists of towns within 50 miles of East St. Louis or Chicago.

The first observation from Table 17 related to the differences in findings for the three types of municipalities. Only for the nonsuburban municipalities do we find several of the variables related to the level of political control. Among the nonsuburban municipalities the relationships between the characteristics of the municipality and the level of political control are in the expected direction, and most are statistically significant. As the municipality grows in size, has control over greater wealth, as represented by per capita public expenditures in 1970 and the average housing value, and develops a more "rationalistic management" style of city government, as indicated by the presence of a city manager, the degree of political control over the water system decision making decreases. For both types of suburban municipalities this does not appear to be the case, however, except in the case of size for the suburbs in the largest urban areas. The expected relationships between control over decision making and municipal characteristics apparently operate for more autonomous municipalities but not in the suburban municipalities.

We expected that the relationship between water system characteristics and political control of decision making would show that as the water system became of large size, and the level of expertise among its employees increased, the level of political control over the water system would decrease. Table 17 indicates that this relationship does not exist; few of the relationships are statistically significant, and two of those which are statistically significant are in a direction opposite to what was expected.

In conclusion, it appears that the political control over the water system is affected by municipal characteristics only among nonsuburban municipalities. It is probably a reflection of the dependent position of the suburban municipalities within the metropolitan system that municipal characteristics have practically no relationship to the level of political control. The degree of political control also is found to be unrelated to the size or the level of expertise within the water system.

D. Summary

Within municipalities public water systems are one area of concern about which decisions need to be made in the political process. This chapter investigates various aspects of the decision making. It is generally perceived by the respondents that the municipal government is the most important unit in making decisions regarding the water system, although other groups, both residents and outsiders, frequently exert influence.

While municipal governments are seen as the most important decision makers by many respondents, there is in effect considerable variation in the degree to which the political system exercises control over water system decisions. There is a certain specialization of areas of influence within which the municipal government makes decisions (high for capital expenditures, low for purchasing materials).

There is also considerable variation between municipalities in the degree to which the decision making regarding the water system is concentrated in the local political system. Attempts to determine if the degree of political control over decision making is related to other characteristics of the municipality and the water system were largely unsuccessful, except for the nonsuburban communities, where municipal characteristics were found associated with political control.

V. PLANNING AND FINANCIAL MANAGEMENT

In chapter four we discussed the decision making regarding the water system. In chapters five and six we will be more concerned with selected aspects of the ways in which the systems are managed. First, we will deal with the administrative management of the system: planning and financial information. In chapter six we will discuss aspects of the technical management.

A. Planning

Planning refers to efforts of the water system to anticipate future needs and changes (i.e., population change, industrial growth, seeking alternative sources of supply) in an organized, ongoing and rational manner. This is in contrast to a system that responds to change only in a crisis situation. Undesirable consequences of the latter approach frequently are misspent funds, duplication of effort, or a system which may be soon outmoded. The construction of waterworks is such that large capital outlays and long time periods are necessary for the execution of these investments. Long-range planning and the support of well-thought-out financial policies are necessary to provide the resources for expansion. If shortages of water develop, these can become acute and may persist until new facilities are brought into operation. It is therefore important that water systems plan for future developments.

While planning for water systems may in effect take slightly different forms, we looked for the following indicators of planning: the presence of a formal plan, scope of the areas covered in the plan, age and updating of the plan.

In an effort to ascertain the aforementioned information, several questions were asked and the results were compiled into an index whose minimum value was zero (a complete lack of planning) and the maximum was four (denoting total planning). The first question pertained to the existence of a plan. If the town had one it scored two points. If a plan was being developed, it scored one. Otherwise, the town received zero points. The next two questions dealt with whether the plan was formulated recently (after 1971) or if it had been reviewed in the last three years. Affirmative answers on these questions received one point. Another point was given if the plan was devised to be concerned with a series of activities as opposed to one major crisis type activity. The results of this index are seen in Table 18.

A large number of municipalities do not engage in formal planning for the water system (45 percent). An additional ten percent of the municipalities report being currently in the process of having a plan developed. Just over one-third report having up-to-date broad scope written plans for their water system. Most of the municipal water systems have apparently not been perceived as in need of careful planning to prepare for the future; in very many cases the future appears to be taken for granted.

We also determined whether the planning experience was systematically related to water system or municipal characteristics. Table 19 indicates that the existence of a planning process is systematically related to the size of the community and the presence of a city manager in the municipality. The fact that the experienced population change is not--or even negatively--related to the degree of planning should

Table 18. Distribution of Scores on Planning Index (N = 228)

Score	Frequency	Percent
0	103	45.2
1	23	10.1
2	1	.4
3	21	9.2
4	80	35.1

Table 19. Zero-order Pearsonian Correlation Coefficients for Relationships between Water System Planning and Selected Water System and Municipal Characteristics

	METRO		
	1	2	3
Water System			
Number of gallons used in 1973	.02	-.11	.03
Percent of water for industrial use in 1973	.06	.25*	-.01
Ratio of full-time to total employees	.15*	.02	.04
Ratio of college-trained to total employees	-.13	.07	-.01
Certification of water system employees	.08	.16	.09
Municipality			
Population size	.17*	.29*	.38*
Population change 1960-1970	.08	-.21*	.13
Municipal expenditures in 1970	.02	.24*	.09
Median housing value 1970	-.10	-.04	.25
Presence of city manager	.27*	.15	.21*

* Significance P ≤ .10.

give reason for concern: rapid growth of population apparently has not provided an impetus to planning for future needs. The characteristics of the system, however, generally were found not to relate to the amount of planning.

B. Procedures to Deal with Low Pressure

While the above measures refer to generalized long-term planning, we also inquired about the systems' preparedness to handle specific problems which may arise at any one time. In dealing with public water supplies, the Illinois Environmental Protection Agency reports that the most frequent emergency is a drop in water pressure--frequently caused by a break in the distribution system, mechanical failures, or unusually high usage at some point in the system. Pressure drops can result in contamination being drawn into the system (Illinois EPA, 1973).

In order to measure the system's degree of planning for emergencies we asked the following questions: Has the water system a set of procedures to take if a problem of low pressure develops? In the event that the water operator is out of town, is someone else designated to carry out these procedures? And are the procedures written down? A positive point was assigned for affirmative responses to each of these questions.

Table 20 indicates that over 27 percent of the communities did not have procedures for low pressure. Four communities did have procedures, but no one was designated to carry them out in the case the operator was absent; nor were their procedures written down. Eighty-three communities had procedures and either had an alternative delegated to carry them out or had them in written form. Just over one-third of the municipalities obtained three points on our scale, indicating standardized procedures to deal with emergencies existed.

Table 20. Index of Low Pressure Procedures (N = 228)

Score	Frequency	Percent
0	62	27.2
1	4	1.8
2	83	36.4
3	79	34.6

Table 21. Zero-order Pearsonian Correlation Coefficients for Relationships between Existing Low Pressure Procedures and Selected Water System and Municipal Characteristics

	METRO		
	1	2	3
Water System			
Number of gallons used in 1973	.07	.20*	.05
Percent of water for industrial use in 1973	.03	.20*	-.17*
Ratio of full-time employees to total employees	-.07	-.07	.14*
Ratio of college trained to total employees	.20*	.09	.05
Certification of water system employees	-.02	-.16	.05
Municipality			
Population size	.11	.21*	.20*
Population change 1960-1970	-.06	.21*	.10
Municipal expenditures in 1970	-.03	.22*	.00
Median housing value 1970	-.14*	.26*	.15*
Presence of city manager	.08	.10	.11

* Significant P $\leq$ .10.

We again determined if the existence of procedures to deal with low pressure relates to water system and municipal characteristics. Table 21 indicates that system characteristics are generally not related to planning for emergencies although a few exceptions exist which are discussed below. It also indicates again the different relationships found in the different types of municipalities: the suburban municipalities show somewhat different patterns from the nonsuburban municipalities. Especially in the suburbs of medium sized metropolitan centers we find community characteristics related to preparedness for low pressure emergencies; in these communities the existence of procedures to handle low pressure is also associated with the size of the water system and the percent of the water used for industrial purposes. The latter relationship is actually negative in the suburban areas of the larger cities. This differentiation between the suburbs of large and smaller urban centers appears to be rather unusual.

C. Financial Administration

Another facet of management which we explored was that of financial administration. This particular aspect was more likely to be the domain of the mayor than of the water operator, so questions were directed to the mayor, asking him if the following financial information was available: detailed cost information on the water system; knowledge of how much of the water system funds were allocated to interest paid on bonds or long-term loans, to payments to the general municipal fund, and to operating maintenance and administrative expenses, including wages. Finally, the mayors were asked if it was known how much the waterworks spent on capital additions for the water facility during the last four years. The results are found in Table 22. Around 40 percent of the respondents reported having all of this information. Twenty-nine towns had all but one piece of information. Almost 14 percent know all except two parts. Nearly 20 percent did not know three out of the five. Twenty-five mayors were unsure of four of the five possibles, and five mayors did not know any of this information. It appears that approximately 50 percent of the communities' mayors knew most of this information (all, or four out of five).

Relating the index of financial administration to water system and municipal characteristics, we find that in the nonsuburban municipalities the municipal characteristics relate as expected, except that we had expected rapid population growth to relate to financial management in the opposite direction, as it does in the two types of suburban municipalities. Among the nonsuburban municipalities we also find the quality of financial management related to the amount of water used for industrial purposes and the ratio of employees with college degrees.

Among the suburbs of the large metropolitan centers, financial management relates to system characteristics in the expected direction. It also relates as expected to the municipal characteristics albeit that in the latter case the relationships are generally not statistically significant. Financial management in the suburban municipalities of the intermediate size centers is found related in the direction opposite of that expected for median housing values and the ratio of college employees in the labor force. It also related as expected to population change but not to any other variables.

Table 22. Index of Financial Management (N = 228)

Score	Frequency	Percent
0	93	40.8
1	29	12.7
2	31	13.6
3	45	19.7
4	25	11.0
5	5	2.2

Table 23. Zero-order Pearsonian Correlation Coefficients for Relationships between an Index of Financial Management and Selected Water System and Municipal Characteristics

	METRO		
	1	2	3
Water System			
Number of gallons used in 1973	- 04	-.05	.15*
Percent of water for industrial use in 1973	-.25*	-.12	.14*
Ratio of full-time to total employees	.07	-.01	-.20*
Ratio of college trained to total employees	-.21*	.20*	-.18
Certification of water system employees	.11	-.02	-.13
Municipality			
Population size	-.20*	-.04	-.02
Population change 1960-1970	-.17*	.23*	.15*
Municipal expenditures in 1970	-.09	.10	-.11
Median housing value 1970	-.29*	.30*	-.13
Presence of city manager	-.22*	-.09	-.15*

* Significant P ≤ .10

D. Summary

The data on planning and financial administration indicate that adequate planning, both for the long run and for short-run emergencies, is absent in many Illinois municipalities. In general, planning was found to be more often related to municipal characteristics than to water system characteristics. However, these relationships are generally weak and often not consistent between the different types of municipalities.

Financial management was found related to both water system characteristics and municipal characteristics in suburbs of large centers, and to a large extent also in the nonsuburban communities. In the suburbs of medium sized cities the relationships were few, and they were generally in the direction opposite of what had been predicted.

VI. TECHNICAL MANAGEMENT

Chapter VI deals with the management of technical aspects of the water system. We will first deal with the adequacy of supply, including complaints. Then we will discuss the administration of the water system and the complaints of a more aesthetic nature. Finally, we will analyze the testing procedures.

A. Supply

Demands for water are not static. Weather conditions, location, and other factors cause wide fluctuations from month to month. Within months, fluctuations on a day-to-day basis can be large. For example, summer heat, lawn watering, air conditioning, and bathing can build high peaks of consumption. It seems that some utilities do not realize the possibility of water shortages until such shortages arise. Drifting along, relying on excesses of capacity which are normally assigned to fire protection, etc., can be dangerous. During peak months adequate capacity for normal time periods should not be relied upon exclusively. Margins for unforeseen increases in the flow of water should be included. Emergencies can, of course, occur; but problems of pumping capacity, and bottlenecks in water sources, treatment plants, storage tanks and trunk lines should be taken into account.

In order to measure adequacy of the water supply, we computed a number of measures. The first measure (Table 24) consists of the reported average amount of water produced in a 24-hour period divided by the utility's rated daily capacity. This measure indicates the extent to which the water system uses its existing capacity. A quarter of the systems produced on the average 33 percent or less than they were capable of doing. By and large, the majority (around 75 percent) of the systems analyzed produced on the average less than two-thirds of the water which they were capable of producing. It appears that approximately 25 percent of the systems are entering an era where their average and daily capacities converge, and in some cases the average production even exceeds the daily rated capacity: thirteen systems produce amounts of water on an average basis which are equal to or greater than their daily rated capacity.

The second ratio (Table 25) was derived by dividing the reported maximum amount of water produced in a 24-hour period by the system's daily rated capacity. This measure indicates the extent to which a system is operating close to or beyond its limit for long time operations. In this instance, a quarter of the systems have produced maximums that were 56 percent and less of the utility's capacity. Another 51 of the systems reported maximum amounts of water that ranged between 57 percent and 75 percent of capacity. The third quartile (52 systems) produced maximums that were between 75 and 91 percent of their daily rated capacity. Fifty-two of the communities studied have had maximums from 92 to 273 percent of their daily rated capacity. Forty-five of these have had maximums equal to or greater than their total capacity. Once again, the majority of the systems (close to 70 percent) have had no problem in meeting the maximum demands made upon their facilities. However, almost 25 percent of the systems have had maximum demands that have almost equaled, and in quite a few cases have exceeded, the utility's daily rated capacity.

Table 24. Ratio of Average Water Production to the Daily Rated Capacity (N = 207)

Quartiles	Percents
First quartile	3% - 33%
Second quartile	34% - 48%
Third quartile	50% - 66%
Fourth quartile	67% - 138%

Table 25. Ratio of Maximum Water Production to Daily Rated Capacity (N = 206)

Quartiles	Percents
First quartile	4% - 56%
Second quartile	57% - 75%
Third quartile	75% - 91%
Fourth quartile	92% - 273%

Relating the ratio of maximum amount of water produced over the daily rated capacity to system and municipal characteristics, we find that among the nonsuburban municipalities the measure related positively to the amount of water produced; the share of the employees which are full time; the highest level of certification; and the presence of a city manager (Table 26). The measure relates negatively to the share of employees who have college educations, the amount of population change between 1960 and 1970 and the value of housing. Apparently, among these nonsuburban municipalities, better-off communities, which have experienced rapid growth, and employ more college-educated workers in their water system, have been able better to maintain the capacity of their water system in line with their maximum needs.

Among the suburban municipalities surrounding the smaller metropolitan centers, the capacity measure relates negatively to the size of the water system and the presence of college-educated employees, and positively to the level of certification and the general level of municipal expenditures. The suburbs of larger metropolitan centers find their capacity problems related positively to the size of the community and negatively to the employment of college graduates and the amount of water used for industrial purposes.

A third measure of capacity relates to the actual water shortage experience the water system may have had. The respondents were asked if their systems had experienced water shortages and were forced to curtail services at any one time. Table 27 represents the findings; in case of both shortages and curtailment the score is two, in case of a shortage not severe enough to necessitate curtailment of service, a

Table 26. Zero-order Pearsonian Correlation Coefficients for Relationships between the Ratio of Maximum Use Divided by Daily Rated Capacity and Selected Water System and Municipal Characteristics

	METRO		
	1	2	3
Water System			
Number of gallons used in 1973	.23*	-.24*	.02
Percent of water for industrial use in 1973	-.08	.07	-.17*
Ratio of full-time to total employees	.30*	-.01	-.08
Ratio of college trained to total employees	-.33*	-.34*	-.18*
Certification of water system employees	.16*	.26*	.12
Municipality			
Population size	-.08	.00	.16*
Population change 1960-1970	-.24*	-.03	-.06
Municipal expenditures in 1970	-.06	.39*	-.03
Median housing value 1970	-.32*	-.19	.00
Presence of city manager	.21*	.02	.04

* Significant P ≤ .10

Table 27. Index of Shortages of Water and Curtailment of Services (N = 228)

Score	Frequency	Percent
0	189	82.9
1	18	7.9
2	21	9.2

score of one is given. The overwhelming majority (82 percent) of the systems reported no shortage nor any curtailment in service. Thirty-nine communities (approximately 17 percent of our study) responded that they had had shortages or threatened shortages of water, of which 21 communities replied that they had both shortages and curtailment of services.

The correlations of the shortage measure with water system and municipal characteristics are shown in Table 28. Among the nonsuburban municipalities the shortage measure is associated with two system characteristics. Among the suburbs of the larger metropolitan cities the experience of shortages is found related positively to the measures of wealth of the community (housing value and per capita municipal expenditures) and the presence of a city manager, and negatively to the ratio of full-time employees. It is surprising that in none of the samples does the shortage measure relate to the growth experience of the municipalities.

B. Technical Administration

The technical administration of the system was measured through a number of questions which set out to determine how well the water system controlled the flow of water within the systems. The questions pertained to metering, water loss, and mapping of the pipe system.

Metering water is considered good management as well as a practical way of encouraging water conservation. Questions were asked to determine whether the water used for residential, commercial, or industrial purposes was metered. Table 29 shows that over 88 percent of the communities metered all residential water, around 8 percent did not, and 3 percent did not know. Almost 90 percent metered commercial water, 6 percent

Table 28. Zero-Order Pearsonian Correlation Coefficients for Relationships between an Index of Shortages and Selected Water System and Municipal Characteristics

	METRO		
	1	2	3
Water System			
Number of gallons used in 1973	.01	-.17	-.01
Percent of water for industrial use in 1973	-.11	.05	.06
Ratio of full-time to total employees	.16*	-.09	-.20*
Ratio of college trained to total employees	.08	-.08	-.07
Certification of water system employees	.14*	.13	.06
Municipality			
Population size	-.05	.01	-.04
Population change 1960-1970	-.03	-.10	.01
Municipal expenditures in 1970	-.02	-.02	.16*
Median housing value 1970	-.10	.00	.14*
Presence of city manager	-.08	-.06	.18*

* Significant $P \leq .10$

Table 29. All Water Metered for Residential, Commercial, and Industrial Use (N = 228)

	Residential		Commercial		Industrial	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Yes	201	88.2	185	88.9	122	89.7
No	19	8.3	13	6.3	6	4.4
Don't know	7	3.1	8	3.8	8	5.9

did not, and almost 4 percent did not know. In regard to industrial water, 90 percent metered, around 4 percent did not, and close to 6 percent did not know. While by now most of Illinois' water systems meter their water, still more than 10 percent did not.

We also asked what amount of water produced went unaccounted for in 1973. Table 30 presents these figures. As approximately 40 percent of the municipalities do not know how much water was unaccounted for, and only a little more than one-fourth of the communities reported that 10 percent or less of the water could not be accounted for, water loss in the system appears to be a significant problem for Illinois municipal water systems.

The same issue of the adequacy of the water systems' internal accounting is reflected in the extent to which the water system is well mapped. About two-thirds of the communities questioned (146 or 64 percent) had all parts of the system well mapped. Around 33 percent (or 74 communities) had some areas well mapped, other areas poorly or not mapped, and close to 4 percent (8 communities) had no accurate maps of any part of the system.

An index was constructed to determine the level of technical administration found in the water systems. The index was constructed by giving one point when all of the residential water was not metered by the system. Another point was given if the system had over 25 percent of its water unaccounted for in 1973 or if the respondent didn't know how much was unaccounted for. Another point was given for having some areas of the pipes poorly or not mapped, for having no accurate maps, or not knowing if the pipes were mapped at all. The scale scores are from zero to three, the latter indicating poor administration (Table 31).

Table 30. Percent of Water Unaccounted for in 1973 (N = 228)

Percent of water unaccounted for	Water systems	Percent
Less than 10	66	28.9
10 - 20	33	14.5
More than 20	33	14.5
Unknown	96	42.1

Table 31. Scale of Technical Administration (N = 228)

Score	Frequency	Percent
0	85	37.2
1	87	38.2
2	46	20.2
3	10	4.4

Eight-five systems were considered to have good technical administration. Eighty-seven more were only a little worse, scoring only one negative point. Over 20 percent (46 communities) acquired two bad points. Ten communities received three negative points. Viewing this on a good, average, and poor basis, about 37 percent had good scores; 38 percent were average; and 24 percent scored very poorly.

Table 32 indicates that our technical administration index is related with reasonable consistency to size of the community and housing value. Given the nature of the measure, this indicates that larger and more affluent municipalities have a better performance in terms of the technical administration of the water system. Water system characteristics appear generally unrelated to the level of technical administration, except a negative relationship between certification and the technical administration measure among the intermediate suburban municipalities, and positive relationships between the technical administration measure and college level education among the nonsuburban municipalities, and percent of water used for industrial purposes among the suburbs of large centers.

C. <u>Testing Program</u>

The final aspect of the technical management of the water system relates to the testing programs undertaken by the water systems. In order to provide a reliable source of clean and healthy drinking water it is important that the quality of the water be consistently monitored.

We explored several different aspects of the testing performed by the water system. First we will discuss the types of tests performed (especially over and above state requirements), whether the testing program ever indicated problems with the water ready for consumption. Additionally, we report how different systems are organized for having the tests performed.

Table 32. Zero-order Pearsonian Correlation Coefficients for Relationships between an Index of Technical Administration and Selected Water System and Municipal Characteristics.

	METRO		
	1	2	3
Water System			
Number of gallons used in 1973	-.01	-.17	-.01
Percent of water for industrial use in 1973	-.08	.03	.19*
Ratio of full-time to total employees	-.03	-.07	-.07
Ratio of college trained to total employees	.14*	-.07	.10
Certification of water system employees	-.09	-.33*	.08
Municipality			
Population size	-.19*	-.14	-.16*
Population change 1960-1970	-.01	-.15	-.04
Municipal expenditures in 1970	.06	-.09	-.12
Median housing value 1970	-.13	-.20*	-.16*
Presence of city manager	-.15*	.03	.04

* Significant $P \leq .10$

Table 33. Types of Water Testing (N=228)

Test Name	Yes		No		Don't know	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Coliform	203	89%	15	6.6%	10	4.4%
Flouride	203	89	15	6.6	10	4.4
Hardness	175	76.8	42	18.4	11	4.8
Iron	171	75.0	45	19.7	12	5.3
Nitrogen/Nitrates	117	51.3	85	37.3	26	11.4
Dissolved Solids	100	43.9	99	43.4	29	12.4
Mercury	93	40.8	104	45.6	31	13.6

Table 33 presents the frequencies of testing based upon the municipalities' responses concerning the specific tests performed on the water. Seven questions were asked as to whether the water was tested for: coliform, mercury, nitrogen/nitrates, iron, fluoride, hardness, and dissolved solids. Coliform and fluoride are clearly the most widely used tests. Even though coliform testing is required and the EPA performs it on a monthly basis, 15 water operators said that it was not tested, and 10 said they did not know. This means that over 10 percent of the water operators were less than knowledgeable in the area of tests performed on their systems. Hardness and iron tests come next in the hierarchy of most performed tests with 75 percent and above reporting their performance. One hundred and seventeen respondents (above 50 percent) said that their water was tested for nitrogen/nitrates. One hundred communities replied that dissolved solids were tested. Finally, ninety-three (more than 40 percent of the respondents) reported testing for mercury.

Table 34 indicates that over 28 percent (66 respondents) replied that all of these tests were made on their water supplies. Another 33 towns (14.5 percent) tested for six out of the seven. Twenty-six communities (11.4 percent) reported testing in five of these categories. More than 16 percent (38 respondents) made four of these tests, and another 20 said that three of these tests were performed. Ten percent or 23 towns reported two tests. Fourteen communities responded that one test was made and eight of our respondents said that none of the above-mentioned tests were performed.

This last figure leads us to believe that some of the water operators are probably poorly informed concerning the testing of their

Table 34. Number of Tests Performed for Each Water System (N = 228)

Number of Tests	Frequency	Percent
0	8	3.5%
1	14	6.1
2	23	10.1
3	20	8.8
4	38	16.7
5	26	11.4
6	33	14.5
7	66	28.9

Table 35. Testing Facilities (N=228)

Response	Presence of Private Laboratory		Sent Samples Out	
Yes	126	55.3%	210	92.1%
No	102	44.7%	18	7.9%

Table 36. Who Received Tests Sent Out for Analysis (N=212)

Who received the test	Frequency	Percent
EPA	133	63.0
State	46	22.0
Private laboratory	17	8.1
Department of Public Health	9	4.4
Water Department of Another City	1	0.5
Hygiene Institute	1	0.5
No answer	1	0.5
Don't know	2	1.0

water supplies. A further indication of this fact is that eighty-three towns reported mercury tests ranging from once to thirty times a month. We have been informed that the EPA administers this test approximately once every two years for ground sources and yearly for surface waters. While it is conceivable that those who reported such frequent mercury tests may do it themselves or send it to be done on a private basis, this is somewhat unlikely unless the community in question has had problems with mercury in the past, and only one respondent reported this as the case.

An important aspect of these communities' testing program is presented in Tables 35 and 36. Over half (126) of the respondents reported having their own private laboratory for conducting tests. Some of these also sent samples out for testing by other organizations, for nearly all of those contacted (210) replied that this was the case. Those who sent their samples out to be tested reported sending them to the Department of Public Health, the EPA, the State, (which could be the Department of Public Health, the EPA, or Illinois State Water Survey) private laboratories, the water department of another city, or a hygiene institute. The testing programs appear almost as varied as there are different municipalities. The lack of uniformity in programs may contribute to the shakey knowledge about the testing program at the local level. This unsatisfactory state of local knowledge concerning the testing program is further apparent in Tables 37 through 39.

Several questions were asked of both the mayors and the watermen. Cross-tabulations between the mayor's response and the water system operator's response are presented to show the level of communication

Table 37. Cross-tabulation of Mayor and Waterman on Testing for Nitrogen Nitrates (N = 228)

Water operators response	Mayors' Responses		
	Yes	No	Don't know
Yes	84 36.8%	9 3.9%	24 10.5%
No	58 25.4%	12 5.3%	15 6.6%
Don't know	19 8.3%	3 1.3%	4 1.8%

Table 38. Cross-tabulation of Mayor and Watermen on Iron Testing (N = 228)

Water operators responses	Mayors' Responses		
	Yes	No	Don't know
Yes	133 58.3%	9 3.9%	29 12.7%
No	29 12.7%	4 1.8%	12 5.3%
Don't know	7 3.1%	2 0.9%	3 1.3%

Table 39. Cross-tabulation of Mayors and Watermen on Coliform Testing (N = 228)

Water operators' responses	Mayors' responses		
	Yes	No	Don't know
Yes	161 70.6%	4 1.8%	38 16.7%
No	11 4.8%	0 0%	4 1.8%
Don't know	9 3.9%	0 0%	1 0.4%

and knowledge between these two officials concerning the testing of their water supplies. The first, that dealing with nitrogen/nitrates shows agreement among 100 pairs of these officials, while 128 (over half of the communities) either disagreed or one or the other did not know if this test was performed. In regard to iron testing, the watermen and the mayors agreed that this test was or was not performed in 140 out of 228 cases. However, over 38 percent of our respondents differed as to whether this test was being done. In the area of coliform testing 66 mayors and watermen disagreed. There is obviously a great deal of uncertainty and misinformation at the local level regarding the safeguards applied to ensure clean water.

The tests are not done altogether without reason, either. We inquired if, since 1970, the tests performed (coliform, mercury, nitrogen/nitrates, iron, fluoride, hardness, and dissolved solids) had ever indicated a problem with the water ready for consumption. Just under one-fourth of the municipalities responded that they had. Forty-two towns said that they had, in at least one of these areas. Nine responded that problems had been indicated by the tests in two of these categories. Three communities replied that three testing areas had indicated problems, and one said that their tests had revealed problems in five of the seven selected testing categories (see Table 40). This is, it would appear, a sufficient reason to continue and perhaps even increase water testing programs, as well as to more systematically educate local level decision makers about water testing.

Among the problems, coliform (26 cases) and fluoride (22 cases) were most frequently encountered. These problems were easily resolved in almost all cases, as was the one reported case of excessive mercury

Table 40. Number of Problems Uncovered by Tests (N = 228)

Number of problems	Frequency	Percent
0	173	75.9%
1	42	18.4
2	9	3.9
3	3	1.3
5	1	0.4

content. In the case of iron, four out of eleven problems were not solved to the water operator's satisfaction. In the categories of dissolved solids (1 case) and hardness (13 cases) the problems were more often not resolved than the reverse.

D. Summary

In this chapter we examined certain technical aspects of the water system. Capacity as expressed in terms of the ratio between maximum daily usage and daily rated capacity, or as determined by the past experience of the system in terms of interruption of the water supply, does not appear to be a problem for approximately three-fourths of the municipalities. Where shortages do exist or threaten, they are not found to relate consistently to other system or municipal characteristics.

Almost ninety percent of the municipalities meter the water that is delivered to residential, commercial, or industrial users. However, in only about 60 percent of the municipalities does the water system have knowledge about how much water is unaccounted for, and in only 25 percent of the systems does the unaccounted for water amount to less than 10 percent of all water produced. Only two-thirds of the systems, furthermore, reported that their pipe systems were generally well mapped. The level of technical management was found to be higher in larger, more affluent municipalities.

The data we collected on the testing program reflected much ignorance and confusion on the part of water plant operators. The answers frequently were apparently contrary to common sense and the information we obtained from the Illinois Environmental Protection Agency. However, nowhere in the State were we able to find a centralized data system which allowed us to compare reported testing procedures and frequencies against actual data. The general confusion surrounding testing also is reflected in the widely discrepant answers regarding the water tests given by the water systems operator and the mayor. In many municipalities these important decision makers for the water system do not agree on what type of tests are performed to determine the safety of public water supplies.

VII. DISCUSSION

In the preceding analysis we have reported both descriptive material and some analytical relationships on municipally owned water systems in a 50 percent sample of Illinois municipalities. The amount of descriptive information is extensive and helps further delineate an important segment of local service provision about which very little is known by the general public, or, frequently, by the people charged with the responsibility for it (Afifi and Bassey, 1969). The purpose of this chapter is not, however, to summarize the descriptive material, but to reflect on the findings of our analyses.

As part of our objectives we intended to analyze the relationship between selected water system variables (our dependent variables) and other characteristics of the water system as well as other characteristics of the municipality.

The rationale for this strategy is based on other analyses for which both organizational and city characteristics have been found related to local government performance (Clark, 1973). Most of this research has been based on small samples or has been done on large metropolitan centers. The present research was based on a relatively large sample of small and medium-sized Illinois cities.

Based on previous research and the availability of data (for the smaller municipalities the availability of data is restricted), we selected variables to represent the demographic characteristics of the municipality (size and growth), the relative affluence or resources of the municipality, (per capita municipal expenditures and median housing value), and the type of municipal government (presence of a city manager or not). This set of variables was expected to relate to the type of decision making as well as the performance of the water system.

In addition, we selected variables which we called water system characteristics, but which tend to be highly related to city characteristics as well. We selected size of the water system in terms of the number of gallons produced annually. The percent of water allocated to industrial usage was the second system characteristic we used. The percent of the water system's labor force which was employed full time indicates the relative degree of autonomy accorded the water system within the municipal structure. Finally, the percent of employees with some college education and the level of certification of the employees are used as measures of the quality of the labor force.

As part of the analysis, we divided our sample into three subcategories: the suburbs of the two largest metropolitan centers (Chicago and East St. Louis); the suburbs of the medium-sized metropolitan centers, and the municipalities which we considered nonsuburban. Given the strong impact of metropolitan centers on the surrounding municipalities, especially in terms of infringement upon local autonomy, it was judged that the analysis should be performed separately for these three types of municipalities. It can be reasoned that the relationship between municipal characteristics and the water system performance variables would be strongest in the most autonomous, nonsuburban communities, the weakest in the municipalities which form the suburbs of largest metropolitan centers, while the suburban municipalities surrounding the intermediate metropolitan centers would exhibit relationships between dependent and independent variables which would also be intermediate between the nonsuburban municipalities and the suburbs of the largest centers. For example, it was expected that planning in suburban municipalities would be more a function of the general environment of these municipalities (dense population, competition between municipalities for resources) than of particular characteristics of individual suburban municipalities.

Contrary to the expected relationship between municipal characteristics and water system performance, with the decreasing impact of metropolitan dominance, we expected the independent variables made up of water system characteristics to be relatively unaffected by metropolitan dominance.

The zero-order correlation coefficients which we reported in chapters four, five and six do not correspond completely with our expectations. Although there are exceptions, the general pattern indicates no systematic pattern of relationships between our dependent and independent variables. Nor did we find systematic differences between the subsamples based on different degrees of metropolitan dominance.* On the other hand we found the relationships between dependent and independent variables to repeatedly change signs from one sample to the next.

There are two general explanations why the model of analysis we used yielded these results. On the one hand, the model may be relevant and appropriate, but the implementation was inadequate. On the other hand, the model may be inappropriate or incorrect, even though it was put together in a satisfactory manner.

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* We also analyzed the data for the total sample without subdividing it according to urban dominance. The relationships in the total sample were found frequently to be weaker than those found in the subsamples.

The implementation of the model deals with the selection of variables and the quality of measurement. In all research where the researcher is dependent on others to provide the necessary data, the ultimate selection of variables may have been dictated as much by concern for availability of data as by theoretical precision. In the present analysis this is also the case: many of the independent variables are not directly tied to more generalizable concepts. However, a similar set of variables has proven to be of utility in an analysis of municipal grantsmanship (van Es and Rexroat, 1975).

The selection of variables may not be faulty as much as the measurement of the selected variables may be inadequate. More than sixty percent of the water system operators had received a high school level diploma or less. Previous studies have noted that respondents at this educational level frequently have more trouble understanding and responding to interview questions than do better educated persons. The responses to the questions on testing indicate, at least in that area, an inability by some respondents to properly understand the question. However, checking of the interview schedules for similar areas of concern, including occasional rechecks with water systems, did not indicate any persistent types of problems with the data. Although we are confident that our data will stand the test of reliability, other sources of information on water systems necessary for rechecking data unfortunately are not available.

Leaving the matter of data quality aside it would be worth considering the possibility that the absence of expected relationships is due to the fact that the model used to analyze the data is not appropriate for water systems.

The analytic model is based on the premise that on a comparative basis municipalities differ from one another in a way which is systematic and can be predicted. The variables we use both for the dependent and independent variables show that considerable differences exist between municipalities but apparently the differences in decision making, planning and financial management, and technical management between the different water systems cannot be predicted from the set of independent variables in the model.

It is, of course, possible that new, different and better measures of the dependent and independent variables will result in successful predictions. However, an alternative explanation is that at this particular point in time water systems are not appropriately analyzed by the model used because it is an attempt to relate municipal characteristics to policy outcomes and it makes the assumption that the municipal governments actively pursue improved water system performance.

We stated in the early paragraphs of this report that Illinois citizens appear to assume that an ample supply of quality water will always be there. Our data lead us to conclude that many water systems are also operated on such an assumption.

Most water systems have, of course, been in operation for a long period of time. The technology involved is well known and frequently simple enough to allow lowly skilled personnel to operate the system in a routine fashion. The information gathered in this study, while certainly not indicating that water systems in Illinois are in serious immediate danger of collapse, does indicate that many systems suffer from benign neglect interspersed with only occasional attention to financial and technical details when a specific crisis demanding some action occurs.

If, indeed, benign neglect with occasional action rather than active pursuit characterizes the way water systems in Illinois municipalities are operated, it would certainly explain why our analytical model was found to have little utility.

In terms of practical considerations it appears that Illinois water systems have been able to operate as they do because few obvious problems have arisen up to this point. Water generally has been of good quality and in adequate supply. However, the water systems do not appear to be in a position to respond well to changing circumstances. The low educational levels attained by many of the water operators do not prepare them for the increasingly more complex and diverse demands which may be placed upon them and their systems by both their immediate superiors and outside regulatory agencies. Added to this, we have seen a relative lack of communication (nearly 80 percent disagreement in at least one of the areas under question) between the mayor and the water operator in regard to shared information concerning the water system. And in another instance we found that almost 45 percent of the municipalities do not engage in any formal planning, while another 10 percent are only now in the process of developing a plan. It seems, therefore, that many systems do not see the necessity for long-range planning. On the contrary they appear to be run on the assumption that they need little attention and that changes occur gradually.

In the past, changes in either the quality, the supply, or the demand for water have no doubt overwhelmingly been of a gradual nature. However, it is likely that the current concern with improved water quality standards will lead to demands for rapid changes in municipal water systems. Our research leads us to believe that many municipal water systems are not organized to respond effectively to such challenges to established routine. Depending somewhat on the nature of future changes, it is quite probable that the relative unpreparedness of the municipal water systems will lead to a greater direct participation of the State and Federal governments in local water system operations. While this role of the State will likely involve setting standards, it must be realized that if the State and Federal agencies are placing new demands upon water systems, they should anticipate that many local systems are not prepared to respond to new and complex standards. Therefore, both the State and Federal governments may find themselves forced into more active participation in the affairs of local water systems, which will likely not only be in the form of providing financial assistance, and expansion of such roles as testing for water quality and approving expansion plans, but may even involve overseeing the proper allocation of local resources.

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APPENDIX A

Means and Standard Deviations of the Variables Used in the Correlations

Means and Standard Deviation of the Variables Used in the Correlations

DEPENDENT VARIABLES

		Metro 1	Metro 2	Metro 3
Political control over water system decision making	$\bar{X}$	3.69	3.58	3.29
	SD	1.39	1.53	1.26
Water system planning	$\bar{X}$	1.65	1.67	1.99
	SD	1.86	1.80	1.84
Existing low pressure procedures	$\bar{X}$	1.65	1.87	1.88
	SD	1.19	1.24	1.17
Index of financial management	$\bar{X}$	1.54	1.71	1.46
	SD	1.50	1.58	1.59
Ratio of maximum use divided by daily rated capacity	$\bar{X}$	0.75	0.83	0.75
	SD	0.29	0.43	0.35
Index of shortages	$\bar{X}$	0.19	0.22	0.36
	SD	0.49	0.56	0.74
Index of technical administration	$\bar{X}$	1.07	0.91	0.77
	SD	0.84	0.85	0.88

INDEPENDENT VARIABLES

		Metro 1	Metro 2	Metro 3
Number of gallons of water produced in 1973	$\bar{X}$	2426.91	2756.55	1773.21
	SD	4069.82	4213.75	3251.15
Percent of water for industrial use in 1973	$\bar{X}$	18.95	19.49	21.28
	SD	31.73	31.47	32.16
Ratio of full-time to total employees	$\bar{X}$	0.79	0.76	0.84
	SD	0.31	0.34	0.43
Ratio of college to total employees	$\bar{X}$	0.17	0.15	0.22
	SD	0.24	0.25	0.25
Certification of water system employees	$\bar{X}$	3.02	2.96	2.95
	SD	1.25	1.04	1.02
Population size	$\bar{X}$	4361.06	4279.02	10322.15
	SD	5523.02	7257.47	9146.98
Population change 1960-70	$\bar{X}$	0.08	0.22	1.66
	SD	0.19	0.37	6.95
Municipal expenditures in 1970	$\bar{X}$	53.80	45.93	61.23
	SD	26.38	25.86	29.44

		Metro 1	Metro 2	Metro 3
Median housing value in 1970	$\bar{X}$	11110.99	15568.87	23469.56
	SD	3457.92	4662.32	9356.26
Presence of a city manager	$\bar{X}$	0.04	0.09	0.46
	SD	0.21	0.29	0.50

APPENDIX B

Mayors' Schedule

(Relevant material begins with question #37.)

OFFICE USE ONLY		
Quest.#	________	1-7
Study	172	8-10
Intvr.#	________	11-13

6/74

University of Illinois
Survey Research Laboratory

Municipal Services and Economic Development Survey

Municipal Head Questionnaire

(Please circle one number code for each question unless otherwise specified.)

Municipal Government and Services

1. Do the residents of your municipality pay taxes to the following separate taxing bodies?

	Yes	No	
a. Park district	1	2	14
b. Sanitary district	1	2	15
c. Mass transit district	1	2	16
d. Water district	1	2	17
e. Fire district	1	2	18
f. Health district	1	2	19
g. Library district	1	2	20
h. Other, please specify	1	2	21

____

2. How many full-time workers does the municipality employ, excluding policemen and firemen?

__________ 22,23

3. How many full-time workers with college degrees does your municipality employ, excluding firemen and policemen?

__________ 24,25

4. How many full-time policemen are employed by your municipality? __________ 26,27

5. How many full-time firemen are employed by your municipality? __________ 28,29

6. What percent of all full-time municipal employees are under civil service?

__________% 30,31

7. Have any of the following groups of employees engaged in collective bargaining?

	Yes	No	
a. Policemen	1	2	32
b. Firemen	1	2	33
c. Sanitation workers . . .	1	2	34
d. Street maintenance . . .	1	2	35
e. Library employees	1	2	36
f. Hospital workers	1	2	37

8. Have municipal employees ever organized a strike, including "blue flue," etc.?

Yes . . . 1 38

No 2

9. Does your municipality have . . .

	Yes	No	
a. A full-time mayor or village president? . . .	1	2	39
b. A city manager or village administrator? . .	1	2	40
c. A mayor-council form of government?	1	2	41
d. A commissioner government?	1	2	42
e. Bipartisan elections?	1	2	43
f. At-large elections?	1	2	44

10. How many council members are there? __________ 45,46

11. How many council members have been re-elected at least once? __________ 47,48

12. How many council members have been on the council at least since 1965? __________ 49,50

13. What percent of votes did you get in the last election?

________% or (________ votes out of ________ total votes) 51,52

Not applicable (not elected by popular election) . . . 00

14. In what year did you first come into office? 19________ 53,54

15. What were the two largest allocations for the 1973 revenue-sharing funds of this municipality?

1) ______________________________ 55,56

2) ______________________________ 57,58

16. Is the state Environmental Protection Agency (EPA) currently threatening or taking action against your municipality?

Yes 1 59

No *(Go to Q.18a)* 2

(If Yes)

17. Are the alleged violations in the following areas?

		Yes	No	
a.	Water	1	2	60
b.	Sewage treatment	1	2	61
c.	Landfill	1	2	62
d.	Air	1	2	63
e.	Noise abatement	1	2	64

Planning

18a. Has there been a comprehensive plan developed for your community?

Yes 1 65

No *(Go to Q.21)* 2

Plan being developed--
(Answer b then skip to Q.21) 3

(If Yes or Plan being developed)

b. Who developed the comprehensive plan for your municipality? *(Circle one number)*

The municipal planning office 1 66

Regional or county planners 2

Consultants 3

Other *(Specify)* 4

____

19a. Has your municipality benefited from the comprehensive plan?

Yes 1 67
No *(Go to Q.20)* 2

b. In what way has your municipality benefited? ______________ 68,69

____

(GO TO Q.21)

(If No)

20. Why didn't your municipality benefit?

____ 70,71

____

21. What is the most useful thing planners could do for a community like yours?

____ 72

____

______ 73-75

______ 76-78

79 | BK

80 | 1

1-7 | DUP

22a. Has your municipality ever applied for a grant in . . .	Yes	No	*(If Yes)* b. In what year did your city first apply?	c. Did your city receive funds from the grant? Yes	No	*(If Yes)* d. In what year were funds received?	
(1) Urban renewal?	1	2	19______	1	2	19______	8-13
(2) Public housing?	1	2	19______	1	2	19______	14-19
(3) Community development?	1	2	19______	1	2	19______	20-25
(4) Sewage treatment? . . .	1	2	19______	1	2	19______	26-31
(5) "Planning"?	1	2	19______	1	2	19______	32-37
(6) Parks and recreation? .	1	2	19______	1	2	19______	38-43
(7) Mass transit?	1	2	19______	1	2	19______	44-49
(8) Public safety and law enforcement? . .	1	2	19______	1	2	19______	50-55
(9) Water (for drinking)?	1	2	19______	1	2	19______	56-61

23\. Do you have enough of the following facilities in your municipality to meet the demand?

	a. In your Municipality Yes	a. In your Municipality No	b. Can they be found within easy reach outside your municipality? Yes	b. No	
(1) Parks and sports fields, such as baseball diamonds	1	2	1	2	62,63
(2) Indoor sports facilities, other than public schools	1	2	1	2	64,65
(3) Swimming pools	1	2	1	2	66,67
(4) Indoor and/or outdoor movie theaters	1	2	1	2	68,69
(5) Playhouse or stage theater	1	2	1	2	70,71
(6) Library	1	2	1	2	72,73
(7) Hospital	1	2	1	2	74,75
(8) General practitioners	1	2	1	2	76,77
(9) Dentists	1	2	1	2	78,79 80 | 2 1-7 | DUP
(10) Ambulance	1	2	1	2	8,9

Environmental Quality

24\. If a resident of the municipality phoned your office to report what you felt to be an environmental quality problem or violation, to whom or what office would you report the problem or refer the caller?

Office of (Specify title) ______________________________ 10,11

No office 97

25. During 1973, did your municipality . . .

	Yes	No	
a. Fine or prosecute any noise violators, excluding hot-rodders and noisy parties?	1	2	12
b. Have to warn any noise violators, excluding hot-rodders and noisy parties?	1	2	13
c. Receive any complaints from residents about "noise", excluding hot-rodders and noisy parties?	1	2	14
d. Fine or prosecute any water polluters?	1	2	15
e. Have to warn any water polluters?	1	2	16
f. Receive any complaints about water pollution?	1	2	17
g. Fine or prosecute any air polluters?	1	2	18
h. Have to warn any air polluters?	1	2	19
i. Receive any complaints about air pollution?	1	2	20

Energy

26a. As a result of the energy shortage, have municipal public services been cut back or otherwise altered in your municipality?

Yes 1   21

No *(Go to Q.27a)* 2

(If Yes)

b. How? ____ 22,23

____

27a. One year ago, approximately how many gasoline service stations were there in your municipality?

____________ stations 24-26

b. Currently, how many stations are there? ____________ stations 27-29

28. Have new home owners in your municipality experienced any difficulty in obtaining any of the following utility hookups?

	Yes	No	
Electricity	1	2	30
Oil	1	2	31
Natural gas	1	2	32
Propane	1	2	33

Sewage Treatment System

29. What percent of the residences in this municipality are hooked up to the sewage treatment system?

_________% 34-36

(OR # ______hooked up out of ______total # of residences)

30. Approximately how much money has been spent on major capital additions to the sewage treatment plant since 1970?

$__________________ 37-40

31a. Certain groups may attempt to influence the policies of the sewage treatment system. How important are the following groups in influencing the policies, other than rates, of the sewage treatment system?

	Very important	Somewhat important	Not important	
(01) Residential users	1	2	3	41
(02) Large volume users	1	2	3	42
(03) Citizens groups	1	2	3	43
(04) Bond holders or financial underwriters for the bonds	1	2	3	44
(05) Sanitary board, commission, district authority	1	2	3	45
(06) Real Estate Development Firms	1	2	3	46
(07) Illinois Commerce Commission	1	2	3	47
(08) Municipal administration	1	2	3	48
(09) Environmental Protection Agency (EPA) . . .	1	2	3	49
(10) Consulting engineer	1	2	3	50
(11) Community Development Corporation or Chamber of Commerce	1	2	3	51

b. Which group (01-11) is most important? __________ 52,53

c. Which group (01-11) is the second most important? __________ 54,55

32. Is there a written plan or report which has analyzed the current and future needs of the sewage treatment system in this municipality?

Yes 1 56
No *(Go to Q.37)* 2
Plan being developed *(Go to Q.35)* . . . 3
Don't know *(Go to Q.37)* 8

33. When was the plan written? 19_______ 57,58

Don't know . . 98
(If 1971 or after, Go to Q.35)

34a. Has the plan been reviewed in the last three years?

Yes 1 59
No *(Go to Q.35)* 2

(If Yes)

b. By whom? ________________________________ 60
(Title or position)

35. What were the reasons for having the plan formulated?

____ 61,62

____

____

36. Have the contents of the plan been publicized in the local news media?

Yes . . . 1 63
No 2

Water System

37. Is the water facility for your municipality privately, regionally, or publicly owned?

Privately owned *(Go to Q.41)* . . . 1 64
Regionally owned *(Go to Q.41)* . . 2
Publicly owned 3

(If publicly owned)

38. Is detailed cost information on the water system available to you?

Yes . . . 1 65
No 2

39. Of the total water system funds received during 1973, how much money was allocated to the following?

		None	Information not available	*(Don't know)*	
a. Interest paid on bonds or long-term loans	$________	[]	[]	[]	66-69
b. Payments to general municipal fund	$________	[]	[]	[]	70-73
c. Operating, maintenance, and administrative expenses, including wages	$________	[]	[]	[]	74-77

78,79 | BK
80 | 3
1-7 | DUP

40. Since 1970, how much has the water works spent on capital additions for the water facility, such as on the plant or for equipment?

$____________ 8-11

None . . . 9997

Don't know 9998

41. Is there a written plan or report which has analyzed the current and future needs of the water system of this municipality?

Yes 1 12

No *(Go to Q.47)* 2

Plan being developed *(Go to Q.45)* . . . 3

Don't know *(Go to Q.47)* 8

42. Was the plan designed mainly to be concerned with only one major activity, such as drilling a new well, or does it recommend a series of activities for a period of years?

One major activity *(Specify)*

______________________________ 13

Series of activities 7

43. When was the plan written?

19________ 14,15

Don't know . . 98

(If 1971 or after, Go to Q.45)

44a. Has the plan been reviewed in the last three years?

Yes . . . . 1 — 16

No *(Go to Q.45)* 2

(If Yes)

b. By whom? ________________________________ (Title) — 17

45. What were the reasons for having the plan formulated?

________________________________ 18,19

____

____

46. Have the contents of the plan been publicized in the local news media?

Yes . . . 1 — 20

No 2

47. Approximately what percent of the total water supply for your municipality comes from the following sources?

Surface Water, such as reservoirs or rivers .	________%	21-23
Ground Water, such as well or springs	________%	24-26
Purchased Water, purchased from other utilities	________%	27-29
TOTAL	100%	

48a. Given your current water system, will your municipality have an ample supply of usable water through 1980?

Yes *(Go to Q.49a)* . . . . 1 — 30

No 2

(If No)

b. What do you see as the problem? ________________________________ 31-33

____

____

49a. Is the water tested for nitrogen or nitrate?

Yes 1 34
No *(Go to Q.50a)* 2
Don't know *(Go to Q.50a)* . . . 8

(If Yes)

b. How many times per month is it tested for nitrogen or nitrate?

________ times per month 35,36

50a. Is the water tested for iron?

Yes 1 37
No *(Go to Q.51a)* 2
Don't know *(Go to Q.51a)* . . . 8

(If Yes)

b. How many times per month is it tested for iron?

________ times per month 38,39

51a. Is the water tested for coliform?

Yes 1 40
No *(Go t0 Q.52a)* 2
Don't know *(Go to Q.52a)* . . . 8

(If Yes)

b. How many times per month is it tested for coliform?

________ times per month 41,42

c. Does your office receive the coliform test results routinely, only when there may be a problem, or never?

Routinely 1 43
Only when there may be a problem 2
Never 3

52a. Does your office have any set procedures it would take if your water system developed a problem of severe low pressure?

Yes 1   44

No *(Go to Q.55)* 2

(If Yes)

b. What procedures would be taken by your office?

____ 45,46

____

____

53. In the event you are out of town, is someone else designated to carry out these procedures?

Yes . . . 1   47

No 2

54. Are these procedures written down any place?

Yes . . . 1   48

No 2

55. In some systems it is possible to determine what proportion of the total water supply cannot be accounted for in terms of use. What proportion of your water supply is unaccounted for?

__________%   49,50

Don't know 98

56a. In many towns certain groups attempt to influence the water rate schedule. How important are the following groups in influencing the rate schedule in your municipality?

		Very important	Somewhat important	Not important	
(01)	Residential users	1	2	3	51
(02)	Large volume users	1	2	3	52
(03)	Bond holders or financial underwriters for the bonds . .	1	2	3	53
(04)	Citizens groups	1	2	3	54
(05)	Water board, commission, district, authority, or private company	1	2	3	55
(06)	Real Estate Development firms .	1	2	3	56
(07)	Illinois Commerce Commission . .	1	2	3	57
(08)	Municipal administration	1	2	3	58
(09)	Consulting engineer	1	2	3	59
(10)	Community Development Corporation of Chamber of Commerce	1	2	3	60

b. Which group (01-10) is most important? __________ 61,62

c. Which group (01-10) is the second most important? __________ 63,64

57a. How important are the following groups in <u>influencing the decisions on major capital expenditures</u> for the water system?

		Very important	Somewhat important	Not important	
(01)	Residential users	1	2	3	65
(02)	Large volume users	1	2	3	66
(03)	Bond holders or financial underwriters for the bonds	1	2	3	67
(04)	Citizens groups	1	2	3	68
(05)	Water board, commission, district, authority, or private water company	1	2	3	69
(06)	Real Estate Development firms	1	2	3	70
(07)	Illinois Commerce Commission	1	2	3	71
(08)	Municipal administration	1	2	3	72
(09)	Consulting engineer	1	2	3	73
(10)	Community Development Corporation or Chamber of Commerce	1	2	3	74
(11)	Environmental Protection Agency (EPA)	1	2	3	75

b. Which group (01-11) is most important? ________ 76,77

c. Which group (01-11) is the second most important? ________ 78,79

80|4

THANK YOU FOR YOUR COOPERATION

APPENDIX C

Water Operators' Schedule

OFFICE USE ONLY		
Quest. #	______	1-7
Study	172	8-10
Intvr. #	______	11-13

6/74

University of Illinois
Survey Research Laboratory

Municipal Services and Economic Development Survey

Water Plant Operator Questionnaire

(Please circle one number code for each question unless otherwise specified.)

1. What communities were served by this water utility in 1973?

Name of Community

1. ______________________________ 14-19
2. ______________________________ 20-25
3. ______________________________ 26-31
4. ______________________________ 32-37
5. ______________________________ 38-43

2. What is the title of the person or group who has the authority for . . .

a. Purchasing materials necessary for system operation, for example, oil, chemicals, etc.?

______________________________ 44,45

b. Purchasing or contracting for system services, for example, repair or maintenance work?

______________________________ 46,47

c. Capital expenditures for system improvement?

______________________________ 48,49

d. Collecting revenue, billing, or suggesting rate changes?

______________________________ 50,51

3. What percent of your water source is surface water?

__________ % 52-54

None *(Go to Q.7)* . . 000

4. The following questions deal with matters since 1970. If your information does not go back to 1970, from what year do you have information?

From 1970 . . . 1 55

From 1971 . . . 2

From 1972 . . . 3

From 1973 . . . 4

5a. Has the water utility had a shortage, or threatened shortage of surface water?

Yes 1 56

No *(Go to Q.6a)* . . . 2

(If Yes)

b. What was the reason for the shortage?

______________________________ 57,58

____

c. How did you become aware of the problem(s)? ______________ 59,60

____

d. Was curtailment or restriction of service necessary?

Yes . . . 1 61

No . . . 2

e. Have the problems been resolved?

Yes 1 62

No *(Go to Q.6a)* . . . 2

(If Yes)

f. How? ______________________________ 63,64

____

6a. Has the water utility had any complaints with the quality of the surface water supply, such as taste, odor, color or safety?

Yes . . . . 1 — 65

No *(Go to Q.7)* . . . 2

(If Yes)

b. What kinds of complaints and how many of each?

Complaint	Number	
________	____	66-68
________	____	69-71
________	____	72-74

c. What is the largest number of complaints you ever got in a single week in 1973?

________ — 75,76

d. Was curtailment or restriction of service necessary?

Yes . . . 1 — 77

No . . . 2

e. Have the problems been resolved?

Yes . . . . 1 — 78

No *(Go to Q.7)* . . . 2

79 | BK
80 | 1
1-7 | DUP

(If Yes)

f. How? ________________________________ — 8,9

____

7. What percent of your water source is ground water?

________ % — 10-12

None *(Go to Q.13)* . . . 000

8. The following questions deal with matters since 1970. If your information does not go back to 1970, from what year do you have information?

From 1970 . . . 1 — 13

From 1971 . . . 2

From 1972 . . . 3

From 1973 . . . 4

9a. Has the water utility had a shortage, or threatened shortage of ground water?

Yes 1 14
No *(Go to Q.10a)* . . . 2

(If Yes)

b. What was the reason for the shortage? ______________________ 15,16

____

c. How did you become aware of the problem(s)? ______________________ 17,18

____

d. Was curtailment or restriction of service necessary?

Yes . . . 1 19
No . . . 2

e. Have the problems been resolved?

Yes 1 20
No *(Go to Q.10a)* . . . 2

(If Yes)

f. How? ______________________________________ 21,22

____

10a. Has the water utility had any complaints with the quality of the ground water supply, such as taste, odor, color, or safety?

Yes 1 23
No *(Go to Q.11)* . . . 2

(If Yes)

b. What kind of problem(s)? ______________________________ 24,25

____

c. What is the largest number of complaints you ever received in a single week in 1973?

______________ 26,27

d. Was curtailment or restriction of service necessary?

Yes . . . 1 — 28

No . . . 2

e. Have the problems been resolved?

Yes . . . . 1 — 29

No *(Go to Q.11)* . . . 2

(If Yes)

f. How? ______________________________ 30,31

____

11. Do you receive any of your ground water from springs?

Yes . . . 1 — 32

No . . . 2

12a. Do you receive any of your ground water from wells?

Yes . . . . 1 — 33

No *(Go to Q.13)* . . . 2

b. How many wells does the water system have? ________ 34,35

c. What are the depths of the three deepest wells?

Well #1 ________ 36-38

Well #2 ________ 39-41

Well #3 ________ 42-44

(If ALL wells are less than 50 feet deep.)

d. If you were to drill a deeper well would you probably have a severe salinity problem?

Yes . . . 1 — 45

No . . . 2

13. What percent of your water source is purchased water?

_________ % 46-48

None *(Go to Q.17)* . . 000

14. The following questions deal with matters since 1970. If your information does not go back to 1970, from what year do you have information?

From 1970 . . . 1 49

From 1971 . . . 2

From 1972 . . . 3

From 1973 . . . 4

15a. Has the water utility had problems with the amount of water it could purchase?

Yes 1 50

No *(Go to Q.16a)* . . . 2

(If Yes)

b. What kind of problems? ______________________________ 51,52

____

c. How did you become aware of the problems? ______________ 53,54

____

d. Was curtailment or restriction of service necessary?

Yes . . . 1 55

No . . . 2

e. Have the problems been resolved?

Yes 1 56

No *(Go to Q.16a)* . . . 2

(If Yes)

f. How? ______________________________________ 57,58

____

16a. Has the water utility had any problems with the quality of the purchased water supply, such as taste, odor, color, or safety?

Yes 1 59

No *(Go to Q.17)* . . . 2

(If Yes)

b. What kind of problems? ______________________________ 60,61

____

c. What is the largest number of complaints you ever received in a single week in 1973?

________ 62,63

d. Was curtailment or restriction or service necessary?

Yes . . . 1 64

No . . . 2

e. Have the problems been resolved?

Yes 1 65

No *(Go to Q.17)* . . . 2

(If Yes)

f. How? ______________________________ 66,67

____

17. What is the utility's rated daily capacity, on the basis of filters, pumps, or other limiting factors?

________ gallons/24 hours 68-72

18. In 1973, how many gallons per day of water did you provide on the average in a 24 hour period?

________ gallons/24 hours 73-77

78,79 | BK

80 | 2

1-7 | DUP

19. In 1973, what was the maximum amount of water you provided in a 24 hour period, that is, the largest amount on any single day?

________ gallons/24 hours 8-12

20a. Is the water tested for:	Yes	No	*(If Yes, tested)* b. How many times per month is it tested for . .	c. Since 1970, have your tests ever indicated a problem with water ready for consumption? Yes	No	Don't know	*(If Yes, problem)* d. To whom did you report the problem *(Title, not name)*	e. Was the problem solved to your satisfaction? Yes	No	*(If Yes, solved)* f. How?	
(1) Coliform? .	1	2	____/month	1	2	8	____	1	2	____ ____	13-21
(2) Mercury? . .	1	2	____/month	1	2	8	____	1	2	____ ____	22-30
(3) Nitrogen/ nitrates? .	1	2	____/month	1	2	8	____	1	2	____ ____	31-39
(4) Iron? . . .	1	2	____/month	1	2	8	____	1	2	____ ____	40-48
(5) Flouride? .	1	2	____/month	1	2	8	____	1	2	____ ____	49-57
(6) Hardness? .	1	2	____/month	1	2	8	____	1	2	____ ____	58-66
(7) Dissolved Solids? . .	1	2	____/month	1	2	8	____	1	2	____ ____	67-75
(For each "Yes", answer Columns b and c)				*(For each "Yes", answer Columns d and e)*				*(For each "Yes", answer Column f)*			

21. Does your water plant have its own private laboratory for conducting tests on water samples?

Yes . . . 1 76

No . . . 2

22a. Do you send out water samples for testing by other organizations?

Yes 1 77

No *(Go to Q.23)* . . . 2

78,79 | BK

80 | 3

1-7 | DUP

(If Yes)

b. To whom do you send the samples and what tests are conducted on them?

____ 8-10

____

23. How many gallons of water did you produce in 1973?

__________ million gallons 11-14

24a. What percentage of the water you produced in 1973 went toward:

b. Is all of it metered?

	Percent	Yes	No	
(1) Residential use?	______%	1	2	15-17
(2) Commercial use?	______%	1	2	18-20
(3) Industrial use?	______%	1	2	21-23

25. How much of the water you produced in 1973 was <u>un</u>accounted for?

_____% (or _____ million gallons out of _____ total)

Don't know 98 24,25

26. How well-mapped are the pipes of your system?

All parts of system well-mapped . . 1 26

Some areas well-mapped, other areas poorly or not mapped 2

No accurate maps 3

Don't know 8

27. What year did your current water rate schedule go into effect? *(If schedule went into effect prior to 1965, skip to Q.29)*

19________ 27,28

28. Were any of the following major reasons for any rate increases in the current water schedule . . . *(Circle one number under "Yes" or "No" for each item.)*

	Yes	No	
a. An increase in operating and maintenance costs?	1	2	29
b. The replacement of depreciated or obsolete plant or equipment?	1	2	30
c. The installation of major additions to plant capacity? . . .	1	2	31
d. An attempt to decrease water usage?	1	2	32
e. Some other reason? *(Specify)* ______________________________	1	2	33,34

29. Who determines the water rates schedule? *(Circle one number)*

a. Mayor	1	35
b. Council	2	
c. City Manager	3	
d. Water company	4	
e. Water board, commission, district, or authority	5	
f. Illinois Commerce Commission (ICC) . . .	6	
g. Other *(Specify)* ______________________	7	36

30. Does the water system do any of the following to decrease the usage of water? *(Circle one number under "Yes" or "No" for each item.)*

	Yes	No	*(If Yes)* b. Is this done every year? Yes	No	
(1) Surcharges or demand charges (sprinkling, air conditioning, or other)?	1	2	1	2	37,38
(2) Promotion campaign (newspaper, TV, etc.)? .	1	2	1	2	39,40
(3) Summer adjustments of rates?	1	2	1	2	41,42
(4) Summer restriction on usage?	1	2	1	2	43,44
(5) Other *(Specify)* ______________________	1	2	1	2	45-47

31. Who approves new trunk-lines? *(Circle one number under "Yes" or "No" for each item.)*

	Yes	No	
a. Mayor	1	2	48
b. Council	1	2	49
c. City manager	1	2	50
d. Water company	1	2	51
e. Water board, commission, district or authority	1	2	52
f. Illinois Commerce Commission (ICC) .	1	2	53
g. Environmental Protection Agency (EPA)	1	2	54
h. Other *(Specify)* ________________	1	2	55,56

32a. Is detailed cost information on the water system available to you?

Yes . . . . 1 — 57

No *(Go to Q.33)* . . . 2

(If Yes)

b. How frequently is it updated? ______________________________ 58,59

33. Since 1970, how much has the water works spent for the water facility on such capital additions as plant or equipment?

Approximately $______________ 60-64

None 00000

34a. Does your office have any set procedures it would take if your water system developed a problem of severe low pressure?

Yes . . . . 1 — 65

No *(Go to Q.37a)* . . . 2

(If Yes)

b. What procedures would be taken by your office? ________________ 66,67

____

35. In the event you are out of town, is someone else designated to carry out these procedures?

Yes 1 68

No 2

36. Are these procedures written down any place?

Yes 1 69

No 2

70-79 | BK

80 | 4

1-7 | DUP

37a. Since 1965, has there been a change in water demand (increase or decrease for . . .

(If Yes, a change in demand)

b. Approximately what is the percentage of increase or decrease?

	Yes	No	Increase		Decrease	
(1) Residential users?	1	2	____%	or	____%	8-11
(2) Commercial users?	1	2	____%	or	____%	12-15
(3) Industrial users?	1	2	____%	or	____%	16-19
(4) Public or municipality use?	1	2	____%	or	____%	20-23
(5) Sale to other government units?	1	2	____%	or	____%	24-27
(6) Total consumption?	1	2	____%	or	____%	28-31

38. How much increase or decrease in demand do you estimate in 1980, as compared to 1973?

	Increase		Decrease		No change	
(1) Residential users?	____%	or	____%	or	____%	32-34
(2) Commercial users?	____%	or	____%	or	____%	35-37
(3) Industrial users?	____%	or	____%	or	____%	38-40
(4) Public or municipality use?	____%	or	____%	or	____%	41-43
(5) Sale to other government units?	____%	or	____%	or	____%	44-46
(6) Total consumption?	____%	or	____%	or	____%	47-49

39a. Since 1970, has any additional capacity been added by your water system?

Yes . . . . 1 — 50

No *(Go to Q.40a)* 2

(If Yes)

b. Where has this expansion taken place?	c. Approximately what percent additional capacity does it represent?	
Place of expansion	Percent additional capacity	
______	______%	51-55
______	______%	56-60
______	______%	61-65

40a. Will your water system need any additional capacity by 1980?

Yes . . . . 1 — 66

No *(Go to Q.41)* 2

(If Yes)

b. What will this entail and at what approximate cost?

______________________________ 67,68

______________________________ 69-73

41. Were your answers based on your own estimate, or were they devised from a technical plan or engineering report on the future of your water system?

Own estimate . . . . 1 — 74

Plan or report . . . 2

42. Is the water utility owned privately, regionally or municipally?

Privately . . . . 1 — 75

Regionally 2

Municipally *(Go to Q.49)* . . . 3

43. Is there a plan or projection which has analyzed the current and future needs of the water system in this community?

Yes . . . . 1 — 76

No *(Go to Q.49)* 2

(Writing in progress (47) . . 3

44. When was the plan written? 19________ — 77,78

(If 1971 or after, go to Q.46)

45a. Has the plan been revised in the last three years?

Yes . . . . 1 — 79

No *(Go to Q.46)* 2

80 | 5

1-7 | DUP

(If Yes)

b. By whom? ______________________________ — 8,9

(Title, not name)

46. What were the reasons for having the plan formulated?

____ — 10,11

47a. Has the plan been submitted to any local municipal body or agency for discussion or information?

Yes . . . . 1 — 12

No *(Go to Q.48)* 2

(If Yes)

b. Which agency? ______________________________ — 13,14

48. Have the contents of the plan been publicized in the local news media?

Yes . . . 1 — 15

No 2

49. How many people are employed to work in your water system? ________ 16,17

50. Of this number, how many employees are:

Part time? ________ 18,19

Full time? ________ 20,21

51. How many water system employees are at each of the following levels of certification? *(Please state number employed at each level.)*

Not certified . . ________ 22,23

Class A . . . . . . ________ 24,25

Class B . . . . . . ________ 26,27

Class C . . . . . . ________ 28,29

Class D . . . . . . ________ 30,31

52a. Of the total number of employees in this system, how many graduated from college? ________ 32,33

b. How many have some colelge education, but did not graduate? ________ 34,35

c. How many graduated from high school, but did not attend college? ________ 36,37

d. How many did not graduate from high school? ________ 38,39

53. What is your job title? ________________ 40,41

54a. Are you certified by the State of Illinois as a water plant operator?

Yes 1 42

No *(Go to Q.55)* 2

(If Yes)

b. What class of certification?

Class A 1 43

Class B 2

Class C 3

Class D 4

55. What is the highest level of formal education you obtained?

Grammar school or less 1 44
Some high school 2
High school graduate 3
Some college 4
College graduate 5
Postgraduate degree 6

45-73 | BK

_______ 74-76

_______ 77-79

80 | 6

Thank You For Your Cooperation.