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WATER QUALITY RELATIONSHIPS IN THE GREAT LAKES: ANALYSIS OF A SURVEY QUESTIONNAIRE

By
J. W. BULKLEY
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J.W. Bulkley[1] and A.P. Mathews[2]

[1]Department of Civil Engineering and School of Natural Resources

[2]Department of Civil Engineering

The University of Michigan
Ann Arbor, MI 48104

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ABSTRACT

The maintenance and improvement of water and shoreline quality ultimately requires that the various governmental units responsible for quality be able to perceive the nature of factors influencing water and shoreline quality, and the cause and effect relationships among these factors. A questionnaire survey conducted among 650 governmental units in the Great Lakes area has identified the levels of water quality in the respective areas, the perceived factors contributing to the destruction of water resources and possible solutions to the problem of deteriorating water quality.

One-way frequency distributions obtained, based on the 300 responses to the questionnaires, indicate that the water quality is medium or lower in 92% of the cases, while it is low or very low in 35% of the cases. Inadequate municipal sewage treatment and inadequate industrial effluent treatment were identified to be the most common factors causing the destruction of water resources. The primary agencies responsible for the maintenance of water quality in the local areas were reported to be the state and provincial agencies.

Analysis of two-variable relationships have been made with a view to link the chain of causal factors influencing water in the Great Lakes. Water quality is found to vary with the type of land use and population density, decreasing with increasing degree of industrialization and decreasing with increasing population density. A causal sequence model in which population density appears as the intervening variable between land use and water quality is proposed, and this seems to correlate with the data.

I. INTRODUCTION

The Great Lakes provide a wide range of uses, from municipal and industrial to recreational and esthetic, and are a vital asset for a large segment of the population in both the United States and Canada. The implications of continued deterioration of the Lakes through multiple use must be realized by the various governmental units responsible for maintaining and improving water and shoreline quality. It is important that these units of government are able to perceive the nature of factors influencing water and shoreline quality, and the cause and effect relationship among these factors. In January 1971, a survey questionnaire was designed with the assistance of personnel from a number of Sea Grant projects to elicit information into the range of water resource problems perceived by the various units of government along the shorelines of the Great Lakes. Specifically, the following areas formed the subject of the study:

(1) Issues concerned with the destruction of resources.
(2) Issues concerned with the utilization of resources.
(3) Issues concerned with the problem of planning for the wise use of resources.
(4) Rating (by respondents) of the quality of the inshore water and the shoreline and beaches along their area of jurisdiction of the Great Lakes.
(5) Identification of government agencies responsible for protecting the quality of shoreline (inshore) waters.
(6) Identification of the role of different groups in either aiding or hindering maintenance of water quality and quality of shoreline and beaches along the Great Lakes.
(7) Identification and ranking of solutions to the problems of deteriorating water quality.
(8) Identification of certain factors of growth under current economic and social conditions and the effect of these growth factors on the future water quality.

In February and March 1971, the survey questionnaire was sent to a non-random sample of 650 units of government in both the United States and Canada, which have jurisdiction over the Great Lakes shoreline. These units of government include townships, cities, counties, state, provincial, and regional and federal government agencies.

By September 1971, over 200 questionnaires had been returned, and 177 of these contained the required information. The information contained in the 177 questionnaires was coded and analysed using the Statistical Package for the Social Sciences (SPSS), and the results were reported in the Sea Grant Report #25, MICHU-SG-72-203. The data on location of the governmental unit, type of government, land use, and population density for these questionnaires

were obtained from the Great Lakes Water Use Map, prepared by the Deaprtment of Fisheries, Ottawa, Canada.

A second effort to obtain additional responses from the units of government was made in May-June 1972. A package containing a slightly modified questionnaire, and the first progress report was mailed to all the units that did not respond to the first mailing. This was followed within two weeks by telephone calls to selected governmental units throughout the Great Lakes which had not responded to the questionnaire. Furthermore, the progress report and a sheet requesting information previously obtained from the Great Lakes Water Use Map were mailed to all the 650 units of government. The total effort produced more than 150 replies, of which 123 were new, the others being from units of government that had responded before. They were combined with the original data set, and an SPSS system file was created with 300 cases. This report summarizes the results obtained from the analysis of this data from three hundred responses.

The major objective of this research is to utilize the techniques of survey research to provide a realistic indication of the range of resource problems and issues perceived by units of government along the Great Lakes shorelines. The nature of these problems and issues as reported by the units of government may indicate where research efforts need to be concentrated in order to alleviate identified problems. Data analysis in this report has mainly focused on water quality and factors that influence water quality. The data base will be made available to other research centers or universities desiring analysis of data related to other areas of interest.* This research project at the Michigan Sea Grant Program will make every effort to respond effectively to special requests for additional data analysis.

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*The Canada Centre for Inland Waters (CCIW) at Burlington, Ontario has received a copy of the data base.

II. DATA ANALYSIS: ONE-WAY FREQUENCY DISTRIBUTIONS

One-way frequency distributions provide a convenient means for displaying information for each of the variables. The results for the first 177 questionnaires were reported in the Michigan Sea Grant Reports #19 and #25. In this chapter, one-way frequency distributions for all the variables for the 300 cases are examined, and comparisons of the responses of different governmental units for certain variables are made.

(i) Level of Response:

An examination of the degree of response to the questions indicate that all the questions were of some relevance in the respondents area of jurisdiction. The average response on questions one to four, and six and eight is 87%, and varies from 77% to 97%. On question five, the effect of various groups and interests on water and shoreline quality, the response of each case is limited to particular groups active in their own area. The response thus varied from 31% for student groups, to 75% for conservation groups. Question seven did not contain any specific issues in the first mailing, and only the 123 cases from the second mailing were exposed to all sixteen issues. Hence the response on this question is limited and varies from 12% to 40%.

(ii) Distribution of Responses:

The questionnaires were mailed to 490 governmental units in the United States and 160 in Canada. Of the 300 cases returned, 23.3% of the sample are from Canada and 76.7% are from the U.S. Furthermore, the responses from the Lakes were as follows: Lake Erie, 20.2%; Lake Ontario, 13.4%; Lake Michigan, 32.2%; Lake Huron, 17.1%; Lake Superior, 12.3%. Of the sample, 4.8% had jurisdiction over shorelines of connecting waters. A breakdown of the responses by the type of government is shown in Table 1. Tables 2 and 3 show the frequency distributions of predominant land use and population density in the respective areas.

(iii) Water and Shoreline Quality:

The water quality is rated by the respondents as medium or lower quality in 92% of the cases, with 35% of the respondents indicating low or very low water quality. Ninety-three percent of the respondents rated the shoreline quality to be medium or lower, and 34% rated it be low or very low. Seventy-four percent of the respondents indicate the source of pollution to be within their own area, or both from within and outside their area of jurisdiction. Thus, at least 26% of the respondents consider the source of pollution to be outside their own area, and this lays more stress on Federal involvement in interstate problems, and State-Provincial involvement in local problems. At the international level, additional agreements must be reached between the United States and Canada to control pollution more effectively and to

TABLE 1 - GOVERNING AGENCY

	Absolute Frequency	Relative Frequency	Adjusted Relative Frequency
Township	165	55%	56.1%
County	67	22.3	22.8
City	48	16.0	16.3
State, Regional, Federal	13	4.3	4.4
Others	7	2.3	missing

TABLE 2 - LAND USE

	Absolute Frequency	Relative Frequency	Adjusted Relative Frequency
Industrial and Residential	78	26.0%	26.6%
Agricultural	68	22.7	23.2
Residential	83	27.7	28.3
Recreational and Wildlife	64	21.3	21.8
Others - Unknown	7	2.3	missing

TABLE 3 - POPULATION DENSITY
(Persons per square mile)

	Absolute Frequency	Relative Frequency	Adjusted Relative Frequency
Less Than 50	109	36.3%	37.7%
50 - 499	102	34.0	35.3
Greater than 500	78	26.0	27.0
Unknown	11	3.7	missing

TABLE 4 - ISSUES RELATED TO THE DESTRUCTION OF RESOURCES

Issues	Adjusted Relative Frequency		
	Unimportant	Somewhat Important	Important
Water pollution due to inadequate municipal sewage facilities	24%	19.9%	56.1%
Water pollution due to inadequate industrial sewage facilities	34.2	20.6	45.3
Water pollution due to agricultural runoff	52.0	32.0	16.0
Pollution of both land and water due to disposal of solid waste materials	44.0	28.6	27.4
Beach and slope erosion	30.7	20.4	48.9
Sedimentation due to poor land use practices	60.0	24.7	15.3
Alteration of shoreline by filling or dredging	52.8	19.4	27.8
Threat of thermal pollution	69.4	13.8	16.8

restore the quality of the Great Lakes. The Great Lakes Water Quality Agreement signed between the United States and Canada on April 15, 1972 is a significant step towards effective control of water quality within the Great Lakes.

(iv) Protection of Water Quality:

The agencies responsible for the protection of water quality in the Great Lakes vary from local, state-provincial and federal government agencies to regional agencies. State-provincial and local governments have traditionally played the lead role in environmental protection. The states still continue to play a vital role, but more and more federal involvement is becoming apparent. Seventy-five percent of the respondents reported single or combined participation of state agencies in the protection of water quality in their areas, while the corresponding figure is 39% for local agencies, 44% for federal agencies and 25% for regional agencies. In 27.3% of the cases the state agencies hold the main responsibility, and the corresponding figures for local, federal and regional agencies are 7.5%, 9.4% and 3.4% respectively.

(v) Issues Relating to the Destruction of Resources

The issues perceived to be causing the destruction of resources, and their importance are listed in Table 4. Water pollution due to inadequate municipal sewage facilities is reported to be the most important factor responsible for the deterioration of water quality in the Great Lakes. This feeling is equally shared by township, city, and county governments. Coupled with this is the reported need for more funds to build additional wastewater treatment plants (see Section IX). This indicates that broader fiscal support is perceived to be desirable from the Federal and State governments than is generally available at present.

Forty-five percent of the respondents consider industrial pollution to be a serious factor causing destruction of the lake resources. As expected, Fifty-eight percent of the respondents from the cities consider this issue to be important, compared to only 34% from the townships, because of the larger industrial base of the cities. Industry moves the nation, but in doing so, it generates wastes that are usually more toxic than municipal effluents. Industry already uses more than ten times as much water as the municipal systems. Industrial pollution can be curbed by a strong concern among management for the environment, and a commitment to include the consideration of environmental quality in basic decision-making processes. The city, county, and township governments consider the enforcement of existing regulations, and further enaction of new regulations aimed at restricting the sources of pollution to be possible solutions to the problem of deteriorating water quality.

Agricultural runoff is not perceived to be an important problem by the various units of government. Only 12% from townships, 20% from county and

8% from the city government consider agricultural runoff to be an important factor causing the destruction of resources. This is especially significant when we consider the fact that 34% of the respondents from the agricultural areas reported the water quality in their areas to be low or very low. Agricultural use ranks next to industrial use in terms of adverse influence on water quality. However, it is not recognized as an important issue causing the destruction of resources by the township, county, or city government. This is especially significant in the case of townships where 27% of the land use is agriculture.

Pollution of both land and water due to the disposal of solid waste materials is not considered to be a serious problem by 44% of the respondents. Only 30% of the respondents from the city governments and 25% from the townships and counties consider solid wastes to be a current problem. Industry generates a good percentage of the country's non-agricultural and non-mineral solid wastes. In 1969, industry generated 110 million tons of solid wastes, compared to 250 million tons from residential, commercial and institutional sources (1). These figures are likely to increase each year with growth. However, 71% of the respondents do not anticipate any harm to the environment from the present methods of solid wastes treatment in the next five years. This is in sharp contrast to the concern voiced in the Resources Recovery Act of 1970, which places more emphasis on recycling as an alternative for the disposal of some solid wastes (2).

Beach and slope erosion seem to be of great concern to township and county governments, with 52% and 51% of the respective respondents considering it to be an important issue, compared to 27% from the city. Erosion control is favored highly and, at the same time, a majority of the respondents indicate that enjoyment of shore areas is not reduced by erosion prevention structures.

(vi) Issues Relating to the Utilization of Resources:

Table 5 lists the issues relating to the utilization of resources and their perceived importance. There is a perceived need for making more land available for public use in the form of recreational developments, parks and wilderness areas. Congestion and inferior facilities in recreation developments, inadequate accessibility or the shoreline, and poor quality development adjacent to the shoreline are some of the more important problems in the utilization of resources. The city governments stress inadequate shoreline accessibility, poor quality, and the issue of inadequate adaption of transportation to the shore zone more than the township governments.

State-provincial expenditures in parks and their maintenance have gone up in recent years. However, there is a need for sustained efforts at the federal, state and local levels to acquire more lands or assure access to lands for public recreation and to preserve more unique natural areas. The U.S. federal government's "Legacy of Parks" program, and the decision to

TABLE 5

ISSUES RELATING TO THE UTILIZATION OF RESOURCES

Issues	Adjusted Relative Frequency		
	Unimportant	Somewhat Important	Important
Inadequate accessibility, both functional and visual to the waters edge	31.9%	26.7%	41.4%
Conflict over land use by competing users	40.8	22.9	36.3
Poor quality development adjacent to shoreline	34.1	25.2	40.7
Decreasing land available for public use	25.4	17.4	57.1
Congestion and inferior facilities in recreation developments	35.3	24.0	40.7
Reduced enjoyment of shore areas due to erosion prevention structures	65.5	16.4	18.1
Lack of proper marina facilities	32.1	28.4	39.5
Lack of proper port facilities	47.3	22.8	30.0
Inconsistency of contrasting land use characteristics within the shore zone	51.0	25.3	23.7
Inadequate adaption of transportation to the shore zone	53.4	19.7	26.9

release under-used U.S. federal properties to state and local governments are steps in the right direction to alleviate identified problems in resource utilization (3). Eighty-seven percent of the respondents indicate that preservation of existing national shoreland areas would be beneficial under the current economic and social conditions (see Table 11). At the same time 72% contend that recreational growth would be beneficial in their areas. Thus there is a need for coordinated action from state and local government on the one hand to develop more recreational areas and to make them easily accessible to the public. And on the other hand, land use policies and zoning ordinances at the local or higher levels will have to be enacted for the preservation of natural areas for the present and future generations.

(vii) Issues Concerned with the Problem of Planning for the Wise Use of Resources

There has been considerable activity in recent years at the state and federal level towards more comprehensive planning by reorganization and consolidation of pollution control agencies and programs. This action is a welcome departure from the more traditional state of affairs, when the effluent standards were set by boards and commissions that operated without benefit of comprehensive guidelines. The enforcement of these limited standards was conducted by units typically found within a State Department of Public Health.

The state of Illinois has three agencies, the Pollution Control Board, the State Environmental Protection Agency, and the Institute for Environmental Quality to set and enforce standards, and to conduct long-range planning and applied research. In Michigan and New York these responsibilities are held by different units of the Water Resources Commission. The respondents consider such long-range and comprehensive water-oriented environmental planning at all levels of government to be important in future planning for the wise use of resources (Table 6). This is emphasized more by the county governments than the cities and townships. The need for water-oriented environmental planning is considered to be important by 45% of the county governments and unimportant by 8%, while the corresponding figures for the city agencies are 48% and 25%, and for the townships 39% and 38%. The need for long-range comprehensive planning is rated to be important by 50% of the counties and unimportant by 21%. The corresponding figures for cities are 37% and 35%, and for townships 45% and 31%.. A large number of respondents expect zoning to be a controversial issue in the next four years (See Section XI). However, the need for state or province-wide zoning regulation and local zoning and building regulations are not as strongly emphasized by the respondents. This response suggests that actual implementation of effective zoning at the state-province level may not be politically feasible at present.

(viii) Effect of Various Groups on the Maintenance and Improvement of Water and Shoreline Quality

The perceived effects of various groups on the maintenance and improvement

TABLE 6

ISSUES CONCERNED WITH PROBLEMS OF PLANNING FOR THE WISE USE OF RESOURCES

Issues	Adjusted Relative Frequency		
	Unimportant	Somewhat Important	Important
Inadequate emphasis in water-oriented environmental planning by all levels of government	25.9%	31.7%	42.4%
Lack of inter-agency cooperation with regard to this matter	34.3	28.7	36.9
A piecemeal approach to planning-solving of immediate problems with no long-range comprehensive planning	29.2	24.8	46.0
Need for state or province-wide zoning of shorelands	40.5	17.0	42.5
Lack of resource information	43.2	27.3	29.5
Inadequate zoning and building regulations	39.2	20.2	40.8
Lack of planning methods, goals policies, and identification of user values	35.2	29.3	35.5

of shoreline water quality of the shoreline and beaches are shown in Tables 7 and 8. The need to restrict excessive real estate development along the shorelines of the Great Lakes is voiced by 70% of the respondents, with a majority of them considering such development to be harmful. In addition to real estate developers, homeowners, industrial corporations, and utility companies are reported to have adverse influence on the maintenance and improvement of water and shoreline quality. In each case, the hindering influence is indicated to be much greater than the aiding influence. For example, of the 46% cases that reported industrial corporations aid in the maintenance of water quality, only 19% felt the influence to be significant, while of the 54% that felt that industrial corporation hinder, 63% felt that their influence was significant. Conservation groups and federal and state agencies and regulations are major positive forces in the maintenance and improvement of water quality.

A systematic means for representation of the perceived influence (both positive and negative) combined with the degree of importance of a particular group for maintenance of shoreline water quality is as follows (all data from Table 7):

For each group-

(a) Multiply the AID % figure by the associated Great Deal of Influence % figure.

(b) Multiple the HINDER % figure by the associated Great Deal of Influence % figure.

(c) Identify the maximum and minimum values obtained for both the AID and HINDER axis.

(d) Normalize the results for both AID and HINDER axis by subtracting the minimum value observed from all other values and dividing by the resulting maximum value.

(e) Plot the results on a graph with the vertical axis representing HINDER and the horizontal axis representing AID. Both axes range from zero to 1.0, and intersect at 0.5.

(f) For both axis, HINDER and AID, the normalized value of 0.5 is the cutoff between "more important" and "less important." For example, one would expect that agencies or groups that are perceived to be "more important" in aiding the maintenance of shoreline water quality would have a normalized value 0.5 on the AID axis. Furthermore, these same groups may be expected to have a normalized value 0.5 on the HINDER axis. Accordingly, one would expect to find those groups identified as aiding the maintenance of shoreline water quality in the lower right hand quadrant; on the other hand, those groups identified as hindering the maintenance of shoreline water quality may be expected to be found in the upper left hand quadrant. The line A-A' is a reference line which links these two quadrants.

Figure 1 represents the above calculation performed on the groups associated with the maintenance of shoreline water quality. Figure 2 plots the same groups as perceived regarding the maintenance of the quality of shoreland and beaches. The federal agencies have a higher perceived value in the

Figure 1. Effects of Various Groups on the Maintenance of Shoreline Water Quality

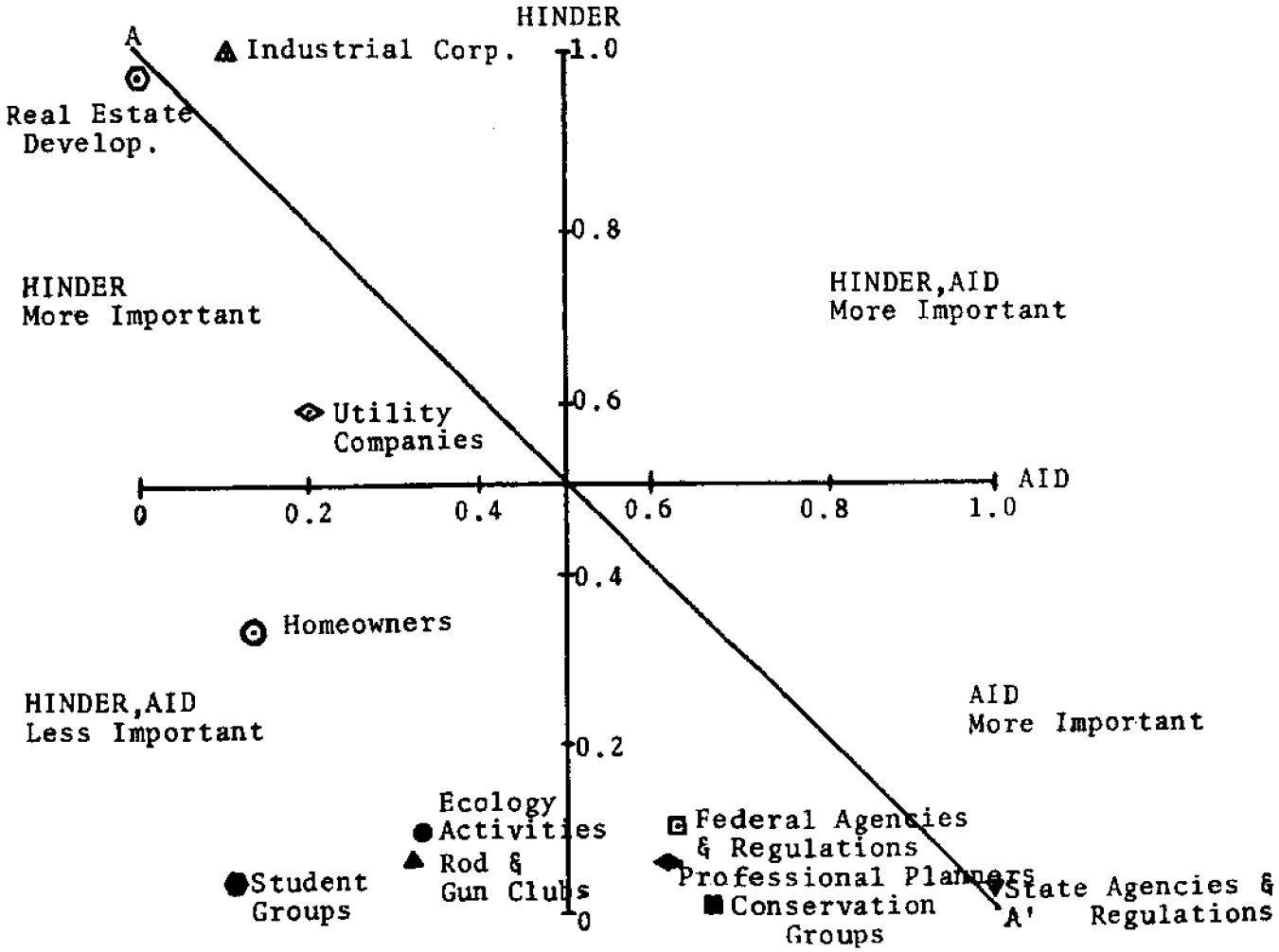

Figure 2. Effects of Various Groups on the Maintenance of the Quality of Shoreland and Beaches

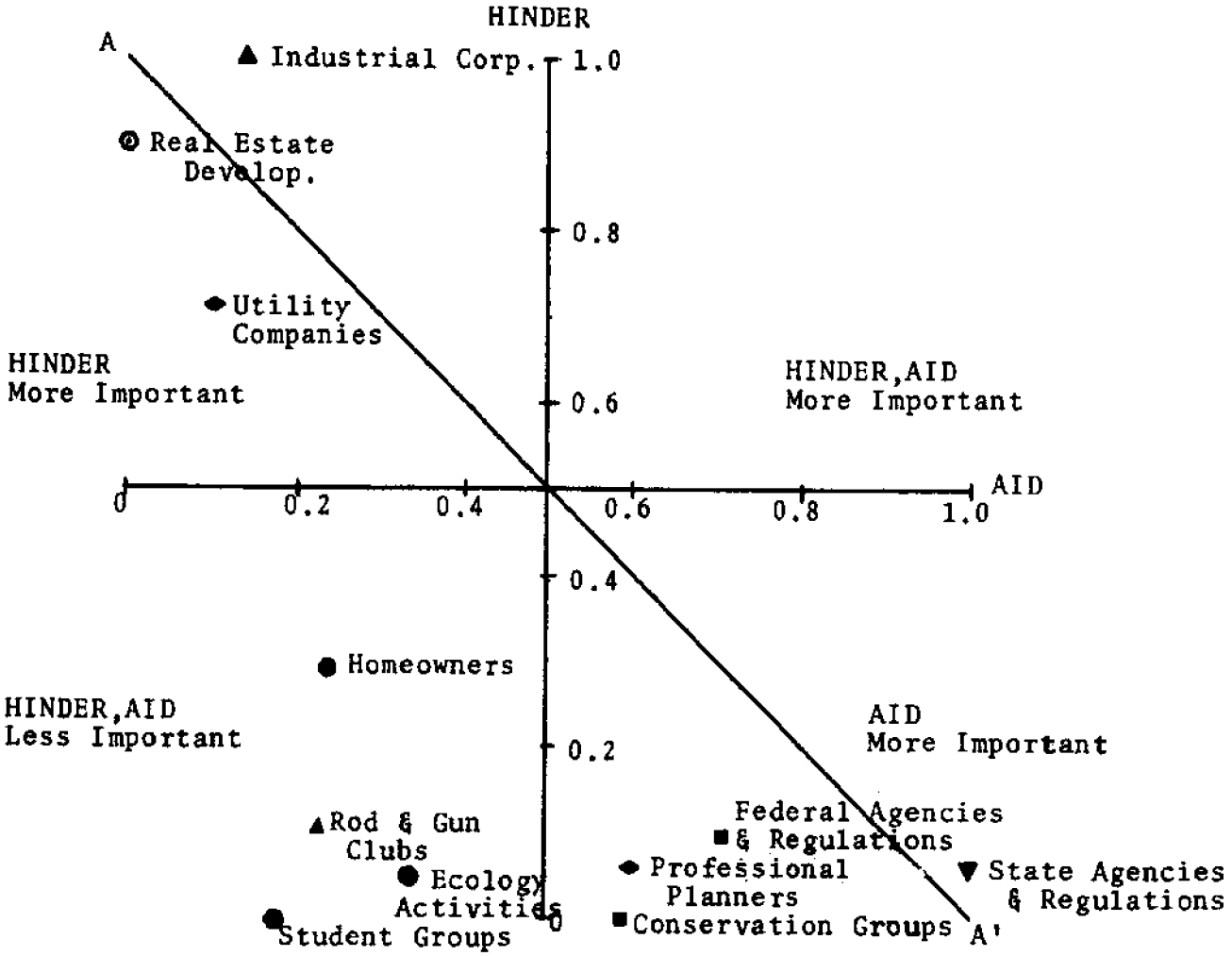

TABLE 7

EFFECT OF VARIOUS GROUPS ON THE MAINTENANCE OF SHORELINE WATER QUALITY

Groups	Aid	Influence		Hinder	Influence	
		Hardly Any	Great Deal		Hardly Any	Great Deal
Conservation Groups	99.6%	33.5%	36.4%	0.4%	-	-
Ecology Activists	91.5	45.4	22.0	8.5	27.3	36.4
Rod & Gun Clubs	94.9	46.7	20.5	5.1	57.1	42.9
Professional planners, etc.	94.1	28.9	36.2	5.9	11.1	33.3
Student Groups	94.4	59.8	10.3	5.6	80.0	20.0
Real Estate Developers	30.1	61.9	14.3	69.9	16.3	46.7
Homeowners	63.3	44.9	16.8	36.7	28.6	30.2
Industrial Corporations	46.4	38.7	19.4	53.6	9.6	63.0
Utility Companies	58.6	42.5	23.3	41.4	20.4	46.9
Federal Agencies & Regulations	92.5	30.9	36.8	7.5	33.3	44.4
State Agencies & Regulations	95.9	14.9	54.0	4.1	33.3	16.7

TABLE 8

EFFECT OF VARIOUS GROUPS ON THE MAINTENANCE OF THE QUALITY OF THE SHORELAND AND BEACHES

Groups	Aid	Influence		Hinder	Influence	
		Hardly Any	Great Deal		Hardly Any	Great Deal
Conservation Groups	99.4%	32.5%	30.0%	0.6%	-	-
Ecology Activists	93.2	47.7	19.8	6.8	33.3	22.2
Rod & Gun Clubs	95.0	52.9	14.1	5.0	20.0	60.0
Professional Planners, etc.	94.7	28.1	31.9	5.3	16.7	33.3
Student Groups	95.4	60.8	11.4	4.6	75.0	-
Real Estate Developers	37.0	65.1	7.0	63.0	16.4	41.1
Homeowners	71.2	37.1	19.0	28.7	36.6	29.3
Industrial Corporations	48.1	42.9	18.4	50.9	13.2	54.7
Utility Companies	62.2	54.2	11.9	37.8	14.3	54.3
Federal Agencies and Regulations	92.8	33.6	38.0	7.2	37.5	37.5
State Agencies and Regulations	94.1	20.5	51.7	5.9	57.1	28.6

latter rather than the former. This may be attributed to the work of certain federal agencies in providing erosion control structures in the present period of high lake levels. Also, it is interesting to note that utility companies are perceived to play a more influential role in hindering the maintenance of shoreline water qulaity. This result indicates that a distinction is made between occupancy of shoreline areas by utilities and thermal discharges from utility facilities. In both Figure 1 and 2, the A-A' axis represents the line along which one would expect the groups to fall. Those groups which are in the "less important" region for both axes, i.e., homeowners, ecology activists, student groups, and rod and gun clubs are perceived by the respondents to have only marginal impact upon the maintenance of environmental quality.

(ix) Possible Solutions to the Problem of Deteriorating Water Quality

Table 9 summarizes the results obtained from question number six, which requested information regarding possible solutions to the problem of deteriorating water quality. The two solutions which were ranked highest by the respondents are (1) more funds to build additional wastewater treatment plants, and (2) stricter enforcement of existing water quality regulations.

There have been significant increases in the United States in state and federal contributions to finance construction of waste treatment plants in the last few years. The U.S. federal government has funded construction of pollution control facilities largely through the Federal Water Pollution Control Act. Also, local communities were awarded a bonus in federal grant assistance whenever the state payed 25% of the cost. However, despite these contributions, it is evident from the questionnaire response that a severe shortage of funds and manpower still exists in many areas.

The problem has to be confronted in two ways: (1) through application of economically feasible technological innovations and, (2) as emphasized in the issues in planning, through long-range and comprehensive water-oriented environmental planning at all levels of government. The former implies the necessity for continued support of environmental research in pollution control technology and in effective management techniques. More importantly, the time required for approval of feasible projects at the state level must be reduced and field experimentation must be increased.

To cope with the problem of inadequate waste treatment facilities and the lack of funds for the construction of such facilities, some states such as New York and Ohio have created public corporations with responsibilities for the financing, construction, and operation of wastewater, solid waste, and water supply facilities. In Illinois, the State Environmental Pollution Cont Act permits the Pollution Control Board to force municipalities with inadequate treatment facilities to generate funds through the issuance of general obligation or revenue bonds. The Ohio Water Development Authority undertakes projects for industrial facilities also, but it does not have any responsibilities over regional planning.

TABLE 9

POSSIBLE SOLUTIONS TO THE PROBLEM OF DETERIORATING WATER QUALITY

Issues	Yes	Very Important
More funds to build additional wastewater treatment plants	88.2%	69.0%
Stricter enforcement of existing regulations	88.8	68.5
New regulations to further restrict the sources of pollution	82.4	55.6
Redistribution of responsibility for pollution control among existing government agencies	65.1	35.8
Creation of new agencies with responsibility for water pollution control	61.5	21.2
Increased leadership from public officials in water quality	78.5	58.4
Increased coordination of the activities of the existing agencies in water quality management	83.5	67.0

The enforcement of existing regulations is considered to be an important solution to the problem of deteriorating water quality and ranks much ahead of new regulations aimed at further restricting the sources of pollution. This points out the inadequacy of current water quality monitoring facilities and enforcement programs. At the state-province level, reorganization of pollution control agencies and programs has been the main approach in tackling this situation.

The perceived importance of the possible solutions are listed according to the level of government in Table 10. The results indicate that the level of government may in fact influence the perceived importance of alternative solutions to problems of deteriorating water quality. While the cities and counties both ranked additional funds first, the townships ranked enforcement of existing regulations considerably ahead of additional funds for wastewater treatment. This difference may in fact represent differences in the functions performed by the different units of government. One should note that the creation of new agencies as a solution to the water quality problem ranked at the bottom of each of the rank-ordered lists. Also the high ranking of increased coordination by the county may reflect that county government contains a major component which is directed toward interfacing and coordinating with municipal and township governments which are within the political boundaries of the county.

(x) Benefit of Certain Factors Under the Current Economic and Social Conditions, and the Effect on Future Water Quality

The state of the environment has in large measure been dependent on the population density and the levels of economic activity in the area. With low levels of economic activity, and a low population density the waste products could be easily assimilated by the receiving waters. However, with accelerated economic growth and limited effluent standards and controls, the capacity of natural systems to absorb and assimilate wastes has been severly overtaxed. Thus, there is a need to protect water quality at the expense of some economic growth or productivity. This is in essence expressed in response to question eight, where 94% consider protection of water quality to be beneficial to their areas under the present social and economic conditions (Table 11). However, social and economic needs will not be satisfied by eliminating completely future economic growth to meet water quality objectives. Only 9% of the respondents consider a strictly "no growth" policy to be beneficial, while 76% consider development under controlled conditions to be beneficial.

The land use pattern envisaged by most respondents gives high priority to the preservation of existing shoreland areas, and recreational growth. Industrial development is considered beneficial by 57% of the governmental units and it is considered to be detrimental to future water quality by 39% (Table 12). Urban growth and agricultural development receive only limited support. Only 12% of the respondents consider agricultural development to be detrimental to the future water quality in their areas. This substantiates our finding, reported earlier, that there is inadequate perception of agricultural use as an issue causing the destruction of resources. As shown in Table 17, agricultural use ranks only second to industrial use in terms of the adverse influence on water quality.

TABLE 10

Solutions: Deteroriating Water Quality
(Rank ordered) P
Product: [Yes (%) x Very Important (%)]

Township	- Enforce Existing Regulations	[58.5]
	Additional Funds Wastewater Treatment Plants	[52.4]
	Increased Coordination	[49]
	New Regulations - Curb Pollution	[44]
	Increased Leadership	[43]
	Redistribute Responsibility	[24]
	Create New Agencies	[13]
County	- Additional Funds Wastewater Treatment Plants	[72]
	Increased Coordination	[71.6]
	Enforce Existing Regulations	[56]
	Increased Leadership	[52.5]
	New Regulations - Curb Pollution	[46.5]
	Redistribute Responsibility	[30.0]
	Create New Agencies	[13.0]
City	- Additional Funds Wastewater Treatment Plants	[75]
	Enforce Existing Regulations	[71]
	New Regulations - Curb Pollution	[53.5]
	Increased Leadership - Increased Coordination	[46](tie)
	Redistribute Responsibility	[20.6]
	Create New Agencies	[17]

TABLE 11

BENEFIT OF CERTAIN FACTORS UNDER THE PRESENT SOCIAL AND ECONOMIC CONDITIONS

Issues	Not Beneficial	Somewhat Beneficial	Beneficial
Urban growth	39.6%	27.5%	32.9%
Recreational growth	11.4	16.9	71.7
Industrial development	23.0	20.0	57.0
Protection of water quality	2.2	4.0	93.8
Preservation of existing natural shoreland areas	4.8	8.4	86.8
More control of development	14.1	18.8	67.2
"No growth" policy	70.0	20.6	9.4
The construction of nuclear power plants	59.1	20.9	20.0
The construction of fossil fuel power plants	74.3	19.3	6.4
Agricultural development	37.3	29.9	32.8
Mining operations	78.8	8.5	12.7

TABLE 12

EFFECT OF CERTAIN FACTORS ON FUTURE WATER QUALITY

Issues	Not Detrimental	Somewhat Detrimental	Detrimental
Urban growth	36.9%	28.7%	34.4%
Recreational growth	59.5	20.3	20.3
Industrial development	31.1	29.9	39.0
The construction of nuclear power plants	33.6	19.3	47.1
The construction of fossil fuel power plants	26.5	22.4	51.1
Agricultural development	64.3	23.5	12.2
Mining operations	39.8	14.1	46.1

TABLE 13

CONTROVERSIAL ISSUES IN WATER QUALITY MANAGEMENT

Issues	Pro	Degree of responsibility None	Degree of responsibility Complete	Con	Degree of responsibility None	Degree of responsibility Complete
Financing needed, sewer construction	99.3%	28.0%	49.2%	0.7%	-	-
Storm drain construction	96.1	40.6	33.3	3.9	50.0	-
Industrial pollution	55.0	58.1	30.2	45.0	55.6	13.9
Solid wastes	70.8	26.6	46.9	29.2	19.2	38.5
Thermal pollution	40.0	70.6	11.8	60.0	60.9	13.0
Marine sewage discharge	64.4	60.5	16.3	35.6	70.8	16.7
Erosion control	93.1	44.2	26.0	6.9	80.0	-
Industrial development	84.0	35.5	30.6	16.0	8.3	50.0
Marsh land development	60.0	40.0	31.4	40.0	28.6	52.4
Cluster development	80.0	25.5	42.6	20.0	16.7	66.7
Construction of recreational facilities	97.2	20.2	44.4	2.8	33.3	66.7
Nuclear power plants	61.1	75.0	10.0	38.9	66.7	25.0
Zoning	95.9	9.7	69.0	4.1	20.0	80.0
Preservation of natural shoreline	93.8	39.1	29.9	6.2	33.3	33.3
Land use planning	96.3	8.9	61.4	3.7	-	66.7
Regional planning	94.3	21.2	43.8	5.7	50.0	25.0

TABLE 14

LAKE BY WATER QUALITY

Lake	Water Quality		Row Total Count
	High-Medium	Low-Very Low	
Erie	31%*	69%	58
	18	40	
Ontario	50	50	36
	18	18	
Michigan	73.3	26.7	90
	66	24	
Huron	87.8	12.2	49
	43	6	
Superior	91.7	8.3	36
	33	3	
Connecting Waters	57.1	42.9	14
	8	6	
Column Total	186	97	283

* row percent

TABLE 15

LAKE BY POPULATION DENSITY

Lake	Population Density (Persons/square mile) Less Than 50	50-499	Greater Than 500	Row Total Count
Erie	8.5%*	37.3%	54.2%	59
	5	22	32	
Ontario	18.4	42.1	39.5	38
	7	16	15	
Michigan	41.3	45.7	13.0	92
	38	42	12	
Huron	48.0	30.0	22.0	50
	24	15	11	
Superior	86.1	11.1	2.8	36
	31	4	1	
Connecting Waters	23.1	23.1	53.8	13
	3	3	7	
Column Total	108	102	78	288

*row percent

TABLE 16 - WATER QUALITY BY POPULATION DENSITY

Water Quality	Population Density (persons/sq. mile)		
	Less than 50	50-499	Greater than 500
High-Medium Quality	50%*	32.6%	17.4%
	92	60	32
Low-Very low Quality	15.6	38.5	45.8
	15	37	44

*row percent

TABLE 17 - WATER QUALITY BY LAND USE

Water Quality	Land Use			
	Ind. & Resid.	Agri.	Resid.	Rec. & Wild.
High-Medium Quality	40.8%*	65.6%	73.8%	84.4%
	31	59	42	54
Low-Very low Quality	59.2	34.4	26.2	15.6
	45	21	22	10

*Column percent

The construction of nuclear and fossil fuel power plants, and mining operations seem to be the least desirable activities in terms of the effects on the social and economic conditions, as well as the effects on future water quality. Power plants require large amounts of cooling water, and the resultant increased temperature affects the aquatic life in the receiving waters. The siting of power plants requires considerable forethought and planning at the various levels of government to satisfy local aesthetic and recreational needs, local, national, and international water quality objectives, and the need for electrical energy.

(xi) Controversial Issues in Water Quality Management

The 177 questionnaire responses to the first mailing indicated that in the next five years the issues listed in Table 13 may stand out as controversial issues in water and shoreline quality protection in the Great Lakes. The questionnaire was modified based on this and the results for the 300 cases appear in Table 13. The need for funds for sewer construction has been pointed out before as an important issue, and it is expected to continue in the foreground in the next few years. Land use planning and zoning seem to be prominent issues in terms of the number of respondents favoring these and the degree of jurisdiction the agencies have over such issues. Over 95% of the applicable cases favor zoning and land use planning, and more than 60% of these respondents have major responsibility in the jurisdiction over these problems.

III. TWO VARIABLE RELATIONSHIPS: WATER QUALITY AND INDEPENDENT VARIABLES

The effective management of water and shoreline quality requires a proper understanding of the factors that influence shoreline water qulaity, and the interrelationship between these factors. Analysis of two-variable relationship by cross-tabulation or correlation provides a preliminary step towards delineating factors that influence water quality and towards establishing comprehensive models of inshore water quality in the Great Lakes. The primary dependent variable considered in this study is inshore water quality and the effect of independent variables such as land use, population density, the degree of effluent treatment. Possible solutions to the problem of deteriorating water quality are examined here.

(i) Lake Water Quality and Population Density

The water quality in the shoreline areas adjacent to the various lakes is shown in Table 14. Sixty-nine percent of the respondents from Lake Erie, and 50% from Ontario report low – very low water quality, while only 8.3 % of the respondents from Superior report the water quality to be low - very low quality in their areas. At the same time from an examination of Table 15, it is apparent that lakes with predominantly low shoreline water quality tend to have greater percentage of high population density areas than others. Lake Erie has 54.2% of the respondents, and Lake Ontario 39.5% with population density greater than 500 persons per square mile, while the corresponding figures are 22% for Lake Huron, 13% for Lake Michigan and 2.8% for Lake Superior. Now, if increasing population density has a negative influence on water quality, it would then appear that one of the factors indirectly responsible for the low - very low of inshore water quality in Lakes Erie and Ontario is the population density. The cross-tabluation of population density by water quality in Table 16 bears out this relationship. Thus, it is important that the adverse environmental effects of population density and its growth are considered in future governmental planning.

(ii) Lake by Water Quality and Land Use

Land use is another critical environmental factor, and the effects of four broad categories of land use on water quality are shown in Table 17. Sixty percent of the respondents with predominatly industrial use and 34% with agricultural use consider the water quality in their areas to be low or very low. Water quality decreases with increasing degree of industrialization. The cross-tabulation of lake by land use is shown in Table 18, and it appears from this that Lake Erie has 86% and Ontario 69% of the shoreline areas in a combination of industrial or agricultural use. This indicates that the lower levels of shoreline water quality in the lower Great Lakes can be partly attributed to the greater industrialization of their adjacent shoreline areas.

(iii) Water Quality, Land Use, and Population Density

Thus, we have two independent variables, land use and population density affecting water quality, and the question to ask now is whether these variables [illegible] independently of each other. To determine [illegible]

TABLE 18

LAKE BY LAND USE

Lake	Land Use				Row Total Count
	Ind & Resid	Agri	Resid	Rec & Wild	
Erie	61.0%*	25.4%	10.2%	3.4%	59
	36	15	6	2	
Ontario	25.6	43.6	23.1	7.7	39
	10	17	9	3	
Michigan	14.9	17.0	47.9	20.2	94
	14	16	45	19	
Huron	20.0	26.0	18.0	36.0	50
	10	13	9	18	
Superior	11.1	5.6	27.8	55.6	36
	4	2	10	20	
Connecting Waters	21.4	35.7	28.6	14.3	14
	3	5	4	2	
Column Total	77	68	83	64	292

*row percent

one with population density as the intervening variable in the relationship between land use and water quality, and the second one with population density as the antecedent variable. The second model is examined first by cross-tabulating population density by water quality controlling on land use (Table 19). It is apparent from the data that in each of the land use categories water quality is still associated with population density. Water quality is cross-tabulated against land use controlling on population density in Table 20. An examination of the tables indicates that in each stratum of population density the relationship between water quality and land use is substantially reduced except in the high density category. It can be concluded then, that in any land use pattern, population density significantly affects water quality, but the effect of land use on water quality is pronounced only in the high population density areas, and where industrial use is predominant.

The intervening and extraneous variables considered are in essence the sum effect of the component problems of inadequate perception of deteriorating water quality, and inadequate planning to cover perceived needs, either to limit urban and industrial growth or to provide adequate effluent treatment and enact stringent effluent standards. Further analysis must be done to determine if perception of water quality problems is lacking or if inadequate planning methods are responsible for the relationships between water quality, population density, and land use. The survey did not obtain information on the type of effluent treatment in the different areas of jurisdiction and, hence, cannot focus on the latter problem. However, inadequate municipal and industrial sewage treatment are perceived to be the most important factors causing the destruction of resources. The perception of these factors and the perception of additional wastewater treatment as a solution to the problem of deteriorating water quality seems to occur only after the water quality has deteriorated to some extent.

(iv) Water Quality, Inadequate Municipal Sewage Treatment and Inadequate Industrial Sewage Treatment

It was reported earlier that only 8% of the respondents consider the water quality in their areas to be high. The two issues that were found to be important causing the destruction of resources were inadequate municipal sewage treatment and inadequate industrial sewage treatment. Cross-tabulations of these two variables against water quality appear in Tables 21 and 22. Fifty-two percent of the respondents with high water quality do not perceive inadequate municipal sewage treatment to be important in causing the destruction of resources. However, once the water quality is deteriorated to some extent, only 23% consider this issue to be unimportant; while with low water quality, 19% consider it to be unimportant. This variation of perception with water quality may be partly due to the fact that areas with high water quality tend to have a low population density and hence minimal water quality problems. Water quality and inadequate municipal sewage treatment are cross-tabulated controlling population density in Table 23. It is apparent that in each population density category there is a dramatic increase in perception of the issue as soon as the water quality is degraded to some extent from high to medium quality. Inadequate industrial effluent treatment follows the same pattern, with 100% of the respondents with high

TABLE 19

WATER QUALITY BY POPULATION DENSITY CONTROLLING ON LAND USE

	Industrial & Residential			Agricultural			Residential			Recreational & Wild.		
	Population Density			Population Density			Population Density			Population Density		
	Less Than 50	50-499	Greater Than 500	Less Than 50	50-499	Greater Than 500	Less Than 50	50-499	Greater Than 500	Less Than 50	50-499	Greater Than 500
High-Medium Quality	71.4%* 5	43.5% 10	34.8% 16	75.0% 18	65.6% 21	28.6% 2	87.5% 28	68.8% 22	56.3% 9	93.2% 41	70.0% 7	71.4% 5
Low-Very Low Quality	28.6 2	56.5 13	65.2 30	25.0 6	34.4 11	71.4 5	12.5 4	31.3 10	43.8 7	6.8 3	30.0 3	28.6 2
Column Total	7	23	46	24	32	7	32	32	16	44	10	7

*column percent

TABLE 20

WATER QUALITY BY LAND USE CONTROLLING ON POPULATION DENSITY

	Less Than 50				50-499				Greater Than 500			
	Land Use				Land Use				Land Use			
	Indus & Resid	Agri	Resid	Rec & Wild	Indus & Resid	Agri	Resid	Rec & Wild	Indus & Resid	Agri	Resid	Rec & Wild
High-Medium Quality	71.4%* 5	75.0% 18	87.5% 28	93.2% 41	43.5% 10	65.6% 21	68.8% 22	70.0% 7	34.8% 16	28.6% 2	56.3% 9	71.4% 5
Low-Very Low Quality	28.6 2	25.0 6	12.5 4	6.8 3	56.5 13	34.4 11	31.3 10	30.0 3	65.2 30	71.4 5	43.8 7	28.6 2
Column Total	7	24	32	44	23	32	32	10	46	7	16	7

*column percent

TABLE 21 - WATER QUALITY BY INADEQUATE MUNICIPAL SEWAGE FACILITIES

	Unimportant	Somewhat Important	Important
High Quality	11 52.3%*	5 23.8%	5 23.8%
Medium Quality	33 22.5%	36 24.5%	78 53.1%
Low Quality	19 19.3%	13 13.3%	66 67.4%

*row percent

TABLE 22 - WATER QUALITY BY INADEQUATE INDUSTRIAL SEWAGE TREATMENT FACILITIES

	Unimportant	Somewhat Important	Very Important
High Quality	19 100.0%*	0.0 0.0%	0.0 0.0%
Medium Quality	46 36.5%	35 27.8%	45 35.7%
Low Quality	16 17.3%	14 15.1%	63 67.7%

*row percent

TABLE 23

WATER QUALITY BY INADEQUATE MUNICIPAL SEWAGE TREATMENT
CONTROLLING ON POPULATION DENSITY

	Population Density: persons/sq. mile								
	Less than 50			50 - 499			Greater Than 500		
	Unimportant	Somewhat Important	Important	Unimportant	Somewhat Important	Important	Unimportant	Somewhat Important	Important
High Quality	7 43.8%*	4 25.0%	5 31.3%	4 80.0%	1 20.0%	0 0.0%	- -	- -	- -
Medium Quality	15 24.6	13 21.3	33 54.1	12 24.0	14 28.0	24 48.0	6 19.4	7 22.6	18 58.1
Low Quality	5 35.7	2 14.3	7 50.0	4 11.1	3 8.3	29 80.6	8 18.6	8 18.6	27 62.8

*row percent

water quality considering the issue to be unimportant, compared to 36% for medium water quality and 17% for low water quality.

(v) Water Quality and Possible Solutions to the Problem of Deteriorating Water Quality

Water quality is tabulated against additional wastewater treatment plants as a solution in Table 24. Forty-seven percent of the respondents with high water quality consider the solution to be unimportant in their areas, while only 16% with medium water quality and 7% with low water quality consider it to be unimportant. Again, with enforcement of existing regulations as a solution (Table 25), 50% of the respondents with high water quality consider the solution to be unimportant, the corresponding figures for medium, and low water quality being 13% and 7% respectively. It thus appears that solutions to the problem of deteriorating water quality are perceived to be important only after the water quality has deteriorated to some extent.

TABLE 24 - WATER QUALITY BY ADDITIONAL WASTE TREATMENT PLANTS AS A SOLUTION TO THE PROBLEM OF DETERIORATING WATER QUALITY

	Unimportant	Somewhat Important	Important
High Quality	7 46.7%*	3 20.0%	5 33.3%
Medium Quality	22 15.9%	22 15.9%	94 68.1%
Low Quality	6 6.9%	15 17.2%	66 75.9%

*row percent

TABLE 25 - WATER QUALITY BY ENFORCEMENT OF EXISTING REGULATION AS A SOLUTION TO THE PROBLEM OF DETERIORATING WATER QUALITY

	Unimportant	Somewhat Important	Important
High Quality	6 50%*	0 0.0%	6 50.0%
Medium Quality	18 13.0%	32 23.0%	89 64.0%
Low Quality	6 6.9%	14 16.1%	67 77.0%

*row percent

IV. CORRELATION AND CLUSTER ANALYSIS

Bivariate correlation analysis in a manner similar to cross-tabulation provides a single coefficient that describes the association between two variables. In cross-tabulation, the strength of the association is determined by observing the joint frequency distribution of the two variables, while in bivariate correlation analysis the strength is indicated by the magnitude of the coefficient and the level of significance. Kendalls tau rank-order correlation coefficients were computed for a number of variables, with the objective of examining two-variable relationships and as input to partial correlation and cluster analysis subprograms. Listwise deletion of missing data was used so that the coefficients would be based on the same sample size. A correlation matrix for all the variables defined was not obtained because listwise deletion of missing cases would reduce the sample size drastically.

The variables in each empirical group were clustered using the hierarchical clustering program available in OSIRIS*. The objective of clustering is to group together variables with similar attributes so that one can discover general properties of the cases analyzed. For example, the eight issues in the destruction of resources can be grouped into four clusters and the destruction of resources can be attributed to inadequate effluent treatment, poor land use practices, poor methods of solid waste disposal, and beach and slope erosion. The contribution of each cluster to the destruction of resources can be seen by obtaining the combined frequency distribution of all the variables in each cluster. Similarly, five of the fourteen issues in the utilization of resources can be condensed into one cluster that indicates one of the major problems in the use of resources is the lack of good quality shoreline areas for public use.

The criterion for clustering is the correlation between each of the variables clustered. A clustering from M to M-1 clusters is obtained by putting together those two clusters for which the minimum between cluster proximity is the maximum over all pairs of clusters. The minimum between cluster proximity is the minimum of correlations between pairs of variables from the two clusters. The hierarchical clustering program in OSIRIS gives values of "ratio" and "proximity level" for each level of clustering. "Ratio" is a rough index of the arbitrariness of clustering. The larger its value the lesser the arbitrariness. "Proximity level" is the criterion for clustering at that given number of clusters. It is the maximum of the between cluster proximities in the previous clustering.

(i) Issues in the Destruction of Resources

The correlation coefficients and the levels of significance for variables in the destruction of resources are shown in Table 26. Hierarchical clustering of these variables produced the following four groups at a proximity level of 0.31 and ratio of 0.625.

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*OSIRIS= Organized Set of Integrated Routines for Investigation with Statistics

TABLE 26

ISSUES IN THE DESTRUCTION OF RESOURCES#

	VAR006	VAR007	VAR008	VAR009	VAR010	VAR011	VAR012	VAR013
VAR006	1.0	0.4256*	0.1778	0.2787	0.0340	0.1178	0.1912	0.1349
		0.001**	0.001	0.001	0.246	0.009	0.001	0.003
VAR007	0.4256	1.0	0.2426	0.3007	-0.0371	0.1967	0.2310	0.02728
	0.001		0.001	0.001	0.227	0.001	0.001	0.001
VAR008	0.1778	0.2426	1.0	0.3144	0.2127	0.4467	0.2416	0.3087
	0.001	0.001		0.001	0.001	0.001	0.001	0.001
VAR009	0.2787	0.3007	0.3144	1.0	0.1660	0.3638	0.3518	0.2884
	0.001	0.001	0.001		0.001	0.001	0.001	0.001
VAR010	0.0340	-0.0371	0.2127	0.1660	1.0	0.2121	0.0848	0.1311
	0.246	0.227	0.001	0.001		0.001	0.043	0.004
VAR011	0.1178	0.1967	0.4467	0.3638	0.2121	1.0	0.3972	0.3249
	0.009	0.001	0.001	0.001	0.001		0.001	0.001
VAR012	0.1912	0.2310	0.2416	0.3518	0.0848	0.3972	1.0	0.2633
	0.001	0.001	0.001	0.001	0.043	0.001		0.001
VAR013	0.1349	0.2728	0.3087	0.2884	0.1311	0.3249	0.2633	1.0
	0.003	0.001	0.001	0.001	0.004	0.001	0.001	

Based on sample number of 185
* Kendall correlation coefficients
** level of significance

(1) Water pollution due to inadequate municipal sewage treatment and water pollution due to inadequate industrial sewage treatment.
(2) Water pollution due to agricultural runoff, sedimentation due to poor land use practices, and the threat of thermal pollution.
(3) Pollution of both land and water due to solid waste materials, and alteration of shoreline by filling or dredging.
(4) Beach and slope erosion.
It is apparent from this and the one-way frequency distributions that beach and slope erosion is a distinct issue in the destruction of resources. Also, inadequate municipal sewage treatment is an important issue in residential as well as industrial areas.

(ii) Issues in the Utilization of Resources

One-way frequency distributions identified decreasing land available for public use, inadequate accessibility to the shoreline, and poor quality development adjacent to the shoreline as some of the more important issues in the utilization of resources. It is seen from Table 27 that these issues correlate well with each other. Cluster analysis produced the following four clusters at a proximity level of 0.331 and ratio of 0.85:
(1) Inadequate accessibility to the water's edge. Conflicts over land uses by competing users, poor quality development adjacent to the shoreline, decreasing land available for public use, and inconsistency of contrasting land use within the shore zone.
(2) Congestion and inferior facilities in recreation developments.
(3) Reduced enjoyment of shore areas due to erosion prevention structures and inadequate adoption of transportation systems to the shore zone.
(4) Lack of proper marina facilities and lack of port facilities.

(iii) Issues in the Planning of the Wise Use of Resources

The correlation coefficients for issues in planning are shown in Table 28. Cluster analysis provides the following four clusters at a proximity level of 0.396 and ratio of 0.75.
(1) Inadequate emphasis on water-oriented environmental planning by all levels of government; lack of interagency cooperation with regard to this matter; a piecemeal approach to planning-solving of immediate problems with no long-range comprehensive planning, and lack of planning methods, goals, policies, and user identification values.
(2) Need for state or province-wide zoning of shorelands.
(3) Lack of resource information.
(4) Lack of zoning and building regulations.

(iv) Benefit of Certain Growth Factors Under the Current Social and Economic Conditions, and the Effect on Future Water Quality

Correlations of variables relating to the benefit of growth factors is shown in Table 29. There is fairly good relationship between variables defining protection of water quality, preservation of existing natural shoreland areas,

TABLE 27 - ISSUES IN THE UTILIZATION OF RESOURCES

	VARO14	VARO15	VARO16	VARO17	VARO18	VARO19	VARO20	VARO21	VARO22	VARO23
VARO14	1.0	0.4576*	0.3607	0.3777	0.2392	0.1530	0.1008	0.0824	0.3434	0.2632
		0.001**	0.001	0.001	0.001	0.001	0.019	0.046	0.001	0.001
VARO15	0.4576	1.0	0.5019	0.3521	0.3218	0.2458	0.0859	0.1968	0.5884	0.3160
	0.001		0.001	0.001	0.001	0.001	0.039	0.001	0.001	0.001
VARO16	0.3607	0.5019	1.0	0.3311	0.3309	0.1810	0.0989	0.1845	0.5823	0.3103
	0.001	0.001		0.001	0.001	0.001	0.021	0.001	0.001	0.001
VARO17	0.3777	0.3521	0.3311	1.0	0.3300	0.1979	0.0857	0.1794	0.3487	0.1421
	0.001	0.001	0.001		0.001	0.001	0.040	0.001	0.001	0.002
VARO18	0.2392	0.3218	0.3309	0.3300	1.0	0.1838	0.1874	0.1055	0.3613	0.2406
	0.001	0.001	0.001	0.001		0.001	0.001	0.015	0.001	0.001
VARO19	0.1530	0.2458	0.1810	0.1979	0.1838	1.0	0.1147	0.1791	0.2576	0.2524
	0.001	0.001	0.001	0.001	0.001		0.009	0.001	0.001	0.001
VARO20	0.1008	0.0859	0.0989	0.0857	0.1874	0.1147	1.0	0.3705	0.1541	0.1652
	0.019	0.039	0.021	0.040	0.001	0.009		0.001	0.001	0.001
VARO21	0.0824	0.1968	0.1845	0.1794	0.1055	0.1791	0.3705	1.0	0.2388	0.1228
	0.046	0.001	0.001	0.001	0.015	0.001	0.001		0.001	0.006
VARO22	0.3434	0.5884	0.5823	0.3467	0.3613	0.2576	0.1541	0.2388	1.0	0.4638
	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001		0.001
VARO23	0.2632	0.3160	0.3103	0.1421	0.2406	0.2524	0.1652	0.1228	0.4638	1.0
	0.001	0.001	0.001	0.002	0.001	0.001	0.001	0.006	0.001	

Sample number 190
* Kendall correlation coefficient
** level of significance

TABLE 28

ISSUES IN THE PLANNING FOR THE WISE USE OF RESOURCES#

	VAR024	VAR025	VAR026	VAR027	VAR028	VAR029	VAR030
VAR024	1.0	0.5606*	0.3960	0.3687	0.3469	0.3000	0.413
		0.001**	0.001	0.001	0.001	0.001	0.001
VAR025	0.5606	1.0	0.4564	0.2921	0.3462	0.2934	0.4292
	0.001		0.001	0.001	0.001	0.001	0.001
VAR026	0.3960	0.4564	1.0	0.2821	0.3337	0.3284	0.5416
	0.001	0.001		0.001	0.001	0.001	0.001
VAR027	0.3687	0.2921	0.2821	1.0	0.3490	0.3418	0.3868
	0.001	0.001	0.001		0.001	0.001	0.001
VAR028	0.3469	0.3462	0.3337	0.3490	1.0	0.3394	0.4116
	0.001	0.001	0.001	0.001		0.001	0.001
VAR029	0.300	0.2934	0.3284	0.3418	0.3394	1.0	0.5113
	0.001	0.001	0.001	0.001	0.001		0.001
VAR030	0.413	0.4292	0.5416	0.3868	0.4116	0.5113	1.0
	0.001	0.001	0.001	0.001	0.001	0.001	

Sample number 228
* Kendall correlation coefficients
** level of significance

TABLE 29

	VAR130	VAR131	VAR132	VAR133	VAR134	VAR135	VAR136	VAR137	VAR138	VAR139
VAR130	1.0	0.2609*	0.1345	0.0564	0.0344	-0.2196	0.0542	0.1149	0.1012	0.1274
		0.001**	0.004	0.133	0.249	0.001	0.143	0.012	0.023	0.006
VAR131	0.2609	1.0	0.2011	0.0733	0.0667	-0.1849	0.1614	0.1255	0.0438	0.2022
	0.001		0.001	0.074	0.094	0.001	0.001	0.007	0.194	0.001
VAR132	0.1345	0.2011	1.0	0.4378	0.2676	-0.0258	-0.0408	-0.0955	0.0050	-0.0428
	0.004	0.001		0.001	0.001	0.306	0.211	0.030	0.461	0.199
VAR133	0.0564	0.0733	0.4378	1.0	0.3477	0.0656	-0.0916	-0.0573	0.1450	-0.1066
	0.133	0.074	0.001		0.001	0.098	0.036	0.129	0.002	0.018
VAR134	0.0344	0.0667	0.2626	0.3477	1.0	0.1556	-0.0510	0.0171	0.0760	-0.0111
	0.249	0.094	0.001	0.001		0.001	0.158	0.368	0.067	0.414
VAR135	0.2196	-0.1849	0.0258	0.0656	0.1556	1.0	0.0545	0.0787	0.0891	0.0258
	0.001	0.001	0.306	0.098	0.001		0.141	0.060	0.040	0.305
VAR136	0.0542	0.1614	-0.0408	-0.0716	-0.0510	0.0545	1.0	0.4233	0.0933	0.1833
	0.143	0.001	0.211	0.036	0.158	0.141		0.001	0.033	0.001
VAR137	0.1149	0.1255	-0.0955	-0.0573	0.0171	0.0787	0.4233	1.0	0.0541	0.2706
	0.012	0.007	0.030	0.129	0.368	0.060	0.001		0.143	0.001
VAR138	0.1012	0.0438	0.0050	0.1450	0.0760	0.0891	0.0933	0.0541	1.0	0.076
	0.023	0.194	0.461	0.002	0.067	0.040	0.033	0.143		0.067
VAR139	0.1274	0.2022	-0.0428	-0.1006	-0.011	0.0258	0.1833	0.2706	0.076	1.0
	0.006	0.001	0.199	0.018	0.414	0.305	0.001	0.001	0.067	

Sample number 176
* Kendall correlation coefficients
** level of significance

TABLE 30

	VAR141	VAR142	VAR143	VAR144	VAR145	VAR146
VAR141	1.0	0.3220* 0.001**	0.3295 0.001	0.1767 0.001	0.1783 0.001	0.2214 0.001
VAR142	0.3220 0.001	1.0	0.2438 0.001	0.0688 0.086	0.0548 0.139	0.3637 0.001
VAR143	0.2395 0.001	0.2438 0.001	1.0	0.3905 0.001	0.4205 0.001	0.0968 0.028
VAR144	0.1767 0.001	0.0688 0.086	0.3905 0.001	1.0	0.6127 0.001	0.0073 0.442
VAR145	0.1783 0.001	0.0548 0.139	0.4205 0.001	0.6127 0.001	1.0	-0.0374 0.229
VAR146	0.2914 0.001	0.3637 0.001	0.0968 0.028	0.0073 0.442	-0.0374 0.229	1.0

Sample number 178
* Kendall correlation coefficients
** level of significance

and more control of development. Also, the construction of nuclear and fossil fuel power plants are correlated and are not considered to be beneficial in the respective areas. Table 30 gives the correlations for the effect of the growth factors on future water quality. Three clusters were obtained from these at ratio of 1.0 and proximity level of 0.364.

(1) Recreational growth and agricultural development.

(2) Industrial development, construction of nuclear fuel power plants, and construction of fossil fuel power plants.

(3) Urban growth.

V. SUMMARY AND CONCLUSIONS

This report documents the results obtained from the analysis of a survey questionnaire sent to 650 units of government in both the United States and Canada. Each of these units of government have jurisdiction over Great Lakes shoreline. The survey questionnaire establishes a base of information regarding a range of water resource problems as perceived by governmental units in the Great Lakes in 1971-72. Three hundred responses were received and coded for analysis.

The survey analysis identified the following important points:

i. Inshore water quality is rated by respondents as medium or lower quality in 92% of the cases with 35% of the respondents reporting low or very low water quality.

ii. Water pollution due to inadequate municipal sewage facilities is reported to be the most important factor responsible for the deterioration of water quality in the Great Lakes.

iii. Thirty-four percent (34%) of the respondents from agricultural areas reported the inshore water quality in their area to be low or very low quality; however, agricultural runoff is not perceived to be an important problem by the various units of government.

iv. A perceived need exists for making more land available for public use along the Great Lakes shoreline. This public use includes recreational development, parks, and wilderness areas.

v. Land-use policies and zoning ordinances at the local or higher levels of government are perceived to be important for the preservation of natural areas for present and future generations.

vi. Inadequate accessibility to the water's edge, conflicts over land uses by competing users, poor quality development adjacent to the shoreline, decreasing land available for public use, and inconsistency of contrasting land use within the shore constitute one significant cluster of issues associated with the utilization of resources.

vii. Inadequate emphasis on water-oriented environmental planning by all levels of government, lack of interagency cooperation with regard to water-oriented planning, a piecemeal approach to planning, and a lack of planning methods including goals, policies and user identification values are issues which constitute a significant cluster associated with planning for the wise use of resources.

viii. The need is perceived to restrict excessive real estate development along the shoreline of the Great Lakes.

ix. The most important solutions for the problem of deteriorating water quality in the Great Lakes are as follows:

a. More funds to build additional wastewater treatment plants
b. Stricter enforcement of existing water quality regulation
c. Increased coordination among existing units of government

NOTE: Creating of new agencies ranked lowest as a solution to problems of deteriorating water quality.

x. The analysis of the survey data identified the following groups as being important in aiding the maintenance of water quality:

State agencies and regulations
Conservation groups
Professional planners
Federal agencies and regulations

It is important to note that the strongest perception of being IMPORTANT and AIDING in the maintenance of water quality is for the state agencies and regulations. There is essentially zero perception of state agencies and regulations hindering the maintenance of water quality.

xi. The analysis of the survey data identified the following groups as being IMPORTANT and HINDERING the maintenance of water quality:

Real estate developers
Industrial corporations
Utility companies

The real estate developers were polar opposites from the state agencies and regulations cited in (x) above. Namely, real estate developers are perceived to have the strongest orientation toward hindering the maintenance of water quality with essentially zero perception of this group aiding in the maintenance of water quality.

xii. Two variable analyses identified certain key variables as factors contributing to the deterioration of inshore water quality. These variables are population density and land use. As population density increases, water quality decreases; as the degree of industrialization increases, water quality tends to decrease. The analysis of the data demonstrates that population density significantly affects water quality in any land use pattern. On the other hand, the effect of land use on water quality is pronounced only in the high population density areas and where industrial use predominates.

The survey questionnaire developed for this research project has provided many useful insights into the nature of resource utilization as perceived by units of government within the Great Lakes Basin. The data base itself constitutes a major reference point against which one may observe changes in attitudes and perceptions over time. While the analysis to date has focused primarily upon water quality as a dependent variable, it is anticipated that other investigators with other interests, for example, landscape architects, urban and regional planners, land-use planners, and environmental policy analysts will utilize the data base to focus upon Great Lakes Basin research topics of specific interest to these individuals*. In order to facilitate such utilization of the data base, a complete set of the data has been provided to Social Science Division, Canada Centre for Inland Waters, Burlington, Ontario, Canada.

Emphasis must be placed upon developing innovative policy for the preservation of enhancement of water quality throughout the Great Lakes Basin. A component of this innovative policy needs to be to assure that coordination and planning among existing units of government is effectively implemented.

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*SEE "Shoreland Management in High-Risk Erosion Areas", Michael R. McGill, Coastal Zone Management Laboratory, The University of Michigan, 1974.

It would be highly desirable to survey again the same units of government in 1977. At that time, both the Water Quality Agreement between the United States and Canada as well as Public Law 92-500, the U.S. Federal Water Pollution Control Act of 1972 will have been in existence for five years. One measure of the effectiveness of both these legislative devices would be the changes in attitudes regarding water quality in the Great Lakes Basin.

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APPENDIX 1

DATA PROCESSING

Coding

The processing of survey questionnaire information requires coding the information in a convenient form so that it can be easily entered into the computer. This essentially involves defining variables representing the questions in the questionnaire, determining the domain of values for each of these variables, and assigning numeric or alphanumeric codes for these values. The questionnaire contains eight questions (Appendix 2), and from these eight questions 196 representative variables were defined. A listing of the variables, the codes, and value labels used for each variable appears in the listing of the datafile, QUESANAL (Appendix 3). Except for the identification number, numeric coding has been used for convenience.

The coding of questions 1 to 4, and question 8 is straightforward as evident from the listing, and will not be discussed in detail. The questions pertaining to the effect of various vested interests on the maintenance and improvement of water and shoreline quality (#5a, 5b) have been subdivided to define the following three variables:

(1) The effect of a group, whether it aids or hinders the maintenance and improvement of water quality,
(2) The degree of influence of the group in the area, if it aids,
(3) The degree of influence of the group in the area if it hinders.

These variables appear in the listing as variables VAR035 to VAR112. VAR035, VAR038... have the same values, labels and codes, and missing values. VAR036, VAR039,.....are coded in such a manner that if the response to VAR035 is (2), then VAR036 would be coded as (6), and otherwise it would be coded depending on the value indicated in the questionnaire. Similarly VAR037, VAR040,..... are defined in such a manner that if the response to VAR035 is (1), VAR037 would be coded as (6), and otherwise, any of the values 1 to 5 or 7, 8 as indicated in the questionnaire. Codes 6,7 and 8 denote the missing values for the variable VAR036, VAR039,....VAR037, VAR040,.....VAR112. In the instances where no answer has been indicated as to whether the group aids or hinders in the maintenance of water and shoreline quality, but the influence of the group has been indicated, the response has been coded as 'failed to answer' (8), since the latter two variables have no meaning without values for the former.

Question #6 in the questionnaire pertains to the possible solutions perceived to be important in preventing the deterioration of water quality. This has been coded as two variables to determine if the respondents are favorable to the solution indicated and, if so, the degree of importance attached to the solution. Translation of the response into codes has been as follows: If some of the solutions have been checked and the other left blank in the response, the ones checked are construed to be 'yes' and the other 'no' and have been

coded as 1 and 2 respectively. However, if no response is indicated for all the solutions in question 6, the case has been coded as 'failed to answer' for all the variables defining question 6. Variables VAR127 and VAR128 have been uniformly coded as 'failed to answer' unless indicated 'not applicable' or other solutions have been indicated. Variables VAR113 to VAR128 define question 6. If the response to VAR113 is 'no', coded as (2), then the code for VAR114 is (6), 'not a solution' due to the nature in which the variables are defined. The same holds for VAR113, VAR115,...VAR127 and VAR114, VAR116,...VAR128.

Question #7 on controversial issues in water quality management evolved from the screening of the issues indicated in the 177 questionnaires returned. Its coding follows essentially the same pattern as question #5 and needs no further amplification here.

Statistical Package for the Social Sciences (SPSS)

The Computing Center memo #269 (Appendix 3) describes the set up and use of SPSS on MTS. For a detailed description of the statistical programs and the input out facilities available on SPSS, the reader is referred to the SPSS Manual (4). The data file QUESANAL contains the control cards for running SPSS and the data cards from the 300 cases coded. All the control cards have columns 1 to 15 as the control field, and 16 to 80 as the specifications field. Continuation cards must begin at column 16 or after. All the variable labels on the VAR LABELS Cards have been condensed to conform to the requirement of a maximum length of 40 characters. The codes used for the values each variable can take appear on the VALUE LABELS card. These labels again have a length limitation of 20 characters. A MISSING VALUES Control Card has been used to include situations where the respondents did not give the required information, or where the particular variable has no relevance in the respondents area of jurisdiction. SPSS has a number of options available for processing cases with missing information.

The coded data can be input on SPSS either in fixed or free field format. Fixed field format has been used for punching on cards the data for the 300 cases. Fixed format implies that the value for a particular variable must appear in the same position on the card for each case. The format specifications are shown in the listing of the file. There are four cards per case, and the first ten fields on each card are used for the ID number, so that, in case the deck is accidentally dropped, it can be rearranged.

SPSS system files can be created from card or card-image input, and the details of this are given in the Computing Center memo #269. Features on SPSS allow subsequent modifications of the data base, such as addition or deletion of cases and variables, creation of subfiles, etc. Some examples on creation and utilization of SPSS system files on MTS are shown below.

Two temporary sequential files say -A and -B must be created prior to making an SPSS run. The SPSS system file should be a sequential file. The following commands accompanied by the dictionary and data cards will create an SPSS file SPSSFILE from a batch run.

```
$  CREATE -A TYPE = SEQ SIZE = 10P
$  CREATE -B TYPE = SEQ SIZE = 10P
$  CREATE SPSSFILE TYPE = SEQ SIZE = 10P
$ RUN ICPR:SPSS 1 =-A 2 = -B 4 = SPSSFILE
SPSS CONTROL CARDS...
.
.
.
SAVE FILE
FINISH
```

The listing of the dictionary from file QUESANAL given in Appendix 2 shows the typical SPSS control cards needed in the creation of a file from batch run. There must be a SAVE FILE card before the FINISH card in SPSS control statements everytime a new file is created, or when the file is altered and the altered file is to be saved. If the data are in the file named DATAFILE and the control cards are in the file CONTROL, then the following commands will create a SPSS file from card image input.

```
$  CREATE  -A TYPE = SEQ SIZE = 10P
$  CREATE  -B TYPE = SEQ SIZE = 10P
$  CREATE SPSSFILE TYPE = SEQ SIZE = 10P
$  RUN ICPR:SPSS 1 =-A 2 =-B 4 = SPSSFILE 5 = CONTROL
                                           8 = DATAFILE
```

In this case, there must be a statement specifying the input medium to be card image in the control statement.

The sequential files -A and -B need to be created for accessing the created SPSS system file. After creating these, the command

```
$ICPR:SPSS 1 =-A 2 = -B 3 = SPSSFILE
```

will provide access to the system file. Typical commands that follow and tasks that can be performed are detailed in the SPSS manual. To obtain quick access to the file especially from the terminal it has been found useful to have a source file of the following form.

```
Source file CALL
1 - $SET ECHO = OFF
2 - $CRE -A TYPE = SEQ SIZE = 10P
```

```
3 - $CRE -B TYPE = SEQ SIZE = 10P
4 - $RUN ICRP:SSPS 1 = -A 2 = -B 3 = SPSSFILE
5 - GET FILE       SPSSFILE
6 - $CONTINUE WITH *MSOURCE*
```

The fifth statement is a SPSS control statement and should have the file name SPSSFILE starting in column 16. The command $SOURCE CALL would then allow access to the file and the only statements that need to be typed in are the task definition and FINISH statements.

If a correlation matrix is to be output into a file MATRIX or for card image output into the file, the following run command should be used.

```
$RUN ICPR:SPSS 1 =-A 2 = -B 3= SPSSFILE 9 = MATRIX
```

To create a new file NEWFILE from an existing file, the following command should be used

```
$RUN ICPR:SPSS 1 =-A 2 =-B 3 = SPSSFILE 4 = NEWFILE
```

A SAVE FILE card must also be used before the FINISH card.

Organized Set of Integrated Routines for Investigation with Statistics (OSIRIS)

The coded data has been input on the OSIRIS (4) system, in order to utilize the cluster analysis subprograms available in OSIRIS. The OSIRIS I system is described in the MTS users manual, parts I and II. The data coded for SPSS was used to create the OSIRIS data set with a different input format using the file-build program. With this program, it was also possible to check the data for consistency. A listing of the dictionary file is given in Appendix 3.

Appendix 2

Survey Questionnaire

No. _____

It will be appreciated if you can take the time to answer the following eight questions and return them in the enclosed, stamped return envelope. Your answers will help us gain a general insight into local perception of problems concerning the quality and management of the shoreline waters of the Great Lakes. We realize that in many cases your answers will be of your own opinion, but we ask that you attempt to make them as representative as you can of the agency that you represent.

1. A previous request for information was sent to your agency and to numerous others along the shoreline of the Great Lakes early in 1970. The results of that survey identified that following primary issues confronting those concerned with managing and planning for this area. Could you rate the importance of each issue for your particular area of jurisdiction by circling the appropriate number.

ISSUES CONCERNED WITH THE DESTRUCTION OF RESOURCES

		Not Important in your area			Very Important in your area		Not Applicable
a)	Water pollution due to inadequate municipal sewage facilities	1	2	3	4	5	_____
b)	Water pollution due to inadequate industrial sewage facilities	1	2	3	4	5	_____
c)	Water pollution due to agricultural runoff	1	2	3	4	5	_____
d)	Pollution of both land and water due to disposal of solid waste materials	1	2	3	4	5	_____
e)	Beach and slope erosion	1	2	3	4	5	_____
f)	Sedimentation due to poor land use practices	1	2	3	4	5	_____
g)	Alteration of shoreline by filling or dredging	1	2	3	4	5	_____
h)	The threat of thermal pollution	1	2	3	4	5	_____

ISSUES CONCERNED WITH THE UTILIZATION OF RESOURCES

		Not Important in your area			Very Important in your area		Not Applicable
a)	Inadequate accessibility, both functional and visual, to the waters edge	1	2	3	4	5	_____
b)	Conflicts over land uses by competing users e.g. developer/conservationist	1	2	3	4	5	_____
c)	Poor quality development adjacent to shoreline	1	2	3	4	5	_____
d)	Decreasing land available to public use	1	2	3	4	5	_____
e)	Congestion and inferior facilities in recreation developments	1	2	3	4	5	_____
f)	Reduced enjoyment of shore areas due to erosion prevention structures such as breakwaters or retaining walls	1	2	3	4	5	_____
g)	Lack of proper marina facilities	1	2	3	4	5	_____
h)	Lack of proper port facilities	1	2	3	4	5	_____
i)	Inconsistency of contrasting land use characteristics within the shore zone	1	2	3	4	5	_____
j)	Inadequate adaption of transportation systems to the shoreline zone	1	2	3	4	5	_____

ISSUES CONCERNED WITH PROBLEMS OF PLANNING FOR THE WISE USE OF RESOURCES

a)	Inadequate emphasis on water oriented environmental planning by all levels of government	1	2	3	4	5	_____
b)	Lack of inter-agency cooperation with regard to this matter	1	2	3	4	5	_____
c)	A piecemeal approach to planning-solving of immediate problems with no long range comprehensive planning	1	2	3	4	5	_____
d)	Need for state or province wide zoning of shorelands	1	2	3	4	5	_____
e)	Lack of resource information	1	2	3	4	5	_____
f)	Inadequate zoning and building regulations	1	2	3	4	5	_____
g)	Lack of planning methods, goals, policies and identification of user values	1	2	3	4	5	_____

2. Of the issues concerned with the destruction of resources which you rated as important, could you indicate where the source of this problem is:

_____ in you area

_____ outside of your area of jurisdiction (specify) _____

3.a) How does your agency rate the quality of the waters along the shorelines of the Great Lakes in your area of jurisdiction?

_____ High quality - no pollution at any time of the year

_____ Medium quality or generally high quality but some indications of pollution at certain times of the year. This does not restrict human use however.

_____ Low quality or polluted to the extent that human use of the waters is occasionally restricted.

_____ Very low quality or seriously polluted to the extent that human use of the waters would pose a severe health hazard.

3.b) How does your agency rate the quality of the shoreline and beaches of the Great Lakes in your area of jurisdiction.

_____ High quality - no deterioration has occurred

_____ Medium quality - some minor deterioration has occurred

_____ Low quality - deterioration has occurred to the extent that human enjoyment of the shorelands is somewhat reduced

_____ Very low quality - deterioration is excessive and consequently human use and enjoyment of the area is severely limited

4. Which agencies and/or groups are charged with protecting the quality of these waters along the shoreline in your jurisdiction?

_____ Federal offices or agencies (specify) _____

_____ State/provincial agencies (specify) _____

_____ Regional agencies e.g. special purpose agencies such as a water supply or sewer district? _____

_____ Local agencies (specify) _____

5.a) Have attempts in your area to improve and maintain the quality of the waters along the shoreline been aided or hindered by the following types of groups and to what degree? Check aid or hinder and circle the appropriate number.

	Aid	Hinder	Hardly any of influence in your area			A great deal of influence in your area		Not Applicable
Conservation groups	___	___	1	2	3	4	5	_____
Ecology activists	___	___	1	2	3	4	5	_____
Rod and gun clubs	___	___	1	2	3	4	5	_____
Professional planners, landscape architects, engineers etc.	___	___	1	2	3	4	5	_____
Other civic associations (specify)_____	___	___	1	2	3	4	5	_____
Student groups	___	___	1	2	3	4	5	_____
Real estate developers	___	___	1	2	3	4	5	_____
Homeowners	___	___	1	2	3	4	5	_____
Industrial corporations	___	___	1	2	3	4	5	_____
Utility companies	___	___	1	2	3	4	5	_____
Federal agencies and regulations	___	___	1	2	3	4	5	_____
State agencies and regulations	___	___	1	2	3	4	5	_____
Others (specify)_____	___	___	1	2	3	4	5	_____

5.b) Have attempts in your area to improve and maintain the quality of the shoreland and beaches been aided or hindered by the following types of groups and to what degree? Check aid or hinder and circle the appropriate number.

	Aid	Hinder	Hardly any of influence in your area			A great deal of influence in your area		Not Applicable
Conservation groups	___	___	1	2	3	4	5	_____
Ecology activists	___	___	1	2	3	4	5	_____
Rod and gun clubs	___	___	1	2	3	4	5	_____
Professional planners, landscape architects, engineers etc,	___	___	1	2	3	4	5	_____
Other civic associations (specify)_____	___	___	1	2	3	4	5	_____
Student groups	___	___	1	2	3	4	5	_____
Real estate developers	___	___	1	2	3	4	5	_____
Homeowners	___	___	1	2	3	4	5	_____
Industrial corporations	___	___	1	2	3	4	5	_____
Utility companies	___	___	1	2	3	4	5	_____
Federal agencies and regulations	___	___	1	2	3	4	5	_____
State agencies and regulations	___	___	1	2	3	4	5	_____
Others (specify)_____	___	___	1	2	3	4	5	_____

6. If your agency feels that the water quality in your area is deteriorating w' at does it consider to be possible solutions to this problem? How important are these solutions rated? Circle the appropriate number.

		Not important in your area				Very important in your area
_____	More funds to build additional waste water treatment plants	1	2	3	4	5
_____	Stricter enforcement of existing regulations and standards	1	2	3	4	5
_____	New regulations aimed at further restricting the sources of pollution	1	2	3	4	5
_____	Redistribution of responsibility for pollution control among existing government agencies	1	2	3	4	5
_____	The creation of new agencies with responsibility for water polution control	1	2	3	4	5
_____	Increased leadership form public officials in the field of water quality	1	2	3	4	5
_____	Increased coordination of the activities of the existing agencies who have responsibility for managing the water quality in your area	1	2	3	4	5
_____	Other (Specify)	1	2	3	4	5

7. A previous survey indicated that in the next five years, the following problems may stand out as controversial issues in water and shoreline quality protection in the Great Lakes. Please indicate the position of your agency on the issues relevant in your area of jurisdiction, and the extent to w'ich your agency has jurisdiction over these problems.

	Position			Jurisdiction				
	Pro	Con	Not Applicable	No Responsibility				Complete Responsibility
1. Financing needed sewer construction	___	___	___	1	2	3	4	5
2. Financing needed, storm drain construction	___	___	___	1	2	3	4	5

		Position			Jurisdiction				
		Pro	Con	Not Applicable	No Responsibility				Complete Responsibility
3.	Industrial pollution control	___	___	___	1	2	3	4	5
4.	Present methods of solid waste disposal	___	___	___	1	2	3	4	5
5.	Thermal pollution control	___	___	___	1	2	3	4	5
6.	Marine sewage discharge	___	___	___	1	2	3	4	5
7.	Erosion control	___	___	___	1	2	3	4	5
8.	Industrial development	___	___	___	1	2	3	4	5
9.	Marsh land development	___	___	___	1	2	3	4	5
10.	Cluster development	___	___	___	1	2	3	4	5
11.	Construction of recreational facilities	___	___	___	1	2	3	4	5
12.	Nuclear power plants	___	___	___	1	2	3	4	5
13.	Zoning	___	___	___	1	2	3	4	5
14.	Preservation of natural shoreline	___	___	___	1	2	3	4	5
15.	Land use planning	___	___	___	1	2	3	4	5
16.	Regional planning	___	___	___	1	2	3	4	5
17.	Others	___	___	___	1	2	3	4	5

8. The last question is in two parts. The first part pertains to the effect of certain factors upon economic and social conditions in your area. The second part pertains to the relationship between certain factors and the water quality along the shoreline in your area.

a) Does your agency feel the following factors would be beneficial to your area in light of the present economic and social conditions there? If so how benefical would they be? Circle the appropriate number.

		Not beneficial				Very beneficial
_____	Urban growth	1	2	3	4	5
_____	Recreational growth	1	2	3	4	5
_____	Industrial development	1	2	3	4	5
_____	Protection of water quality	1	2	3	4	5
_____	Preservation of existing natural Shoreland areas	1	2	3	4	5
_____	More control of development	1	2	3	4	5
_____	"No growth" policy	1	2	3	4	5
_____	The construction of nuclear fuel power plants	1	2	3	4	5
_____	The construction of fosil fuel power plants	1	2	3	4	5
_____	Agricultural development	1	2	3	4	5
_____	Mining operations	1	2	3	4	5
_____	Other (specify)	1	2	3	4	5

b) Does your agency feel that any of the following factors will prove detrimental to the future quality of the waters along the shoreline in your area? If so how detrimental do you feel they will be? Circle the appropriate number.

		Not Detrimental				Very Detrimental
_____	Urban growth	1	2	3	4	5
_____	Recreational growth	1	2	3	4	5
_____	Industrial development	1	2	3	4	5
_____	The construction of nuclear fuel power plants	1	2	3	4	5
_____	The construction of fosil fuel power plants	1	2	3	4	5
_____	Agricultural development	1	2	3	4	5
_____	Mining operations	1	2	3	4	5
_____	Other (specify)	1	2	3	4	5

Please complete the information requested below, and return along with the questionnaire.

1. Location of your agency?

___ U.S.A.

___ Canada

2. Lake in your area of jurisdiction?

___ Erie

___ Ontario

___ Michigan

___ Huron

___ Superior

3. The area under your jurisdiction can be classified primarily as one of the following:

___ Industrial

___ Residential

___ Agricultural

___ Recreational

___ Wild

___ Residential and Industrial

4. Type of government associated with your agency?

___ Township

___ County

___ City

___ State or Provincial

___ Regional

___ Federal

5. The population density of the area under your agency's jurisdiction, in number of persons per square mile ?

___ Less than 20

___ 20-49

___ 50-99

___ 100-499

___ 500-999

___ Greater than 1000

Appendix 3

Listing of SPSS and OSIRIS system files

```
RUN NAME        CREATION OF DATA FILE WITH 300 CASES
FILE NAME       QUESANAL,ANALYSIS OF DATA FROM QUESTIONNAIRE RESPONSES
# OF CASES      300
VARIABLE LIST   VAR001 TO VAR196
VAR LABELS      VAR001,USA OR CANADA/
                VAR002,LAKE/
                VAR003,AREA/
                VAR004,GOVERNING AGENCY/
                VAR005,POPULATION DENSITY,PERSONS PER SQ MILE/
                VAR006,DESTR RES:WP,INAD MUNIC SEWAGE FACLTS/
                VAR007,DESTR RES:WP,INAD INDL SEWAGE FACLTS/
                VAR008,DESTR RES:WP,AGRICULTURAL RUNOFF/
                VAR009,DESTR RES:POLLN LAND,WATER;SOLID WASTE/
                VAR010,DESTR RES:BEACH AND SLOPE EROSION/
                VAR011,DESTR RES:SEDIM,POOR LAND USE PRACTICES/
                VAR012,DESTR RES:SHORE ALTERN BY FILLING,DRDG/
                VAR013,DESTR RES:THREAT OF THERMAL POLLUTION/
                VAR014,UTIL RES:INADEQ ACCESS TO WATERS EDGE/
                VAR015,UTIL RES:CONFL OVER LND USE,COMPETG USERS/
                VAR016,UTIL RES:POOR QUAL DEV ADJ TO SHORELINE/
                VAR017,UTIL RES:DEC LAND AVAIL FOR PUBL USE/
                VAR018,UTIL RES:CONGSTN,INFERIOR FAC IN REC DEV/
                VAR019,UTIL RES:NEED ENJ OF SHORE;BKWTRS,RETG WLS/
                VAR020,UTIL RES:LACK OF PROPER MARINA FACLTS/
                VAR021,UTIL RES:LACK OF PROPER PORT FACLTS/
                VAR022,UTIL RES:CONTRSTG LAND USE,SHORE ZONE/
                VAR023,UTIL RES:INAD ADAPTN OF TRNSPN TO SHORE/
                VAR024,PLG:INAD EMPH WTR ORIETD ENVL PLG ALL GOV LEVELS/
                VAR025,PLG:LACK INTER-AGCY COOPN,WTR ORID ENVL PLG/
                VAR026,PLG:PCEMEAL APPROACH,NO LONG RGE COMPR PLG/
                VAR027,PLG:NEED STATE OR PROVCE WIDE ZNG OF SHR/
                VAR028,PLG:LACK OF RESOURCE INFORMATION/
                VAR029,PLG:INAD ZONING AND BEACH REGULATIONS/
                VAR030,PLG:LACK PLG METH,GOLS,POLCS,ID USER VALUES/
                VAR031,AREA OF JURISDICTION/
                VAR032,WQ ALONG SHORELINE,YOUR AREA OF JURISDICTION/
                VAR033,QUAL OF SHRLINE,BCHS,YOUR AREA OF JURISDN/
                VAR034,AGCY PROT WQ ALONG SHRLINE IN YOUR JURISDN/
                VAR035,MTCE,IMPROVMT OF WQ:CONSERVATION GROUPS/
                VAR036,MTCE,IMPROVMT OF WQ:CONSERVN GRPS AID/
                VAR037,MTCE,IMPROVMT OF WQ:CONSERVN GRPS HINDR/
                VAR038,MTCE,IMPROVMT OF WQ:ECOLOGY ACTIVISTS/
                VAR039,MTCE,IMPROVMT OF WQ:ECOL ACTVSTS AID/
                VAR040,MTCE,IMPROVMT OF WQ:ECOL ACTVSTS HINDER/
                VAR041,MTCE,IMPROVMT OF WQ:ROD AND GUN CLUBS/
                VAR042,MTCE,IMPROVMT OF WQ:ROD,GUN CLUBS AID/
                VAR043,MTCE,IMPROVMT OF WQ:ROD,GUN CLUBS HINDER/
                VAR044,MTCE,IMPROVMT OF WQ:PROFL PLNR,ENGR,ARCHITECTS ETC/
                VAR045,MTCE,IMPROVMT OF WQ:PLNRS,ENGRS,AID/
                VAR046,MTCE,IMPROVMT OF WQ:PLNRS,ENGRS,HINDER/
                VAR047,MTCE,IMPROVMT OF WQ:OTHER CIVIC ASSOC/
                VAR048,MTCE,IMPROVMT OF WQ:OTHER CIV ASSOC AID/
                VAR049,MTCE,IMPROVMT OF WQ:OTHR CIV ASSOC HINDR/
                VAR050,MTCE,IMPROVMT OF WQ:STUDENT GROUPS/
```

```
VAR051,MTCE,IMPROVMT OF WQ:STUDENT GROUPS AID/
VAR052,MTCE,IMPROVMT OF WQ:STUDT GROUPS HINDER/
VAR053,MTCE,IMPROVMT OF WQ:REAL ESTATE DEVELPRS/
VAR054,MTCE,IMPROVMT OF WQ:RL EST DEVLPRS AID/
VAR055,MTCE,IMPROVMT OF WQ:RL EST DEVLPRS HINDR/
VAR056,MTCE,IMPROVMT OF WQ:HOMEOWNERS/
VAR057,MTCE,IMPROVMT OF WQ:HOMEOWNERS AID/
VAR058,MTCE,IMPROVMT OF WQ:HOMEOWNERS HINDER/
VAR059,MTCE,IMPROVMT OF WQ:INDUSTRIAL CORPNS/
VAR060,MTCE,IMPROVMT OF WQ:INDL CORPNS AID/
VAR061,MTCE,IMPROVMT OF WQ:INDL CORPNS HINDER/
VAR062,MTCE,IMPROVMT OF WQ:UTILITY COMPANIES/
VAR063,MTCE,IMPROVMT OF WQ:UTIL COMPANIES AID/
VAR064,MTCE,IMPROVMT OF WQ:UTIL COMPS HINDER/
VAR065,MTCE,IMPROVMT OF WQ:FED AGCYS AND REGLNS/
VAR066,MTCE,IMPROVMT OF WQ:FED AGCS,REGLNS AID/
VAR067,MTCE,IMPROVMT OF WQ:FED AGCS,REGLNS HINDR/
VAR068,MTCE,IMPROVMT OF WQ:STATE AGCS AND REGLNS/
VAR069,MTCE,IMPROVMT OF WQ:ST AGCS,REGLNS AID/
VAR070,MTCE,IMPROVMT OF WQ:ST AGCS,REGLNS HINDER/
VAR071,MTCE,IMPROVMT OF WQ:OTHERS/
VAR072,MTCE,IMPROVMT OF WQ:OTHERS AID/
VAR073,MTCE,IMPROVMT OF WQ:OTHERS HINDER/
VAR074,MTCE,IMPR SHRLND,BCH Q:CONSERVN GROUPS/
VAR075,MTCE,IMPR SHRLND,BCH Q:CONSVN GRPS AID/
VAR076,MTCE,IMPR SHRLND,BCH Q:CONSVN GRPS HINDR/
VAR077,MTCE,IMPR SHRLND,BCH Q:ECOLOGY ACTIVISTS/
VAR078,MTCE,IMPR SHRLND,BCH Q:ECO ACTVSTS AID/
VAR079,MTCE,IMPR SHRLND,BCH Q:ECO ACTVSTS HINDR/
VAR080,MTCE,IMPR SHRLND,BCH Q:ROD AND GUN CLUBS/
VAR081,MTCE,IMPR SHRLND,BCH Q:ROD,GUN CLUBS AID/
VAR082,MTCE,IMPR SHRLND,BCH Q:ROD,GUN CLB HINDR/
VAR083,MTCE,IMPR SHRLND,BCH Q:PLNRS,ENGRS,ETC/
VAR084,MTCE,IMPR SHRLND,BCH Q:PLNRS,ENGRS,AID/
VAR085,MTCE,IMPR SHRLND,BCH Q:PLNRS,ENGRS,HINDER/
VAR086,MTCE,IMPR SHRLND,BCH Q:OTHER CIVIC ASSOC/
VAR087,MTCE,IMPR SHRLND,BCH Q:OTHR CIV ASSOC AID/
VAR088,MTCE,IMPR SHRLND,BCH Q:OTH CIV ASSOC HIND/
VAR089,MTCE,IMPR SHRLND,BCH Q:STUDENT GROUPS/
VAR090,MTCE,IMPR SHRLND,BCH Q:STUDENT GRPS AID/
VAR091,MTCE,IMPR SHRLND,BCH Q:STUDT GRPS HINDER/
VAR092,MTCE,IMPR SHRLND,BCH Q:REAL EST DEVLPRS/
VAR093,MTCE,IMPR SHRLND,BCH Q:RL EST DEVLPR AID/
VAR094,MTCE,IMPR SHRLND,BCH Q:RL EST DEVL HINDR/
VAR095,MTCE,IMPR SHRLND,BCH Q:HOMEOWNERS/
VAR096,MTCE,IMPR SHRLND,BCH Q:HOMEOWNERS AID/
VAR097,MTCE,IMPR SHRLND,BCH Q:HOMEOWNERS HINDER/
VAR098,MTCE,IMPR SHRLND,BCH Q:INDL CORPNS/
VAR099,MTCE,IMPR SHRLND,BCH Q:INDL CORPNS AID/
VAR100,MTCE,IMPR SHRLND,BCH Q:INDL CORPNS HINDR/
VAR101,MTCE,IMPR SHRLND,BCH Q:UTILITY COMPANIES/
VAR102,MTCE,IMPR SHRLND,BCH Q:UTIL COMPS AID/
VAR103,MTCE,IMPR SHRLND,BCH Q:UTIL COMPS HINDER/
VAR104,MTCE,IMPR SHRLND,BCH Q:FED AGCYS,REGLNS/
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VAR105,MTCE,IMPR SHRLND,BCH Q:FED AGCS,REGLN AID/
VAR106,MTCE,IMPR SHRLND,BCH Q:FED AGCS,REGS HINDR/
VAR107,MTCE,IMPR SHRLND,BCH Q:STATE AGCYS REGLNS/
VAR108,MTCE,IMPR SHRLND,BCH Q:ST AGCS,REGLNS AID/
VAR109,MTCE,IMPR SHRLND,BCH Q:ST AGCS,REGLNS HINDR/
VAR110,MTCE,IMPR SHRLND,BCH Q:OTHERS/
VAR111,MTCE,IMPR SHRLND,BCH Q:OTHERS AID/
VAR112,MTCE,IMPR SHRLND,BCH Q:OTHERS HINDER/
VAR113,SOLN TO DTERIORTG WQ:ADDL WSTE WTR TRTMT PLANTS/
VAR114,ADDL WSTE WTR TRT PLANTS,IF SOLN,HOW IMP/
VAR115,SOLN TO DTERIORTG WQ:ENFCEMT,EXSTG REGLNS/
VAR116,ENFCEMT OF EXSTG REGLNS, IF SOLN,HOW IMP/
VAR117,DET WQ,SOLN:NEW REGLNS,CURB P AT SOURCE/
VAR118,NEW REG,CURB P AT SOURCE,IF SOLN,HOW IMP/
VAR119,DET WQ,SOLN:REDISTRIB RESP,EXSTG GOV AGCS/
VAR120,REDISTRIB RESP,GOV AGCS,IF SOLN,HOW IMP/
VAR121,DET WQ,SOLN:CREATE NEW AGCS RESP FOR WPC/
VAR122,CRE NEW AGCS FOR WPC,IF SOLN,HOW IMP/
VAR123,DET WQ SOLN:INCD LDRSHIP FR OFFCL IN WQ/
VAR124,INCD LDRSHIP FROM OFFCLS,IF SOLN,HOW IMP/
VAR125,DET WQ SOLN:INCD COORD,ACTVTS OF AGCS/
VAR126,INC COORD,ACTVTS WQ AGCS,IF SOLN,HOW IMP/
VAR127,DETERIORATING WQ:OTHER SOLUTIONS/
VAR128,OTHER SOLUTIONS,HOW IMPORTANT/
VAR129,URB GROWTH UNDER PRESENT SOC ECON CONDNS/
VAR130,REC GROWTH UNDER PRESENT SOC ECON CONDNS/
VAR131,INDL DEV UNDER PRESENT SOC ECON CONDNS/
VAR132,WQ PROTECN UNDER PRESENT SOC ECON CONDNS/
VAR133,PRSVN,NATURAL AREAS,UND PR SOC ECON CONDNS/
VAR134,MORE CONTRL OF DEV UNDR PR SOC ECON CONDNS/
VAR135,"NO GROWTH" POLICY UNDR PR SOC ECON CONDNS/
VAR136,NUCLEAR PP UNDER PR SOC ECON CONDNS/
VAR137,FOSSIL FUEL PP UNDER PR SOC ECON CONDNS/
VAR138,AGRICULTURAL DEV UNDER PR SOC ECON CONDNS/
VAR139,MINING OPERATIONS UNDER PR SOC ECON CONDNS/
VAR140,OTHER FACTORS/
VAR141,EFFECT OF URBAN GROWTH ON FUTURE WQ/
VAR142,EFFECT OF RECREATL GROWTH ON FUTURE WQ/
VAR143,EFFECT OF INDL DEVELOPMT ON FUTURE WQ/
VAR144,EFFECT OF NUCLEAR PP ON FUTURE WQ/
VAR145,EFFECT OF FOSSIL FUEL PP ON FUTURE WQ/
VAR146,EFFECT OF AGRICULTURAL DEV ON FUTURE WQ/
VAR147,EFFECT OF MINING OPERATIONS ON FUTURE WQ/
VAR148,EFFECT OF OTHER FACTORS ON FUTURE WQ/
VAR149,CONTRVSL ISSUES:SEWER CONSTRUCTION/
VAR150,SEWR CONSTRUCTION;PRO/
VAR151,SEWR CONSTRUCTION;CON/
VAR152,CONTRVSL ISSUES:STORM DRAIN CONSTRUCTION/
VAR153,STORM DRAIN CONSTRUCTION;PRO/
VAR154,STORM DRAIN CONSTRUCTION;CON/
VAR155,CONTRVSL ISSUES:INDUSTRIAL POLLUTION/
VAR156,INDUSTRIAL POLLUTION;PRO/
VAR157,INDUSTRIAL POLLUTION;CON/
VAR158,CONTRVSL ISSUES:SOLID WSTS,PR TRTMT MTHD/

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            VAR158,SOLID WASTES,PRESENT TRTMT METHODS;PRO/
            VAR159,SOLID WASTES,PRESENT TRTMT METHODS;CON/
            VAR160,CONTRVSL ISSUES:THERMAL POLLUTION/
            VAR161,THERMAL POLLUTION;PRO/
            VAR162,THERMAL POLLUTION;CON/
            VAR163,CONTRVSL ISSUES:WASTE DISCHARGE/
            VAR164,WASTE DISCHARGE;PRO/
            VAR165,WASTE DISCHARGE;CON/
            VAR166,CONTRVSL ISSUES:EROSION CONTROL/
            VAR167,EROSION CONTROL;PRO/
            VAR168,EROSION CONTROL;CON/
            VAR169,CONTRVSL ISSUES:INDUSTRIAL DEVELOPMENT/
            VAR170,INDUSTRIAL DEVELOPMENT;PRO/
            VAR171,INDUSTRIAL DEVELOPMENT;CON/
            VAR172,CONTRVSL ISSUES:MARSH LAND DEVELOPMENT/
            VAR173,MARSH LAND DEVELOPMENT;PRO/
            VAR174,MARSH LAND DEVELOPMENT;CON/
            VAR175,CONTRVSL ISSUES:CLUSTER DEVELOPMENT/
            VAR176,CLUSTER DEVELOPMENT;PRO/
            VAR177,CLUSTER DEVELOPMENT;CON/
            VAR178,CONTRVSL ISSUES:CONSTRUCTION,REC FACLTS/
            VAR179,CONSTRUCTION OF RECREATIONAL FACLTS;PRO/
            VAR180,CONSTRUCTION OF RECREATIONAL FACLTS;CON/
            VAR181,CONTRVSL ISSUES:NUCLEAR POWER PLANTS/
            VAR182,NUCLEAR POWER PLANT;PRO/
            VAR183,NUCLEAR POWER PLANT;CON/
            VAR184,CONTRVSL ISSUES:ZONING/
            VAR185,ZONING;PRO/
            VAR186,ZONING;CON/
            VAR187,CONTRVSL ISSUES:PRSVN,NATURAL SHORELINE/
            VAR188,PRESERVATION OF NATURAL SHORELINE;PRO/
            VAR189,PRESERVATION OF NATURAL SHORELINE;CON/
            VAR190,CONTRVSL ISSUES:LAND USE PLANNING/
            VAR191,LAND USE PLANNING;PRO/
            VAR192,LAND USE PLANNING;CON/
            VAR193,CONTRVSL ISSUES:REGIONAL PLANNING/
            VAR194,REGIONAL PLANNING;PRO/
            VAR195,REGIONAL PLANNING;CON/
LUF LABELS  VAR001 (1) USA (2) CANADA (0) UNKNOWN/
            VAR002 (1) ONTARIO (2) ERIE (3) HURON (4) MICHIGAN (5) SUPERIOR
            (6) CONNECTING WATERS (0) UNKNOWN/
            VAR003 (1) INDUSTRIAL (2) RESIDENTIAL (3) AGRICULTURAL (4) RECREA
            TIONAL (5) WILD (6) RESIDL AND INDL (0) UNKNOWN/
            VAR004 (1) TOWNSHIP (2) COUNTY (3) CITY (4) STATE (5) REGIONAL
            (6) FEDERAL (7) OTHERS (0) UNKNOWN/
            VAR005 (1) LESS THAN 20 (2) 20-49 (3) 50-99 (4) 100-499 (5) 500-9
            99 (6) GT 1000 (0) UNKNOWN/
            VAR006 TO VAR030 (1) UNIMP,YOUR AREA (2) NOT V IMP,YOUR AREA (3)
            SOMWAT IMP,YOUR AREA (4) IMP,YOUR AREA (5) VERY IMP,YOUR AREA (6)
            NOT APPLICABLE (7) FAILED TO ANSWER/
            VAR031 (1) YOUR AREA (2) OUTSIDE YOUR AREA (3) BOTH 1 AND 2 (4) F
            AILED TO ANSWER/
            VAR032,VAR033 (1) HIGH QUALITY (2) MEDIUM QUALITY (3) LOW QUALITY
            (4) VERY LOW QUALITY (5) FAILED TO ANSWER/
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VAR034 (1) FEDL AGENCY (2) STATE AGENCY (3) REGIONAL AGENCY (4) L
OCAL AGENCY (5) FED & STATE AGCS (6) FED & REG AGCS (7) FED & LOC
AL AGCS (8) ST & LOCAL AGCS (9) ST & REG AGCS (10) REG & LOC AGCS
 (11) FED,ST & LOC AGCS (12) FED,ST & REG AGCS (13) FED,LOC,REG A
GCS (14) ST,REG & LOC AGCS (15) FED,ST,REG & LOC AGCS (16) FAILED
 TO ANSWER/
VAR035,VAR038,VAR041,VAR044,VAR047,VAR050,VAR053,VAR056,VAR059,
VAR062,VAR065,VAR068,VAR071,VAR074,VAR077,VAR080,VAR083,VAR086,
VAR089,VAR092,VAR095,VAR098,VAR101,VAR104,VAR107,VAR110 (1) AID (
2) HINDER (3) NOT APPLICABLE (4) FAILED TO ANSWER/
VAR036,VAR039,VAR042,VAR045,VAR048,VAR051,VAR054,VAR057,VAR060,
VAR063,VAR066,VAR069,VAR072,VAR075,VAR078,VAR081,VAR084,VAR087,
VAR090,VAR093,VAR096,VAR099,VAR102,VAR105,VAR108,VAR111 (1) NO IN
FLUENCE (2) V LITTLE INFLUENCE (3) SOME INFLUENCE (4) GOOD AMT OF
INFL (5) GRT DEAL OF INFL (6) HINDER (7) NOT APPLICABLE (8) FAILE
D TO ANSWER/
VAR037,VAR040,VAR043,VAR046,VAR049,VAR052,VAR055,VAR058,VAR061,
VAR064,VAR067,VAR070,VAR073,VAR076,VAR079,VAR082,VAR085,VAR088,
VAR091,VAR094,VAR097,VAR100,VAR103,VAR106,VAR109,VAR112 (1) NO IN
FLUENCE (2) V LITTLE INFLUENCE (3) SOME INFLUENCE (4) GOOD AMT OF
 INFLUENCE (5) GRT DEAL OF INFLUENCE (6) AID (7) NOT APPLICABLE (
8) FAILED TO ANSWER/
VAR113,VAR115,VAR117,VAR119,VAR121,VAR123,VAR125,VAR127 (1) YES
(2) NO (3) FAILED TO ANSWER/
VAR114,VAR116,VAR118,VAR120,VAR122,VAR124,VAR126,VAR128 (1) UNIMP
,YOUR AREA (2) NOT V IMP,YOUR AREA (3) SOMWAT IMP,YOUR AREA (4) I
MP,YOUR AREA (5) VERY IMP,YOUR AREA (6) NOT A SOLUTION (7) FAILED
 TO ANSWER/
VAR129 TO VAR140 (1) NOT BENEFICIAL (2) V LITTLE BENEFIT (3) SOMW
AT BENEFICL (4) BENEFICIAL (5) VERY BENEFICIAL (6) NOT APPLICABLE
 (7) FAILED TO ANSWER/
VAR141 TO VAR148 (1) NOT DETRIMENTAL (2) NOT V DETRIMENTL (3) SOM
WAT DETRIMTL (4) DETRIMENTAL (5) VERY DETRIMENTAL (6) NOT APPLICA
BLE (7) FAILED TO ANSWER/
VAR149,VAR152,VAR155,VAR158,VAR161,VAR164,VAR167,VAR170,VAR173,
VAR176,VAR179,VAR182,VAR185,VAR188,VAR191,VAR194 (1) PRO (2) CON
(3) NOT APPLICABLE (4) FAILED TO ANSWER/
VAR150,VAR153,VAR156,VAR159,VAR162,VAR165,VAR168,VAR171,VAR174,
VAR177,VAR180,VAR183,VAR186,VAR189,VAR192,VAR195 (1) NO RESPONSIB
ILITY (2) V LITTLE RESP (3) SOME RESP (4) GOOD AMT OF RESP (5) CO
MPLETE RESP (6) CON (7) NOT APPLICABLE (8) FAILED TO ANSWER/
VAR151,VAR154,VAR157,VAR160,VAR163,VAR166,VAR169,VAR172,VAR175,
VAR178,VAR181,VAR184,VAR187,VAR190,VAR193,VAR196 (1) NO RESPONSIB
ILITY (2) V LITTLE RESP (3) SOME RESP (4) GOOD AMT OF RESP (5) CO
MPLETE RESP (6) PRO (7) NOT APPLICABLE (8) FAILED TO ANSWER/
ISSING VALUES VAR001 TO VAR005(0)/VAR006 TO VAR030(6,7)/VAR031(4)/VAR032,VAR033
(5)/VAR034(16)/VAR035,VAR038,VAR041,VAR044,VAR047,VAR050,VAR053,
VAR056,VAR059,VAR062,VAR065,VAR068,VAR071,VAR074,VAR077,
VAR080,VAR083,VAR086,VAR089,VAR092,VAR095,VAR098,VAR101,VAR104,
VAR107,VAR110(3,4)/VAR036,VAR039,VAR042,VAR045,VAR048,
VAR051,VAR054,VAR057,VAR060,VAR063,VAR066,VAR069,VAR072,VAR075,
VAR078,VAR081,VAR084,VAR087,VAR090,VAR093,VAR096,VAR099,VAR102,
VAR105,VAR108,VAR111,VAR037,VAR040,VAR043,VAR046,VAR049,VAR052,
VAR055,VAR058,VAR061,VAR064,VAR067,VAR070,VAR073,VAR076,VAR079,
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                VAR082,VAR085,VAR088,VAR091,VAR094,VAR097,VAR100,VAR103,VAR106,
                VAR109,VAR112(6,7,8)/VAR113,VAR115,VAR117,VAR119,VAR121,VAR123,
                VAR125,VAR127(3)/VAR114,VAR116,VAR118,VAR120,VAR122,VAR124,VAR126
                ,VAR128,VAR129 TO VAR148(6,7)/VAR149,VAR152,VAR155,VAR158,VAR161,
                VAR164,VAR167,VAR170,VAR173,VAR176,VAR179,VAR182,VAR185,VAR188,
                VAR191,VAR194(3,4)/VAR150,VAR153,VAR156,VAR159,VAR162,VAR165,
                VAR168,VAR171,VAR174,VAR177,VAR180,VAR183,VAR186,VAR189,VAR192,
                VAR195,VAR151,VAR154,VAR157,VAR160,VAR163,VAR166,VAR169,VAR172,
                VAR175,VAR178,VAR181,VAR184,VAR187,VAR190,VAR193,VAR196(6,7,8)
 INPUT FORMAT   FIXED (10X,5F1.0,1X,9F1.0,1X,10F1.0,1X,7F1.0,1X,3F1.0,F2.0,1X,3F1
                .0,1X,3F1.0,1X,3F1.0,1X,3F1.0,1X,3F1.0,1X,3F1.0,1X,3F1.0,1X,2F1.0
                /10X,F1.0,1X,3F1.0,1X,3F1.0,1X,3F1.0,1X,3F1.0,1X,3F1.0,1X,3F1.0,1
                X,3F1.0,1X,3F1.0,1X,3F1.0,1X,3F1.0,1X,3F1.0,1X,3F1.0,1X,3F1.0,1X,
                3F1.0,1X,3F1.0,1X,3F1.0,1X,3F1.0/10X,3F1.0,1X,2F1.0,1X,2F1.0,1X,2
                F1.0,1X,2F1.0,1X,2F1.0,1X,2F1.0,1X,2F1.0,1X,2F1.0,1X,12F1.0,1X,8F
                1.0/10X,3F1.0,1X,3F1.0,1X,3F1.0,1X,3F1.0,1X,3F1.0,1X,3F1.0,1X,3F1
                .0,1X,3F1.0,1X,3F1.0,1X,3F1.0,1X,3F1.0,1X,3F1.0,1X,3F1.0,1X,3F1.0
                ,1X,3F1.0,1X,3F1.0)

 REPETITION, THE INPUT FORMAT PROVIDES FOR 196 VARIABLES.  196 WILL BE READ.
RECORDS ('CARDS') PER CASE.  A MAXIMUM OF   80 'COLUMNS' ARE USED ON A RECORD.

 INPUT MEDIUM    CARD
 READ INPUT DATA
```

```
*****ICPR FILE-FILE PROCESSING*****

LABEL:  GREAT LAKES SURVEY QUESTIONNAIRE-FIXED DATASET

PARAMETERS:

VSTART=1 NVOUT=197 DICT=(FILE,FIXED) DATA=FILE DECKS=4 PRINT=BADS*

PARAMETERS INTERPRETED:

    STARTING VARIABLE NUMBER =      1
    ENDING VARIABLE NUMBER =    197
    NUMBER OF DECKS/CASE =      4
    MAXIMUM NUMBER OF ERROR CASES =     10
    PRINTOUT WILL       INCLUDE CASES WITH RECODING

VARIABLE DESCRIPTOR INPUT:  SETUP FILE  KEYED FIXED
                                ----        ----

DATA INPUT:  SETUP FILE  TAPE  TESTMERG BLOCKED  HEADER
                 ----

   CHARACTERS PER INPUT CASE =   4 X   80
```

LISTING OF DICTIONARY:

VARIABLE SOURCE LOCATION AND EDIT VALUES:

	VAR#	CT	VT	VARIABLE NAME	TLOC	WID	#D	#R	M.D. 1	M.D. 2		OK	COL	WID	BLANKS	AMPS	DASHES
T	1	0	0	USA OR CANADA	1	1	0	1	0000000		00000	1	11	1			
T	2	0	0	LAKE	2	1	0	1	0000000		00000	1	12	1			
T	3	0	0	LAND USE	3	1	0	1	0000000		00000	1	13	1			
T	4	0	0	GOVERNING AGENCY	4	1	0	1	0000000		00000	1	14	1			
T	5	0	0	POPULATION:PERS PER SQ M	5	1	0	1	0000000		00000	1	15	1			
T	6	0	0	DR:WP,INAD MUN SEWAG FAC	6	1	0	1		0000006	00000	1	17	1			
T	7	0	0	DR:WP,INAD IND SEWAG FAC	7	1	0	1		0000006	00000	1	18	1			
T	8	0	0	DR:WP,AGRI RUNOFF	8	1	0	1		0000006	00000	1	19	1			
T	9	0	0	DR:P LND,WTR:SOLID WASTE	9	1	0	1		0000006	00000	1	20	1			
T	10	0	0	DR:BEACH AND SLOPE EROSN	10	1	0	1		0000006	00000	1	21	1			
T	11	0	0	DR:SEDIM,POOR LND USE PR	11	1	0	1		0000006	00000	1	22	1			
T	12	0	0	DR:SHRF ALTN BY FLG,DRDG	12	1	0	1		0000006	00000	1	23	1			
T	13	0	0	DR:THERMAL POLLUTION	13	1	0	1		0000006	00000	1	24	1			
T	14	0	0	UR:INAD ACCESS,WTRS EDGE	14	1	0	1		0000006	00000	1	26	1			
T	15	0	0	UR:CONFL LD USE,COMPTG U	15	1	0	1		0000006	00000	1	27	1			
T	16	0	0	UR:POOR O DEV ADJ SHLINE	16	1	0	1		0000006	00000	1	28	1			
T	17	0	0	UR:REC LD AVAIL,PUBL USE	17	1	0	1		0000006	00000	1	29	1			
T	18	0	0	UR:INFERIOR REC DEV FACL	18	1	0	1		0000006	00000	1	30	1			
T	19	0	0	UR:RECD ENJ SHL;WKWTRS	19	1	0	1		0000006	00000	1	31	1			
T	20	0	0	UR:LACK PROPR MARINA FAC	20	1	0	1		0000006	00000	1	32	1			
T	21	0	0	UR:LAK OF PROPR PORT FAC	21	1	0	1		0000006	00000	1	33	1			
T	22	0	0	UR:CONTR LD USE,SHORE ZN	22	1	0	1		0000006	00000	1	34	1			
T	23	0	0	UR:INAD ADAPT,TRNSP SHOR	23	1	0	1		0000006	00000	1	35	1			
T	24	0	0	PL:INAD EMPH WTR ENV PLG	24	1	0	1		0000006	00000	1	37	1			
T	25	0	0	PL:LAK INTER-AGCY COORDN	25	1	0	1		0000006	00000	1	38	1			
T	26	0	0	PL:NO LONG RGE COMPR PL	26	1	0	1		0000006	00000	1	39	1			
T	27	0	0	PL:REQ ST WIDE ZNG SHRE	27	1	0	1		0000006	00000	1	40	1			

T	28	0	0	PL:LACK OF RESOURC INFO	28	1	0	1	0000006	00000	1	41	1
T	29	0	0	PL:INAD ZNG,BEACH REGLNS	29	1	0	1	0000006	00000	1	42	1
T	30	0	0	PL:LAK PL METH,POLCS,GOL	30	1	0	1	0000006	00000	1	43	1
T	31	0	0	AREA OF JURISDICTION	31	1	0	1	0000004	00000	1	45	1
T	32	0	0	WQ,SHLINE YOUR AREA JURI	32	1	0	1	0000005	00000	1	46	1
T	33	0	0	0 SHL,PCH YOUR AREA JURI	33	1	0	1	0000005	00000	1	47	1
T	34	0	0	AGC PROT WQ,YOUR AR JURI	34	2	0	1	0000016	00000	1	48	2
T	35	0	0	MTCE WQ:CONSERVN GROUPS	36	1	0	1	0000003	00000	1	51	1
T	36	0	0	MTCE WQ:CONSRVN GRPS AID	37	1	0	1	0000006	00000	1	52	1
T	37	0	0	MTCE WQ:CONSVN GRP MINOR	38	1	0	1	0000006	00000	1	53	1
T	38	0	0	MTCE WQ:ECOLOGY ACTIVIST	39	1	0	1	0000003	00000	1	55	1
T	39	0	0	MTCE WQ:ECOL ACTVSTS AID	40	1	0	1	0000006	00000	1	56	1
T	40	0	0	MTCE WQ:ECOL ACTVST MINO	41	1	0	1	0000006	00000	1	57	1
T	41	0	0	MTCE WQ:ROD,GUN CLUBS	42	1	0	1	0000003	00000	1	59	1
T	42	0	0	MTCE WQ:ROD,GUN CLBS AID	43	1	0	1	0000006	00000	1	60	1
T	43	0	0	MTCE WQ:ROD,GUN CL MINOR	44	1	0	1	0000006	00000	1	61	1
T	44	0	0	MTCE WQ:PROFL PLNRS,ENGR	45	1	0	1	0000003	00000	1	63	1
T	45	0	0	MTCE WQ:PLNRS,ENGRS,AID	46	1	0	1	0000006	00000	1	64	1
T	46	0	0	MTCE WQ:PLNRS,ENGR,MINOR	47	1	0	1	0000006	00000	1	65	1
T	47	0	0	MTCE WQ:OTHR CIVIC ASSOC	48	1	0	1	0000003	00000	1	67	1
T	48	0	0	MTCE WQ:CIVIC ASSOC AID	49	1	0	1	0000006	00000	1	68	1
T	49	0	0	MTCE WQ:CIVIC ASSOC MIND	50	1	0	1	0000006	00000	1	69	1
T	50	0	0	MTCE WQ:STUDENT GROUPS	51	1	0	1	0000003	00000	1	71	1
T	51	0	0	MTCE WQ:STUDT GRPS AID	52	1	0	1	0000006	00000	1	72	1
T	52	0	0	MTCE WQ:STUDT GRPS MINOR	53	1	0	1	0000006	00000	1	73	1
T	53	0	0	MTCE WQ:REAL EST DEVLPRS	54	1	0	1	0000003	00000	1	75	1
T	54	0	0	MTCE WQ:REAL EST DEV AID	55	1	0	1	0000006	00000	1	76	1
T	55	0	0	MTCE WQ:RL EST DEV MINOR	56	1	0	1	0000006	00000	1	77	1
T	56	0	0	MTCE WQ:HOMEOWNERS	57	1	0	1	0000003	00000	1	79	1
T	57	0	0	MTCE WQ:HOMEOWNERS AID	58	1	0	1	0000006	00000	1	80	1

T	58	0	0	MTCE WQ:HOMEOWNERS MINOR	59	1	0	1		0000006	00000	2	11	1
T	59	0	0	MTCE WQ:INDUSTRIAL CORPN	60	1	0	1		0000003	00000	2	13	1
T	60	0	0	MTCE WQ:INDL CORPNS AID	61	1	0	1		0000006	00000	2	14	1
T	61	0	0	MTCE WQ:INDL CORPNS MINO	62	1	0	1		0000006	00000	2	15	1
T	62	0	0	MTCE WQ:UTILITY COMPS	63	1	0	1		0000003	00000	2	17	1
T	63	0	0	MTCE WQ:UTIL COMPS AID	64	1	0	1		0000006	00000	2	18	1
T	64	0	0	MTCE WQ:UTIL COMPS MINOR	65	1	0	1		0000006	00000	2	19	1
T	65	0	0	MTCE WQ:FED AGCS,REGULNS	66	1	0	1		0000003	00000	2	21	1
T	66	0	0	MTCE WQ:FED AGCS,REG AID	67	1	0	1		0000006	00000	2	22	1
T	67	0	0	MTCE WQ:FED AGCS,REG MIN	68	1	0	1		0000006	00000	2	23	1
T	68	0	0	MTCE WQ:ST AGCS,REGULNS	69	1	0	1		0000003	00000	2	25	1
T	69	0	0	MTCE WQ:ST AGCS,REG AID	70	1	0	1		0000006	00000	2	26	1
T	70	0	0	MTCE WQ:ST AGCS,REG MINO	71	1	0	1		0000006	00000	2	27	1
T	71	0	0	MTCE WQ:OTHERS	72	1	0	1		0000003	00000	2	29	1
T	72	0	0	MTCE WQ:OTHERS AID	73	1	0	1		0000006	00000	2	30	1
T	73	0	0	MTCE WQ:OTHERS MINOR	74	1	0	1		0000006	00000	2	31	1
T	74	0	0	MTCE,SH Q:CONSVN GROUPS	75	1	0	1		0000003	00000	2	33	1
T	75	0	0	MTCE,SH Q:CONSVN GR AID	76	1	0	1		0000006	00000	2	34	1
T	76	0	0	MTCE,SH Q:CONSVN GR MINO	77	1	0	1		0000006	00000	2	35	1
T	77	0	0	MTCE,SH Q:ECOLOGY ACTVST	78	1	0	1		0000003	00000	2	37	1
T	78	0	0	MTCE,SH Q:ECOL ACTVS AID	79	1	0	1		0000006	00000	2	38	1
T	79	0	0	MTCE,SH Q:ECOL ACTV MINO	80	1	0	1		0000006	00000	2	39	1
T	80	0	0	MTCE,SH Q:ROD,GUN CLUBS	81	1	0	1		0000003	00000	2	41	1
T	81	0	0	MTCE,SH Q:ROD,GUN CL AID	82	1	0	1		0000006	00000	2	42	1
T	82	0	0	MTCE,SH Q:ROD,GUN CL MIN	83	1	0	1		0000006	00000	2	43	1
T	83	0	0	MTCE,SH Q:PLNRS,ENGR,ETC	84	1	0	1		0000003	00000	2	45	1
T	84	0	0	MTCE,SH Q:PLNR,ENGR AID	85	1	0	1		0000006	00000	2	46	1
T	85	0	0	MTCE,SH Q:PLNR,ENGR,MIND	86	1	0	1		0000006	00000	2	47	1
T	86	0	0	MTCE,SH Q:CIVIC ASSOCNS	87	1	0	1		0000003	00000	2	49	1
T	87	0	0	MTCE,SH Q:CIV ASSOC AID	88	1	0	1		0000006	00000	2	50	1

T	88	0	0	MTCE,SH Q:CIV ASSOC HIND	89	1	0	1	0000006	00000	2	51	1
T	89	0	0	MTCE,SH Q:STUDENT GROUPS	90	1	0	1	0000003	00000	2	53	1
T	90	0	0	MTCE,SH Q:STUDT GRPS AID	91	1	0	1	0000006	00000	2	54	1
T	91	0	0	MTCE,SH Q:STUDT GR HINDR	92	1	0	1	0000006	00000	2	55	1
T	92	0	0	MTCE,SH Q:REAL EST DEVL	93	1	0	1	0000003	00000	2	57	1
T	93	0	0	MTCE,SH Q:RL EST DEV AID	94	1	0	1	0000006	00000	2	58	1
T	94	0	0	MTCE,SH Q:RL EST DEV HIN	95	1	0	1	0000006	00000	2	59	1
T	95	0	0	MTCE,SH Q:HOMEOWNERS	96	1	0	1	0000003	00000	2	61	1
T	96	0	0	MTCE,SH Q:HOMEOWNERS AID	97	1	0	1	0000006	00000	2	62	1
T	97	0	0	MTCE,SH Q:HOMOWNRS HINDR	98	1	0	1	0000006	00000	2	63	1
T	98	0	0	MTCE,SH Q:INDL CORPORNS	99	1	0	1	0000003	00000	2	65	1
T	99	0	0	MTCE,SH Q:INDL CORPN AID	100	1	0	1	0000006	00000	2	66	1
T	100	0	0	MTCE,SH Q:INDL CORP HIND	101	1	0	1	0000006	00000	2	67	1
T	101	0	0	MTCE,SH Q:UTILITY COMPS	102	1	0	1	0000003	00000	2	69	1
T	102	0	0	MTCE,SH Q:UTIL COMPS AID	103	1	0	1	0000006	00000	2	70	1
T	103	0	0	MTCE,SH Q:UTIL COMPS HIN	104	1	0	1	0000006	00000	2	71	1
T	104	0	0	MTCE,SH Q:FED AGCS,REGLN	105	1	0	1	0000003	00000	2	73	1
T	105	0	0	MTCE,SH Q:FED AGCS AID	106	1	0	1	0000006	00000	2	74	1
T	106	0	0	MTCE,SH Q:FED AGCS HIND	107	1	0	1	0000006	00000	2	75	1
T	107	0	0	MTCE,SH Q:ST AGCS,REGLNS	108	1	0	1	0000003	00000	2	77	1
T	108	0	0	MTCE,SH Q:STATE AGCS AID	109	1	0	1	0000006	00000	2	78	1
T	109	0	0	MTCE,SH Q:STATE AGCS HIN	110	1	0	1	0000006	00000	2	79	1
T	110	0	0	MTCE,SH Q:OTHERS	111	1	0	1	0000003	00000	3	11	1
T	111	0	0	MTCE,SH Q:OTHERS AID	112	1	0	1	0000006	00000	3	12	1
T	112	0	0	MTCE,SH Q:OTHERS HINDER	113	1	0	1	0000006	00000	3	13	1
T	113	0	0	SOLN,DET WQ:ADDL WW TRTM	114	1	0	1	0000003	00000	3	15	1
T	114	0	0	ADDL WW TRTMT,HOW IMP	115	1	0	1	0000006	00000	3	16	1
T	115	0	0	SOLN,DET WQ:ENFCEMT,REGL	116	1	0	1	0000003	00000	3	18	1
T	116	0	0	ENFCEM,EXSTG REG HOW IMP	117	1	0	1	0000006	00000	3	19	1
T	117	0	0	SOLN,DET WQ:NEW REGLNS	118	1	0	1	0000003	00000	3	21	1

T	118	0	0	N REG,CURR P SORCE,H IMP	119	1	0	1	0000006	00000	3	22	1
T	119	0	0	SOLN,DFT WQ:REDISTR RESP	120	1	0	1	0000003	00000	3	24	1
T	120	0	0	REDISTR RESP,GOV AGC H I	121	1	0	1	0000006	00000	3	25	1
T	121	0	0	SOLN,DFT WQ:CRE AGC WPC	122	1	0	1	0000003	00000	3	27	1
T	122	0	0	CRE NEW AGCS FOR WPC,H I	123	1	0	1	0000006	00000	3	28	1
T	123	0	0	SOLN,DFT WQ:INC LDRSHIP	124	1	0	1	0000003	00000	3	30	1
T	124	0	0	INC LDRSHIP,WQ IMPLS H I	125	1	0	1	0000006	00000	3	31	1
T	125	0	0	SOLN,DFT WQ:INCR COORDN	126	1	0	1	0000003	00000	3	33	1
T	126	0	0	INCR COORD,ACTVT AGC,H I	127	1	0	1	0000006	00000	3	34	1
T	127	0	0	SOLN,DFT WQ:OTHERS	128	1	0	1	0000003	00000	3	36	1
T	128	0	0	OTHER SOLUTIONS HOW IMP	129	1	0	1	0000006	00000	3	37	1
T	129	0	0	URB GROTH,PR SOC EC COND	130	1	0	1	0000006	00000	3	39	1
T	130	0	0	REC GROTH,PR SOC EC COND	131	1	0	1	0000006	00000	3	40	1
T	131	0	0	INDL DEV,PR SOC ECN COND	132	1	0	1	0000006	00000	3	41	1
T	132	0	0	WQ PROT,PR SOC ECON COND	133	1	0	1	0000006	00000	3	42	1
T	133	0	0	PRSV NATRL AREA,PR S E C	134	1	0	1	0000006	00000	3	43	1
T	134	0	0	MORE CONTRL DEV PR S E C	135	1	0	1	0000006	00000	3	44	1
T	135	0	0	NO GROWTH POLC PR S E C	136	1	0	1	0000006	00000	3	45	1
T	136	0	0	NUCLEAR PP UNDR PR S E C	137	1	0	1	0000006	00000	3	46	1
T	137	0	0	FOSSIL PP UNDR PR S E C	138	1	0	1	0000006	00000	3	47	1
T	138	0	0	AGRI DEV UNDER PR S E C	139	1	0	1	0000006	00000	3	48	1
T	139	0	0	MINING OPERNS PR S E C	140	1	0	1	0000006	00000	3	49	1
T	140	0	0	OTHER FACTORS	141	1	0	1	0000006	00000	3	50	1
T	141	0	0	EFFECT,URB GROTH FUTUR WQ	142	1	0	1	0000006	00000	3	52	1
T	142	0	0	EFFECT,REC GROTH FUTUR WQ	143	1	0	1	0000006	00000	3	53	1
T	143	0	0	EFFECT,INDL DEV FUTURE WQ	144	1	0	1	0000006	00000	3	54	1
T	144	0	0	EFFECT,NUCL PP FUTURE WQ	145	1	0	1	0000006	00000	3	55	1
T	145	0	0	EFFECT,FOSSIL FUEL PP,WQ	146	1	0	1	0000006	00000	3	56	1
T	146	0	0	EFFECT,AGRI DEV FUTUR WQ	147	1	0	1	0000006	00000	3	57	1
T	147	0	0	EFFECT,MINING OPERNS,WQ	148	1	0	1	0000006	00000	3	58	1

T	148	0	0	EFFECT,OTHR FACTORS,NO	149	1	0	1	0000006	00000	3	59	1
T	149	0	0	CONTRVSL ISS:SEWER CONST	150	1	0	1	0000003	00000	4	11	1
T	150	0	0	SEWER CONSTRUCTION:PRO	151	1	0	1	0000006	00000	4	12	1
T	151	0	0	SEWER CONSTRUCTION:CON	152	1	0	1	0000006	00000	4	13	1
T	152	0	0	ISSUES:STORM DRN CONSTRN	153	1	0	1	0000003	00000	4	15	1
T	153	0	0	STORM DRAIN CONSTRN:PRO	154	1	0	1	0000006	00000	4	16	1
T	154	0	0	STORM DRAIN CONSTRN:CON	155	1	0	1	0000006	00000	4	17	1
T	155	0	0	CONTRVSL ISS:INDL POLLN	156	1	0	1	0000003	00000	4	19	1
T	156	0	0	INDL POLLUTION:PRO	157	1	0	1	0000006	00000	4	20	1
T	157	0	0	INDL POLLUTION:CON	158	1	0	1	0000006	00000	4	21	1
T	158	0	0	ISS:PRES SOLID WSTE TR	159	1	0	1	0000003	00000	4	23	1
T	159	0	0	PR SOL WSTE TRT METH:PRO	160	1	0	1	0000006	00000	4	24	1
T	160	0	0	PR SOL WSTE TRT METH:CON	161	1	0	1	0000006	00000	4	25	1
T	161	0	0	ISSUES:THERM POLLUTION	162	1	0	1	0000003	00000	4	27	1
T	162	0	0	THERMAL POLLUTION:PRO	163	1	0	1	0000006	00000	4	28	1
T	163	0	0	THERMAL POLLUTION:CON	164	1	0	1	0000006	00000	4	29	1
T	164	0	0	ISS:MARINE SEWAGE DISCH	165	1	0	1	0000003	00000	4	31	1
T	165	0	0	MARINE SEWAGE DISCH:PRO	166	1	0	1	0000006	00000	4	32	1
T	166	0	0	MARINE SEWAGE DISCH:CON	167	1	0	1	0000006	00000	4	33	1
T	167	0	0	CONTRVSL ISS:EROSN CONTR	168	1	0	1	0000003	00000	4	35	1
T	168	0	0	EROSION CONTROL:PRO	169	1	0	1	0000006	00000	4	36	1
T	169	0	0	EROSION CONTROL:CON	170	1	0	1	0000006	00000	4	37	1
T	170	0	0	CONTRVSL ISSUES:IND DEV	171	1	0	1	0000003	00000	4	39	1
T	171	0	0	INDUSTRIAL DEVELOPMT:PRO	172	1	0	1	0000006	00000	4	40	1
T	172	0	0	INDUSTRIAL DEVELOPMT:CON	173	1	0	1	0000006	00000	4	41	1
T	173	0	0	ISSUES:MARSH LAND DEVEL	174	1	0	1	0000003	00000	4	43	1
T	174	0	0	MARSH LAND DEVELOPMT:PRO	175	1	0	1	0000006	00000	4	44	1
T	175	0	0	MARSH LAND DEVELOPMT:CON	176	1	0	1	0000006	00000	4	45	1
T	176	0	0	CONTRVSL ISS:CLUSTER DEV	177	1	0	1	0000003	00000	4	47	1
T	177	0	0	CLUSTER DEVELOPMENT:PRO	178	1	0	1	0000006	00000	4	48	1

```
T  178  0  0 CLUSTER DEVELOPMENT:CON  179   1  0  1        0000006      00000  4  49  1
T  179  0  0 ISSUES:CONTRN OF REC FAC  180   1  0  1        0000003      00000  4  51  1
T  180  0  0 CONSTR OF REC FACLTS:PRO  181   1  0  1        0000006      00000  4  52  1
T  181  0  0 CONSTR OF REC FACLTS:CON  182   1  0  1        0000006      00000  4  53  1
T  182  0  0 CONTRVSL ISSUES:NUCL PP   183   1  0  1        0000003      00000  4  55  1
T  183  0  0 NUCLEAR POWER PLANTS:PRO  184   1  0  1        0000006      00000  4  56  1
T  184  0  0 NUCLEAR POWER PLANTS:CON  185   1  0  1        0000006      00000  4  57  1
T  185  0  0 CONTRVSL ISSUES:ZONING    186   1  0  1        0000003      00000  4  59  1
T  186  0  0 ZONING:PRO                187   1  0  1        0000006      00000  4  60  1
T  187  0  0 ZONING:CON                188   1  0  1        0000006      00000  4  61  1
T  188  0  0 CONTR ISS:PRSVN NATRL SH  189   1  0  1        0000003      00000  4  63  1
T  189  0  0 PRSVN NATRL SHORELNE:PRO  190   1  0  1        0000006      00000  4  64  1
T  190  0  0 PRSVN NATRL SHORELNE:CON  191   1  0  1        0000006      00000  4  65  1
T  191  0  0 CONTRVSL ISS:LD USE PLG   192   1  0  1        0000003      00000  4  67  1
T  192  0  0 LAND USE PLANNING:PRO     193   1  0  1        0000006      00000  4  68  1
T  193  0  0 LAND USE PLANNING:CON     194   1  0  1        0000006      00000  4  69  1
T  194  0  0 ISSUES:REGIONAL PLG       195   1  0  1        0000003      00000  4  71  1
T  195  0  0 REGIONAL PLANNING:PRO     196   1  0  1        0000006      00000  4  72  1
T  196  0  0 REGIONAL PLANNING:CON     197   1  0  1        0000006      00000  4  73  1
T  197  1  0 CASE ID                   198   4  0  1                     00000  1   1  4
```

DATA LOGICAL RECORD LENGTH = 201

DATA BLOCKSIZE = 3417

New Version of SPSS

[Note: The programs comprising SPSS and the documentation thereof (including this Computing Center Memo 269) are made available to MTS users by the Center for Political Studies of the Institute for Social Research. The Computing Center is not responsible for the documentation or the maintenance of SPSS programs, and hence cannot offer rebates should these programs fail to perform as described. Nor are Computing Center counselors able to assist SPSS users. Users who need assistance should refer to the section "Counseling" on page 2. M. A. Wilkes, Editor, Computing Center.]

Version 4 of the Statistical Package for the Social Sciences (SPSS) is now available on MTS. This is a copy of the SPSS Version 4 that was adapted for MTS at the University of Alberta. SPSS was originally developed by Norman A. Nie, Dale H. Bent, and C. Hadlai Hull at Stanford University. This MTS version was implemented at the University of Michigan by Daniel Ayres and William Murphy of the Department of Sociology, using computer funds contributed by the Center for Political Studies of ISR.

SPSS is an easily used, well - documented package of basic statistical capabilities for the social scientist; it was primarily designed for survey research work, but meets many other needs. The general areas of capability include:

- an easily used recoding and index generation facility
- a variety of univariate distribution displays and statistics
- bivariate frequency displays including a direct method for producing n-way tables, with a number of nonparametric statistics available
- production of Pearson product-moment correlations, or Spearman or Kendall rank-order coefficients, in matrix form if desired
- partial correlation
- multiple regression
- Guttman scaling
- factor analysis

SPSS has a uniform user-language and program structure which considerably facilitates performing several statistical operations within one job. It permits the use of alphabetic names for variables, and alphabetic descriptions or labels of numeric codes. Input data may be a BCD file stored on cards, an SPSS system file or a type-1 OSIRIS dataset. These features make SPSS very useful for both instruction and research.

Documentation

The SPSS manual was published by McGraw-Hill and is available through the local Ann Arbor bookstores for $6.95. (Nie, Norman; Bent, Dale H.; and Hull, C. Hadlai, Statistical Package for the Social Sciences, McGraw-Hill, Inc., 1970.) That manual has been corrected and expanded by two update manuals to include features in Version 4; these two update manuals are available from:

Patrick Bova
National Opinion Research Center
University of Chicago
6030 South Ellis Avenue
Chicago, Illinois 60637

312-684-5600

Counseling

Contact Dan Ayres mornings (phone 764-7501) or Bill Murphy afternoons (phone 764-5561) at the Sociology Department.

MTS Command Language Needed to Run SPSS

SPSS is stored on ccid ICPR. $RUN ICPR:SPSS [necessary logical I/O assignments] [PAR=nnnnn] will call in the system.

The following inputs/outputs and associated logical I/O units are used:

Logical I/O Unit	Input/output
5	Input SPSS control cards and BCD data. Note that the BCD data is included if and only if "INPUT MEDIUM CARDS" is specified.
6	Printed output.
7	Input type-1 OSIRIS dataset dictionary file. Note that this file is applicable if and only if an "OSIRIS VARS" control card is specified.

8	Input BCD data or input type-1 OSIRIS dataset data file. Note that this file is applicable if and only if an "INPUT MEDIUM" other than cards is specified, or an "OSIRIS VARS" control card is specified.
9	Output card-image data. Note that this file is applicable if and only if a "WRITE CASES" control card is specified or correlation matrices are to be saved.
3	Standard SPSS system data input file. Note that this input is used if and only if a "GET FILE fdname" control card is specified; the file or device specified on that control card is attached internally by SPSS and thus does not need to be specified in the RUN command.
4	Standard SPSS system data output file. Note that this output is used if and only if a "SAVE FILE fdname" control card is specified; the file or device specified on that control card is attached internally by SPSS and thus does not need to be specified in the RUN command.
1 & 2	Sequential scratch disk files are automatically created by SPSS and attached to logical units 1 and 2. These need not be specified in the RUN command.

The parameter specified in the $RUN command after "PAR=" is the number of bytes of work storage which is to be made available for SPSS procedures. Suggestions as to the size of this parameter will be found on page 292 of the SPSS manual. Default size is 80,000 bytes, which is too large (and expensive) for most programs.

Notes

1. Logical I/O units 5 and 6 are typically assigned to files only when executing from a terminal.

2. Tapes, if used for any input or output, must be mounted and positioned to the correct file(s) by the user prior to issuing the "$RUN ICPR:SPSS..." command. The tape should be labeled, or the user should issue

   $CONTROL *tape name* FMT=fmt(blksize,lrecl)

   before issuing the "$RUN ICPR:SPSS..." command.

3. If an OSIRIS dataset is input and is on tape, the tape must be standard labeled with the dictionary in the file preceding the data file, and the tape must be positioned to the dictionary file.

4. If an OSIRIS dataset is input and the dictionary and data files are on disk, then the files must be unlabeled and unblocked. Thus, files generated by OSIRIS II cannot be used directly into SPSS; rather, the ICPR:COPY should be used to remove labels and unblock.

5. If a tape is used for the output SPSS system file, the tape control commands should include:

   POSN=*file no* DSN=dsname FMT=U(8000)

6. If a tape is used for the output BCD data or correlations, the tape control commands should include:

   POSN=*file no* DSN=dsname FMT=FB(size,80)

   where size is a multiple of 80.

7. It is generally a better idea to $COPY data cards to either a temporary or permanent file before issuing the $RUN ICPR:SPSS command. This allows the user to specify an estimated number of cases. When this is done, the file to which the data were copied must be specified as unit number 8 on the $RUN command and an "INPUT MEDIUM DISK" control card must be specified.

8. If an output SPSS system file is to be stored in a disk file, the user need not $CREATE the file before running SPSS. The disk file named on the SAVE FILE control card will be created as a sequential file by SPSS if it does not already exist. If it does exist, it will be emptied <u>before</u> the data are saved. For large files, there is a great monetary advantage to creating a file of the proper size before running SPSS. It is marginal for files of fewer than 15 pages. If the file is created before the run, it <u>must</u> be created as a sequential file. Failure to do this will result in an error comment, and no file will be saved. A rough formula for the file size is:

$$\#\ \text{page} = \frac{(\text{NVARS}+3) \times \text{NCASES}}{1000} + 3$$

   where: NVARS is the number of variables to be saved.
   NCASES is the number of cases in the file.

This formula will usually result in a file which is somewhat larger than necessary, depending on the number of variable and value labels included in the file. The MTS $TRUNCATE command should then be used to trim off unused space at the end of the file.

Modification to the SPSS syntax for the MTS environment

1. 1 16

   GET FILE file name

   In the MTS version of SPSS, the file name specified on the GET FILE control card is the name of the disk sequential file (including ccid if necessary) or the pseudo device name of the tape volume that contains an input SPSS system file. The name may be 17 characters in length, including "CCID:" if it is a shared file. See Note 2 in the section "MTS Command Language Needed to Run SPSS."

2. 1 16

   FILE NAME file name [file label]

   In the MTS version of SPSS, the FILE NAME control card is always optional, even when an output SPSS system file is being generated. Any file name or label specified is stored internally in the output SPSS system file and used in the printout whenever the system file is used.

3. 1 16

   SAVE FILE file name

   In the MTS version of SPSS, the specification field of the SAVE FILE control card contains a file name, as indicated above. This file name is the name of the disk file or the pseudo device name of the tape volume that is to contain the output SPSS system file. See Notes 2 and 7 in the section "MTS Command Language Needed to Run SPSS."

Extension to SPSS Control Cards

Two new control cards have been added to the MTS version of SPSS to allow easier debugging of the SPSS program itself and to allow users to write their own SPSS procedures which use SPSS files and I/O routines.

The control cards are:

1. 1 16

   MTS optional MTS command

   This control card returns the user to MTS command mode. If an MTS command is given in columns 16-80, the command is executed and control is immediately returned to SPSS. If columns 16-80 are blank, a return is made to MTS command mode, and MTS commands are read from *SOURCE*. (Note the *SOURCE* may or may not be the same file or device as the

unit from which SPSS is reading commands.) In the second case, the user must issue a $RESTART command to return to SPSS.

An example of the use of the MTS control card to print intermediate time and cost information is shown below.

```
$SET TDB=ON
$RUN ICPR:SPSS PAR=4000
MTS             $DISPLAY $
GET FILE        2CBA:NRC
MTS             $DISPLAY $
CODEBOOK        EDUC
MTS             $DISPLAY $
FINISH
$ENDFILE
```

The MTS control card can also be used to mount and dismount tapes, thus saving some money for jobs with long elapsed times.

```
$MOUNT rack 9TP *T* VOL=volid
$RUN ICPR:SPSS PAR=4000
   .
   .
   .
GET FILE        *T*
first procedure
MTS             $RELEASE *T*
FINISH
$ENDFILE
```

2. 1 16

ACCOUNT account number

This control card is used to change the account number from which SPSS procedures are loaded. It was intended mainly for system maintenance, but users who wish to write their own SPSS procedures may also find it useful.

Normally, SPSS procedures are loaded from account ICPR. The ACCOUNT control card allows a user to change this. An example is shown below:

```
$RUN ICPR:SPSS PAR=4000
ACCOUNT                 XXXX
USER1                   (optional parameters)
ACCOUNT                 ICPR
MARGINALS               AGE, EDUC, RACE
STATISTICS              ALL
FINISH
$ENDFILE
```

In the example above, the user has read in data using a

program located in file XXXX:USER1. SPSS loads and executes the program in this file when it reads the USER1 control card. After reading the data into the proper temporary file, USER1 returns to SPSS. The second ACCOUNT control card informs SPSS that the remainder of the procedures in the run are to be loaded from files on account ICPR.

The entry points USER1 through USER5 are available for those who wish to use them within the context of SPSS. Information on how to do this may be found on pages 328-332 of the SPSS manual. The named common sections used by SPSS will be found in the file 'ICPR:SPSSCNN'.

Some Examples

1. To run SPSS in batch, using input data on cards and not requesting any output data:

```
$RUN ICPR:SPSS   PAR=n
      .
      .  (SPSS control cards, including "INPUT MEDIUM
        CARDS" )
      .
READ INPUT DATA
      .
      .  (data cards)
      .
      .  (more SPSS control cards)
FINISH
$ENDFILE
```

2. To run SPSS in batch, using an input OSIRIS dataset on a tape and outputting an SPSS system file on another tape:

```
$MOUNT
request to mount tape containing an OSIRIS dataset, e.g.
        C00001 9TP *OSIRIS* VOL=5 POSN=SURVEY.DICT
request to mount tape to contain output SPSS system
file, e.g.
        C00002  9TP  *OUT*  RING=IN VOL=271 DSN=SURVEY.S
        POSN=*EOT* FMT=U(8000)
$ENDFILE
$RUN ICPR:SPSS 7=*OSIRIS* 8=*OSIRIS* PAR=4000
     .
     .  (SPSS control cards including an "OSIRIS
        VARS..." card and a "SAVE FILE *OUT*" card)
FINISH
$ENDFILE
```

3. To run SPSS on the terminal, using an SPSS system file on tape as input and outputting a BCD file:

```
$MOUNT
request to mount a tape containing an SPSS system file,
```

e.g.

```
C00002 9TP *IN* VOL=271 POSN=SURVEY.S
$ENDFILE
$RUN ICPR:SPSS 5=SETUP 6=*PRINT* 9=*PUNCH*
```

File SETUP should contain the SPSS control cards including a "GET FILE *IN*" card and a "WRITE CASES..." card.

REFERENCES

1. "Environmental Quality", The Second Annual Report of the Council on Environmental Quality, August 1971, p. 80.

2. "Environmental Quality", The Second Annual Report of the Council on Environmental Quality, August 1971, p. 16.

3. "Environmental Quality", The Second Annual Report of the Council on Environmental Quality, August 1971, p. 20.

4. Statistical Package for the Social Sciences, Norman H. Nie, Dale H. Bent, C. Hadki Herll, McGraw-Hill, 1970.

5. OSIRIS II, MTS USERS MANUAL, The Institute for Social Research, The University of Michigan, Ann Arbor, Michigan, July 1971.