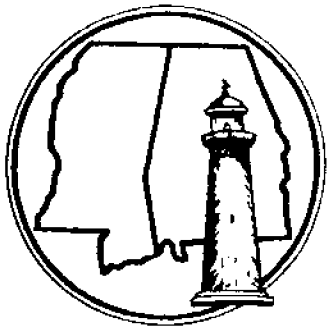
LINKAGES BETWEEN THE ECONOMY AND THE ENVIRONMENT OF THE COASTAL ZONE OF MISSISSIPPI

PART III

Bureau of Business Research
University of Southern Mississippi
Hattiesburg, Mississippi 39401

MISSISSIPPI—ALABAMA
SEA GRANT PROGRAM



MASGP-79-014
June 1980

LINKAGES BETWEEN THE ECONOMY AND THE ENVIRONMENT OF THE COASTAL ZONE OF MISSISSIPPI

PART III

Prepared Under A
Mississippi-Alabama Sea Grant
Consortium Research Grant

by

Edward Nissan, Ph.D.
D. C. Williams, Jr., Ph.D.
Trellis Green, M.S.

Bureau of Business Research
College of Business Administration
University of Southern Mississippi
Hattiesburg, Mississippi 39401

June, 1980

This work is a result of research sponsored in part by NOAA Office of Sea Grant, Department of Commerce under Grant #NA79AA-D-00049, and in part by the Mississippi-Alabama Sea Grant Consortium and the State of Mississippi. The U.S. Government is authorized to produce and distribute reprints for governmental purposes notwithstanding any copyright notation that may appear hereon.

MASGP - 79 - 014

ACKNOWLEDGEMENTS

The work upon which this report was based was financed in part by funds provided by the Mississippi-Alabama Sea Grant Consortium. The completion of this report is attributed to the valuable assistance rendered by many individuals, businesses, and governmental agencies. A special debt of gratitude is owed to Dr. James E. Blaylock of University of North Alabama for providing the basic computer program, and for Mr. Bruce Jones and Mrs. Regina Caveny for their help in adopting and modifying the basic program. The time and effort of Jeane Timms, Hiram Durant, and John Trevillion proved most valuable in gathering data and in computations.

Any error of fact, logic, or judgement remaining in the report are, of course, the responsibility of the authors.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. INTRODUCTION

This report is the third and final portion of a series of three projects concerned with the evaluation of mutual impacts of economic activity and the environment in the coastal region of Mississippi. The procedure followed in providing information about the interrelationships between the output of producing sectors and the uses of environmental resources is that of an input-output approach.

Many operational frameworks of this kind have been developed and applied in other areas of the country. Feld [5] analyzed economic activity and its wasteborn residuals within the Narragansett Bay Drainage Basin. Blaylock [2] studied the economic-environmental interrelationships in the lower Rio Grande region of Texas. Roberts [12] similarly investigated the linkages between the economy and the environment in Clatsop County, Oregon. Laurent [8] made a similar study for the Charleston, S.C., metropolitan region. Many more can be cited. One common feature of all these studies is their utilization of the input-output model as a basic tool of analysis. Differences in techniques of course exist among these investigations, but the general approach is approximately the same.

The methodology followed in this research is similar in nature to these mentioned. It consists of three main phases:

(1) Construction of an input-output model. Such model for the Coastal Region of Mississippi was completed in March 1978 [10]. Here, the economic activity of the region was divided into 29 endogeneous sectors, each producing output to be absorbed by the others and in return absorbing as inputs products produced by other sectors. It is a detailed description of the flows of goods and services, evaluated in dollars, of the economy of the

region. It also provides a systematic way of capturing the total effects of exogenous changes in the economy such as new government expenditures, changes in exports, expansion in existing industries, or the introduction of new industries and services.

(2) Construction of an environmental model. Such model for the Coastal Region of Mississippi was completed in June 1979 [11]. The primary objective of this portion was to allocate physical volumes of pollutants to the proper economic sectors as categorized by the input-output study. The analysis focused on three main categories of pollutants, which are: water effluents, air pollution, and solid wastes.

(3) Construction of the linkages between the economic and environmental models. At this stage information obtained in the previous two stages is combined to produce the mutual interdependency of the two activities.

This report intends to provide this link. It will emphasize that changes in the economy will accompany changes in the environment. Estimates in the form of pollution produced per dollar of output, employment, and income will be presented. Furthermore, environmental-economic multipliers will be calculated for each combination of environmental category and economic sector. Some hypothetical uses of the model will also be discussed.

Since the findings of this report are based on the previous two studies [10] & [11], it will be necessary for the reader to refer to them occasionally.

II. THEORETICAL DISCUSSION

A comprehensive review of models in which the extension of input-output analysis to include environmental externalities as material flows into and out of economic sector shows that there are basically a handful of comparable approaches. Among the most prominent are the Ayers-Kneese model [1], the Daly model [4], the Isard model [7], the Leontief model [9], the Victor model [13], and the Hite-Laurant model [6].

The approach followed in this study is in essence a modification of the Hite-Laurant model as was applied in his study of the Charleston metropolitan region [8]. It is practical and easy to operate and recognizes data problems. The model includes waste residuals from the economy to the environment. This allows the extension of the accounting framework of the input-output table to the environmental sector by specifying the outputs of a number of chemical and biological effluents to air and water and of solid wastes as exports of production by-products as shown in Figure 1. A theoretical exposition of the approach followed in this research is given below.

FIGURE 1

Economic - Ecologic Model

Economic Sector			Ecologic Sector		
Processing Sectors	Final Demand	Total Output	Water Effluents	Air Pollution	Solid Wastes
Value Added					
Total Input					

Assume that there are n producing sectors.

Define:

X_i = Total output of sector i in dollars, i = 1,2,...,n.

x_{ij} = Total sales of sector i to sector j in dollars, j = 1,2,...,n.

D_i = Total of final demand for sector i in dollars.

The input-output transactions can be described by the following equations:

$$(1) \qquad X_i = \sum_{i=1}^{n} x_{ij} + D_i.$$

Let:

$$a_{ij} = \frac{x_{ij}}{X_j},$$

then:

$$(2) \qquad X_{ij} = a_{ij} X_j.$$

Substituting (2) into (1), yields:

$$(3) \qquad X_j = \sum_{i=1}^{n} a_{ij} X_j + D_i, \text{ since } X_i = X_j, \ X_j = \text{total output.}$$

Expansion of the system of equations (3) yields:

$$\begin{aligned}
X_1 &= a_{11} X_1 + a_{12} X_2 + \ldots + a_{1n} X_n + D_1 \\
X_2 &= a_{21} X_1 + a_{22} X_2 + \ldots + a_{2n} X_n + D_2 \\
&\vdots \\
X_n &= a_{n1} X_1 + a_{n2} X_2 + \ldots + a_{nn} X_n + D_n,
\end{aligned}$$

which is equivalent to:

$$(4) \qquad \begin{aligned}
X_1 - a_{11} X_1 - a_{12} X_2 - \ldots - a_{1n} X_n &= D_1 \\
X_2 - a_{21} X_1 - a_{22} X_2 - \ldots - a_{2n} X_n &= D_2 \\
&\vdots \\
X_n - a_{n1} X_1 - a_{n2} X_2 - \ldots - a_{nn} X_n &= D_n.
\end{aligned}$$

In compact matrix form, system of equations (4) is written as:

$$X - AX = D, \tag{5}$$

where:

X = Column vector of total outputs with n elements,

D = Column vector of final demand with n elements,

A = nxn matrix of direct input coefficients.

Factoring X in (5),

$$X(I - A) = D, \tag{6}$$

hence:

$$X = (I - A)^{-1}D. \tag{7}$$

Assume that the ecologic sector is composed of m categories. This sector can be extended into the accounting framework as follows:

Define:

g_{ji} = the output of the i^{th} environmental commodity discharged as a result of the final demand for the j^{th} economic sector, $j = 1,\ldots,n$, $i = 1,\ldots,m$,

and let:

b_{ji} = environmental coefficients. The use of environmental factor i per dollar output in sector j.

then:

$$g_{ji} = b_{ji}X_j,$$

hence:

$$b_{ji} = \frac{g_{ji}}{X_i}.$$

The system of equations obtained for the environmental sector can then be represented by:

$$\begin{aligned} &\sum_{i=1}^{m} g_{ji} \qquad j = 1,\ldots,n, \\ &= \sum_{i=1}^{m} b_{ji}X_j \qquad j = 1,\ldots,n. \end{aligned} \tag{8}$$

In matrix notation, (8) can be expressed as:

$$(9) \qquad \begin{bmatrix} g_{11} & g_{12} & g_{13} & \cdots & g_{1m} \\ g_{21} & g_{22} & g_{23} & \cdots & g_{2m} \\ \vdots & \vdots & \vdots & & \vdots \\ g_{n1} & g_{n2} & g_{n3} & & g_{nm} \end{bmatrix} =$$

$$\begin{bmatrix} b_{11}X_1 & b_{12}X_1 & b_{13}X_1 & \cdots & b_{1m}X_1 \\ b_{21}X_2 & b_{22}X_2 & b_{23}X_2 & \cdots & b_{2m}X_2 \\ \vdots & \vdots & \vdots & & \vdots \\ b_{n1}X_n & b_{n2}X_n & b_{n3}X_n & \cdots & b_{nm}X_n \end{bmatrix} .$$

For simplicity, assume that there are 2 economic sectors and 3 pollutants; then the ecologic sector can be written as:

$$\begin{bmatrix} g_{11} & g_{12} & g_{13} \\ g_{21} & g_{22} & g_{23} \end{bmatrix}$$

where for example g_{11} is the amount of ecologic export 1 due to sector 1, g_{12} is the amount of ecologic export 2 due to sector 1, g_{23} is the amount of ecologic export 3 due to sector 2.

Equate:

$$(10) \qquad \begin{bmatrix} g_{11} & g_{12} & g_{13} \\ g_{21} & g_{22} & g_{23} \end{bmatrix} = \begin{bmatrix} b_{11}X_1 & b_{12}X_1 & b_{13}X_1 \\ b_{21}X_2 & b_{22}X_2 & b_{23}X_2 \end{bmatrix} = \begin{bmatrix} b_{ji}X_j \end{bmatrix} .$$

Transpose the matrices in (10) and obtain,

$$(11) \qquad \begin{bmatrix} g_{11} & g_{21} \\ g_{12} & g_{22} \\ g_{13} & g_{23} \end{bmatrix} = \begin{bmatrix} b_{11}X_1 & b_{21}X_2 \\ b_{12}X_1 & b_{22}X_2 \\ b_{13}X_1 & b_{23}X_2 \end{bmatrix} = \begin{bmatrix} b_{11} & b_{21} \\ b_{12} & b_{22} \\ b_{13} & b_{23} \end{bmatrix} \begin{bmatrix} X_1 & \\ & X_2 \end{bmatrix} .$$

From (7),

$X = (I - A)^{-1}D$, can be expanded as:

$$\begin{bmatrix} X_1 \\ X_2 \end{bmatrix} = \begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix} \begin{bmatrix} D_1 \\ D_2 \end{bmatrix}$$

$$(12) \qquad = \begin{bmatrix} A_{11}D_1 + A_{12}D_2 \\ A_{21}D_1 + A_{22}D_2 \end{bmatrix},$$

where the elements A_{ij} are the elements of the Leontief inverse $(I-A)^{-1}$, and D_j are final demands to sector j.

Substituting the values of X_j in (12) for X_j in (11), obtain:

$$(13) \quad \begin{bmatrix} g_{11} & g_{21} \\ g_{12} & g_{22} \\ g_{13} & g_{23} \end{bmatrix} = \begin{bmatrix} b_{11} & b_{21} \\ b_{12} & b_{22} \\ b_{13} & b_{23} \end{bmatrix} \begin{bmatrix} A_{11}D_1 + A_{12}D_2 & \\ & A_{21}D_1 + A_{22}D_2 \end{bmatrix} =$$

$$\begin{bmatrix} b_{11}(A_{11}D_1 + A_{12}D_2) & b_{21}(A_{21}D_1 + A_{22}D_2) \\ b_{12}(A_{11}D_1 + A_{12}D_2) & b_{22}(A_{21}D_1 + A_{22}D_2) \\ b_{13}(A_{11}D_1 + A_{12}D_2) & b_{23}(A_{21}D_1 + A_{22}D_2) \end{bmatrix} =$$

$$(14) \qquad \begin{bmatrix} b_{11}\sum_j A_{1j}D_j & b_{21}\sum_j A_{2j}D_j \\ b_{12}\sum_j A_{1j}D_j & b_{22}\sum_j A_{2j}D_j \\ b_{13}\sum_j A_{1j}D_j & b_{23}\sum_j A_{2j}D_j \end{bmatrix}.$$

Therefore from (13) and (14) the values of b_{ij} can be computed as:

$$b_{11} = \frac{g_{11}}{\sum_j A_{1j}D_j} \qquad b_{21} = \frac{g_{21}}{\sum_j A_{2j}D_j}$$

$$b_{12} = \frac{g_{12}}{\sum_j A_{1j}D_j} \qquad b_{22} = \frac{g_{22}}{\sum_j A_{2j}D_j}$$

$$b_{13} = \frac{g_{13}}{\sum_j A_{1j}D_j} \qquad b_{23} = \frac{g_{23}}{\sum_j A_{2j}D_j} .$$

The analysis can be presented in compact matrix notation as follows:

let:

a' = A transpose of a matrix G which is a matrix of the environmental commodities produced by the processing sectors.

b' = A transpose of a matrix B which is a matrix of environmental coefficients. Each element in the matrix corresponds the use of an environmental factor i for a dollar output in sector j.

X = An (nxn) diagonal matrix of outputs of the processing sectors.

D = An (nx1) matrix of final demand.

Then:

$$a' = B'X$$

$$= B'[(I-A)^{-1}D] .$$

As can be seen, the solution for b_{ji} is obtained as functions of the final demand D_j. The value of b_{ji} thus obtained will allow the computations of a variety of environmental multipliers. These include resource-output multipliers resource-income multipliers and resource-resource multipliers. A brief theoretical discussion of these multipliers is presented below.

ENVIRONMENTAL-OUTPUT MULTIPLIERS

The resource-output multipliers measure direct and indirect environmental inpacts of economic activity of an area. They show the magnitude of the changes of environmental resources (water effluents, air pollution, solid wastes) resulting from an increase of one unit of sales to final demand of each of the processing sectors contained in the input-output model.

The multipliers can be calculated as follows:

let:

g_{ij} = the output of the i^{th} environmental commodity discharged as a result of the final demand for the j^{th} economic sector,

G_i = total of the i^{th} environmental commodity discharged to the environment due to economic activity of the processing sector,

b_{ij} = ecologic coefficient i per dollar output in sector j,

X_j = total output of sector j,

then:

$$G_i = \sum_j g_{ij} = \sum_j b_{ij} X_j. \tag{15}$$

Expanding system of equations (15) yields:

$$\begin{aligned} G_1 &= b_{11}X_1 + b_{12}X_2 + \ldots + b_{1n}X_n, \\ G_2 &= b_{21}X_1 + b_{22}X_2 + \ldots + b_{2n}X_n, \\ &\vdots \\ G_m &= b_{m1}X_1 + b_{m2}X_2 + \ldots + b_{mn}X_n. \end{aligned} \tag{16}$$

In matrix notation (16) takes the form:

$$\begin{bmatrix} G_1 \\ G_2 \\ \vdots \\ G_m \end{bmatrix} = \begin{bmatrix} b_{11} & b_{12} \cdots & b_{1n} \\ b_{21} & b_{22} \cdots & b_{2n} \\ \vdots & \vdots & \vdots \\ b_{m1} & b_{m2} & b_{mn} \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ \vdots \\ X_n \end{bmatrix},$$

or in compact form:

(17) $G = BX.$

Substituting from (7), $X = (I-A)^{-1}D$ into (17), the result is:

(18)
$$G = B[(I-A)^{-1}D]$$
$$= [B(I-A)^{-1}]D$$

Hence, G is a function of the final demand D, and the elements of the matrix $[B(I-A)^{-1}]$ are the partial derivatives of G with respect to D_j, $i = 1,2,..,m$; $j = 1,2,..,n$. These partial derivatives are the resource-output multipliers which measure the direct and indirect effect of changes in the final demand on the production of ecologic factors.

ENVIRONMENTAL-INCOME MULTIPLIERS

Environmental-income multipliers measure the impact on the environment due to one unit change in money income arising from each producing sector. They are useful indicators of the magnitudes of pollution emissions as the resul of income to employees. They provide useful information for comparing the different types of industries in terms of providing income and pollution emissio

Let:

$\hat{Z}$ = (nxn) matrix of value added.

W = (nxn) matrix of value added coefficients.
It is a matrix of wages paid per dollar of output.

Then:

$$\hat{Z} = W(I-A)^{-1},$$

where $(I-A)^{-1}$ is the Leontief inverse obtained in (7). Income multipliers Z_j are obtained by summing down the columns of $\hat{Z}$ matrix. Each number Z_j represents the total change in income throughout the regional economy from a change in income within sector j.

To find the environmental-income multipliers, it is necessary to divide the appropriate elements of the matrix $[B(I-A)^{-1}]$ by the appropriate income multiplier Z_j.

That is, the elements I_{ij} in the environmental-income multipliers matrix I can be obtained by:

$$I_{ij} = \frac{U_{ij}}{Z_j},$$

where U_{ij} are elements in the matrix $U = [B(I-A)^{-1}]$.

ENVIRONMENTAL-SELF MULTIPLIERS

In essence, environmental-self multipliers evaluate the relationship between the amount of environmental factors (pollutants) a processing sector produces and other environmental factors which it causes to be produced through its purchases of output from other processing sectors in the region.

TYPE I AND TYPE II MULTIPLIERS

So far, in discussing the environmental model, emphasis of producing pollutants is concentrated on those caused by the economic process. That is, the effect of the household sector on the production of pollutants is not included. The multipliers obtained thus are called Type I.

When households are considered to function as part of the endogenous producing sectors, it is then counted as a vital, internal sector just as any other in causing pollution. Therefore, when including households in the model, not only the direct and indirect impacts of an increase in output are counted, but also added is the induced effects. Multipliers thus obtained are called Type II.

The Type II multipliers are more realistic as tools in analyzing total effects due to the fact that consumers' activities are also accounted for in the economic activities. By definition of the two types of multipliers it is obvious that:

$$\text{Type II} > \text{Type I}$$

in all categories since in computation of Type II the direct effects, indirect effects, and induced effects are included while those for Type I only the direct effects and indirect effects are included.

III. APPLICATION OF THE ECONOMIC-ECOLOGIC MODEL MISSISSIPPI COASTAL REGION

In Section II, a theoretical exposition for linking the economic and ecologic matrices was given. In this section, the theoretical presentation will be adapted to describe the economic-ecologic impacts on the economy of the Coastal Region of Mississippi.

The discussion, the tables, and the findings of this section are based on previous work cited in [10] and [11]. The major matrices that were the core of these references are included in Appendix A for convenience.

There are nine tables in this section. The first seven tables, numbered Table 1 through Table 7, are the results of the immediate application of the theoretical portion given in Section II. Tables 8 and 9 show the ranking of sectors as evidenced by the magnitudes of pollutants produced by these sectors for every $1,000 of induced activity in terms of final demands and income, respectively. In each of the tables 1 through 7, the rows indicate the pollutants and the columns numbered 1 through 29 or 1 through 30 are the economic sectors of the region as follows:

Number	Sector
1	Fisheries
2	Forestry
3	Livestock
4	Crops
5	Ag., Forestry & Fish. Services
6	Mining
7	Construction
8	Food Processing
9	Apparel & Other Finished Products
10	Lumber & Wood
11	Paper & Allied
12	Printing & Publishing
13	Chemicals & Petroleum
14	Stone, Clay, & Glass
15	Primary & Fabricated Metals

16	Transportation Equipment
17	Miscellaneous Mfg.
18	Water Transportation
19	Other Transportation & Warehousing
20	Communications & Public Utilities
21	Eating & Drinking Places
22	Service Stations
23	Wholesale & Retail Trade
24	Finance, Insurance, & Real Estate
25	Hotels, Motels & Lodging
26	Medical Services
27	Educational Services
28	Other Services
29	State & Local Government
30	Households

Entries in Table 1 give the technical relationships between the economic sectors and pollutants. They are the units of pollutants in tons produced by these sectors as a result of their activities for each $1,000 of output. Waste water is given in terms of million gallons per year (MGY) for each $1,000 of output. For instance, Sector 8, Food Processing, contributes .075 (MGY) of waste water, .002 tons of nitrogen, .005 tons of BOD, .008 tons of suspended solids, .004 tons of settleable solids, .002 tons of oil and grease, .002 tons of nitrogen oxide, .008 tons of sulfur oxides, .001 tons of particulates, and .426 tons of solid waste for each $1,000 of output. These values are the direct requirements resulting from the sectoral sales.

The secondary environmental effects resulting from the interindustry sales and purchases are called the indirect effects. Together the direct and the indirect effects of $1,000 of each sector's output are given in Table 2. Hence, every entry in this table represents the total exports of pollution to the environment. That is, a $1,000 increase in economic activity of a certain sector will cause increases in production in all other sectors due to the multiplier effect. Through their economic activities to meet the demands of that sector, they in turn will contribute to the pollution. For example, Sector 8, the Food Processing, when increasing its output by $1,000 will cause a total discharge to the environment of .1(MGY) of waste water, .003 tons of nitrogen,

TABLE 1

QUANTITIES (TONS) OF POLLUTANTS PER $1,000 OUTPUT
MISSISSIPPI COASTAL REGION, 1977

	1	2	3	4	5	6	7	8	9
1.WASTE WATER	.000000	.000000	.000000	.111011	.000000	.070143	.006357	.075471	.033145
2.CHLORINE	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000044	.000014
3.NITROGEN	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.002460	.000227
4.SULFIDES	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
5.FLUORIDE	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
6.PHOSPHATE	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
7.HEAVY METALS	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
8.ZINC	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000068
9.CADMIUM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
10.IRON	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
11.CHROMIUM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000068
12.ALUMINUM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
13.COPPER	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
14.NICKEL	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
15.LEAD	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
16.FECAL COLIFM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
17.BOD	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.004687	.000682
18.COD	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
19.SUS SOLIDS	.000000	.000000	.000000	.000000	.000000	.011979	.001200	.008135	.002106
20.SETT SOLIDS	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.004239	.000000
21.OIL & GREASE	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.002097	.000000
22.PHENOLS	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
23.ORG CARBON	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
24.NITROGEN OXD	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.001603	.013019
25.SULFUR OXIDE	.000000	.000000	.000000	.000000	.000000	.019984	.000000	.008115	.014443
26.CARBON MONOX	.000000	.000000	.000000	.000000	.000000	.001588	.000000	.000069	.000119
27.PARTICULATES	.000000	.003435	.017712	.139720	.000000	.001772	.000000	.000801	.001426
28.ALDEHYDES	.000000	.000000	.000000	.000000	.000000	.001588	.000000	.000069	.000119
29.HYDROCARBONS	.000000	.000000	.000000	.000000	.000000	.001588	.000000	.000069	.000119
30.SOLID WASTE	.000000	.000000	5.749978	.000000	.000000	.002268	.001872	.426123	.054559

TABLE 1 (CONT)

	10	11	12	13	14	15	16	17	18
1.WASTE WATER	.019878	.089402	.001082	.365949	.186316	.026389	.620303	.003034	.000698
2.CHLORINE	.000000	.000000	.000000	.000000	.000001	.000014	.000003	.000001	.000001
3.NITROGEN	.000829	.000000	.000000	.000725	.000000	.000325	.000000	.000032	.000017
4.SULFIDES	.000000	.000000	.000000	.000009	.000000	.000000	.000000	.000000	.000000
5.FLUORIDE	.000000	.000000	.000000	.001214	.000000	.000000	.000000	.000000	.000000
6.PHOSPHATE	.000000	.000000	.000000	.000000	.000000	.000127	.000001	.000000	.000000
7.HEAVY METALS	.000000	.000000	.000000	.000062	.000000	.000000	.000000	.000000	.000000
8.ZINC	.000000	.000000	.000000	.000000	.000003	.000016	.000004	.000000	.000000
9.CADMIUM	.000000	.000000	.000000	.000003	.000000	.000027	.000000	.000000	.000000
10.IRON	.000000	.000000	.000000	.000220	.000000	.000053	.000000	.000000	.000000
11.CHROMIUM	.000000	.000000	.000000	.000003	.000000	.000008	.000000	.000000	.000000
12.ALUMINUM	.000000	.000000	.000000	.000000	.000000	.000134	.000000	.000000	.000000
13.COPPER	.000000	.000000	.000000	.000000	.000000	.000014	.000000	.000000	.000000
14.NICKEL	.000000	.000000	.000000	.000000	.000000	.000021	.000000	.000000	.000000
15.LEAD	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000003	.000000
16.FECAL COLIFM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
17.BOD	.002636	.005837	.000000	.001090	.002108	.000001	.000070	.000074	.000087
18.COD	.000000	.000000	.000000	.003151	.000000	.000000	.000000	.000000	.000000
19.SUS SOLIDS	.004350	.017046	.000000	.002874	.036344	.000683	.000083	.000196	.000087
20.SETT SOLIDS	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
21.OIL & GREASE	.000493	.000000	.000000	.000552	.000742	.000307	.000001	.000041	.000044
22.PHENOLS	.000010	.000000	.000000	.000001	.000000	.000000	.000000	.000000	.000000
23.ORG CARBON	.000000	.000000	.000000	.000280	.000000	.000000	.000000	.000000	.000000
24.NITROGEN OXD	.000536	.001035	.000000	.016497	.006783	.001402	.004405	.006675	.003654
25.SULFUR OXIDE	.003474	.006707	.000045	.007575	.011690	.001406	.000223	.005172	.000000
26.CARBON MONOX	.000029	.000055	.000000	.000036	.000094	.000013	.000000	.000393	.005421
27.PARTICULATES	.042563	.006170	.000000	.000391	.062779	.005427	.000000	.001084	.005240
28.ALDEHYDES	.000029	.000055	.000000	.000036	.000094	.000013	.000000	.000043	.000843
29.HYDROCARBONS	.000029	.000055	.041646	.001804	.000094	.000013	.000000	.000043	.001124
30.SOLID WASTE	.218960	.032725	.035344	.081187	.105152	.778894	.057184	.038463	.003218

TABLE 1 (CONT)

	19	20	21	22	23	24	25	26	27
1.WASTE WATER	.000315	.000368	.011270	.012011	.001043	.000051	.002120	.003377	.004560
2.CHLORINE	.000001	.000000	.000020	.000021	.000002	.000000	.000004	.000006	.000008
3.NITROGEN	.000008	.000000	.000282	.000301	.000026	.000001	.000053	.000084	.000114
4.SULFIDES	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
5.FLUORIDE	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
6.PHOSPHATE	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
7.HEAVY METALS	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
8.ZINC	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
9.CADMIUM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
10.IRON	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
11.CHROMIUM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
12.ALUMINUM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
13.COPPER	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
14.NICKEL	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
15.LEAD	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
16.FECAL COLIFM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
17.BOD	.000039	.000000	.001410	.001503	.000130	.000006	.000265	.000422	.000571
18.COD	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
19.SUS SOLIDS	.000039	.000065	.001410	.001503	.000130	.000006	.000265	.000422	.000571
20.SETT SOLIDS	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
21.OIL & GREASE	.000020	.000001	.000705	.000751	.000065	.000003	.000133	.000211	.000285
22.PHENOLS	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
23.ORG CARBON	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
24.NITROGEN OXD	.003920	.000075	.000000	.261199	.000000	.000000	.000000	.000000	.000000
25.SULFUR OXIDE	.000000	.328227	.000000	.050063	.000000	.000000	.000000	.000000	.000000
26.CARBON MONOX	.006031	.000041	.000000	4.701585	.000000	.000000	.000000	.000000	.000000
27.PARTICULATES	.008729	.020514	.000000	.130400	.000098	.000000	.000000	.000000	.000000
28.ALDEHYDES	.000905	.000611	.000000	.000000	.000000	.000000	.000000	.000000	.000000
29.HYDROCARBONS	.001206	.001833	.000000	.565932	.000000	.000000	.000000	.000000	.000000
30.SOLID WASTE	.001447	.002402	2.183258	.009661	.009696	.002357	.031096	.084423	.342022

TABLE 1 (CONT)

	28	29
1.WASTE WATER	.034208	.000212
2.CHLORINE	.000063	.000000
3.NITROGEN	.000906	.000005
4.SULFIDES	.000000	.000000
5.FLUORIDE	.000000	.000000
6.PHOSPHATE	.000000	.000000
7.HEAVY METALS	.000000	.000000
8.ZINC	.000000	.000000
9.CADMIUM	.000000	.000000
10.IRON	.000000	.000000
11.CHROMIUM	.000000	.000000
12.ALUMINUM	.000000	.000000
13.COPPER	.000000	.000000
14.NICKEL	.000000	.000000
15.LEAD	.000000	.000000
16.FECAL COLIFM	.000000	.000000
17.BOD	.004529	.000026
18.COD	.000000	.000000
19.SUS SOLIDS	.004529	.000026
20.SETT SOLIDS	.000000	.000000
21.OIL & GREASE	.002265	.000013
22.PHENOLS	.000000	.000000
23.ORG CARBON	.000000	.000000
24.NITROGEN OXD	.000000	.000000
25.SULFUR OXIDE	.000000	.000000
26.CARBON MONOX	.000000	.000000
27.PARTICULATES	.000000	.000000
28.ALDEHYDES	.000000	.000000
29.HYDROCARBONS	.000000	.000000
30.SOLID WASTE	.009709	.004865

TABLE 2

TYPE I ENVIRONMENTAL - OUTPUT INTERDEPENDENCE MATRIX (TONS)
(ENVIRONMENTAL CHANGE PER $1,000 CHANGE IN FINAL DEMAND
MISSISSIPPI COASTAL REGION, 1977

	1	2	3	4	5	6	7	8	9
1.WASTE WATER (MGY)	.162193	.000601	.027122	.115640	.001969	.073370	.019355	.100265	.036826
2.CHLORINE	.000001	.000000	.000011	.000005	.000001	.000002	.000005	.000050	.000016
3.NITROGEN	.000013	.000008	.000551	.000086	.000050	.000039	.000121	.002725	.000272
4.SULFIDES	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
5.FLUORIDE	.000001	.000001	.000002	.000009	.000001	.000002	.000002	.000001	.000002
6.PHOSPHATE	.000001	.000000	.000000	.000000	.000000	.000001	.000004	.000000	.000000
7.HEAVY METALS	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
8.ZINC	.000001	.000000	.000000	.000000	.000000	.000000	.000001	.000000	.000070
9.CADMIUM	.000000	.000000	.000000	.000000	.000000	.000000	.000001	.000000	.000000
10.IRON	.000001	.000000	.000001	.000002	.000000	.000001	.000002	.000000	.000001
11.CHROMIUM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000070
12.ALUMINUM	.000001	.000000	.000000	.000000	.000000	.000001	.000005	.000000	.000000
13.COPPER	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
14.NICKEL	.000000	.000000	.000000	.000000	.000000	.000000	.000001	.000000	.000000
15.LEAD	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
16.FECAL COLIFM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
17.BOD	.000064	.000034	.001152	.000371	.000107	.000187	.000559	.005317	.000910
18.COD	.000004	.000003	.000006	.000023	.000002	.000005	.000004	.000004	.000006
19.SUS SOLIDS	.000105	.000052	.002004	.000493	.000188	.012400	.003283	.009393	.008481
20.SETT SOLIDS	.000002	.000002	.000893	.000021	.000076	.000001	.000003	.004648	.000002
21.OIL & GREASE	.000024	.000016	.000519	.000182	.000047	.000090	.000235	.002370	.000088
22.PHENOLS	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
23.ORG CARBON	.000000	.000000	.000000	.000002	.000000	.000000	.000000	.000000	.000000
24.NITROGEN OXD	.001568	.000359	.000795	.000940	.000191	.000442	.001301	.002126	.020094
25.SULFUR OXIDE	.001234	.000707	.008778	.007285	.001093	.029470	.005978	.015670	.022359
26.CARBON MONOX	.003555	.003126	.002505	.010806	.000406	.005080	.014839	.001578	.001621
27.PARTICULATES	.000828	.003926	.029000	.141326	.000350	.003150	.005396	.004405	.002315
28.ALDEHYDES	.000039	.000036	.000086	.000055	.000017	.001581	.000047	.000115	.000156
29.HYDROCARBONS	.000462	.000404	.000420	.001411	.000067	.002050	.001894	.000400	.000871
30.SOLID WASTE	.027628	.006117	6.829112	.117752	.018246	.014821	.066955	.643676	.044472

TABLE 2 (CONT)

	10	11	12	13	14	15	16	17	18
1.WASTE WATER	.023002	.092322	.008375	.364119	.192866	.030751	.427454	.011360	.007356
2.CHLORINE	.000001	.000002	.000004	.000002	.000004	.000017	.000004	.000004	.000005
3.NITROGEN	.000917	.000067	.000027	.000764	.000050	.000383	.000014	.000098	.000074
4.SULFIDES	.000000	.000000	.000000	.000009	.000000	.000000	.000000	.000000	.000000
5.FLUORIDE	.000001	.000004	.000002	.001223	.000003	.000002	.000000	.000004	.000002
6.PHOSPHATE	.000000	.000000	.000000	.000000	.000001	.000138	.000002	.000002	.000000
7.HEAVY METALS	.000000	.000000	.000000	.000062	.000000	.000000	.000000	.000000	.000000
8.ZINC	.000000	.000000	.000000	.000000	.000000	.000016	.000004	.000001	.000000
9.CADMIUM	.000000	.000000	.000000	.000003	.000000	.000028	.000000	.000001	.000000
10.IRON	.000000	.000001	.000001	.000222	.000001	.000055	.000001	.000002	.000001
11.CHROMIUM	.000000	.000000	.000000	.000003	.000000	.000008	.000000	.000001	.000000
12.ALUMINUM	.000000	.000000	.000000	.000000	.000001	.000140	.000002	.000003	.000000
13.COPPER	.000000	.000000	.000000	.000000	.000000	.000015	.000000	.000000	.000000
14.NICKEL	.000000	.000000	.000000	.000000	.000000	.000033	.000000	.000001	.000000
15.LEAD	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000003	.000000
16.FECAL COLIFO	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
17.BOD	.002945	.006095	.000557	.001264	.002409	.000222	.000117	.000361	.000344
18.COD	.000003	.000009	.000005	.003174	.000005	.000005	.000001	.000012	.000009
19.SUS SOLIDS	.004888	.017462	.001157	.003270	.037313	.001015	.000199	.000735	.000505
20.SETT SOLIDS	.000001	.000002	.000001	.000005	.000002	.000002	.000000	.000011	.000009
21.OIL & GREASE	.000572	.000095	.000134	.000624	.000856	.000419	.000024	.000167	.000167
22.PHENOLS	.000011	.000000	.000000	.000002	.000000	.000000	.000000	.000000	.000000
23.ORG CARBON	.000000	.000001	.000000	.000252	.000001	.000000	.000000	.000001	.000001
24.NITROGEN OXD	.001005	.001724	.000490	.017383	.007722	.002419	.004688	.007600	.005070
25.SULFUR OXIDE	.006569	.015433	.009329	.019086	.029209	.013059	.002065	.013151	.009170
26.CARBON MONOX	.003865	.005580	.004641	.005144	.006447	.007464	.001824	.007529	.013131
27.PARTICULATES	.048391	.009294	.001366	.001942	.045514	.007624	.000492	.002878	.007764
28.ALDEHYDES	.000077	.000140	.000049	.000115	.000267	.000145	.000012	.000093	.001083
29.HYDROCARBONS	.000583	.000894	.043446	.002548	.001069	.001083	.000245	.001012	.002239
30.SOLID WASTE	.246235	.053542	.051553	.093297	.122273	.824051	.071914	.073566	.028758

TABLE 2 (CONT)

	19	20	21	22	23	24	25	26	27
1.WASTE WATER	.006679	.001355	.020741	.016706	.004046	.002798	.005884	.006855	.008084
2.CHLORINE	.000004	.000001	.000025	.000024	.000004	.000002	.000008	.000009	.000011
3.NITROGEN	.000065	.000017	.000369	.000389	.000073	.000031	.000115	.000156	.000186
4.SULFIDES	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
5.FLUORIDE	.000003	.000000	.000001	.000001	.000001	.000000	.000003	.000002	.000002
6.PHOSPHATE	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
7.HEAVY METALS	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
8.ZINC	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
9.CADMIUM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
10.IRON	.000001	.000000	.000000	.000000	.000000	.000000	.000001	.000000	.000000
11.CHROMIUM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
12.ALUMINUM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
13.COPPER	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
14.NICKEL	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
15.LEAD	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
16.FECAL COLIFM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
17.BOD	.000289	.000069	.001796	.001894	.000317	.000150	.000561	.000682	.000832
18.COD	.000008	.000001	.000003	.000003	.000002	.000001	.000007	.000005	.000005
19.SUS SOLIDS	.000446	.000214	.001892	.001988	.000413	.000347	.000685	.000814	.000968
20.SETT SOLIDS	.000014	.000000	.000026	.000026	.000025	.000002	.000002	.000052	.000052
21.OIL & GREASE	.000139	.000028	.000894	.000943	.000163	.000072	.000277	.000336	.000410
22.PHENOLS	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
23.ORG CARBON	.000001	.000000	.000000	.000000	.000000	.000000	.000001	.000000	.000000
24.NITROGEN OXD	.004938	.000140	.000856	.261399	.000836	.000269	.000589	.000327	.000334
25.SULFUR OXIDE	.008631	.337550	.012435	.362391	.011286	.006637	.012777	.017842	.017890
26.CARBON MONOX	.012491	.000611	.012644	4.703152	.011663	.003499	.005906	.003648	.003775
27.PARTICULATES	.007812	.021556	.001403	.131674	.001400	.000891	.001273	.001454	.001459
28.ALDEHYDES	.001055	.000637	.000036	.000035	.000030	.000020	.000036	.000042	.000042
29.HYDROCARBONS	.002141	.001983	.001709	.366259	.001814	.000519	.000829	.000578	.000828
30.SOLID WASTE	.020494	.007958	2.195548	.036604	.034395	.011838	.046311	.103049	.358851

TABLE 2 (CONT)

	28	29
1.WASTE WATER	.041731	.006046
2.CHLORINE	.000068	.000005
3.NITROGEN	.000940	.000081
4.SULFIDES	.000000	.000000
5.FLUORIDE	.000001	.000002
6.PHOSPHATE	.000000	.000001
7.HEAVY METALS	.000000	.000000
8.ZINC	.000000	.000000
9.CADMIUM	.000000	.000000
10.IRON	.000000	.000001
11.CHROMIUM	.000000	.000000
12.ALUMINUM	.000000	.000001
13.COPPER	.000000	.000000
14.NICKEL	.000000	.000000
15.LEAD	.000000	.000000
16.FECAL COLIFM	.000000	.000000
17.BOD	.004703	.000372
18.COD	.000002	.000005
19.SUS SOLIDS	.004811	.000820
20.SETT SOLIDS	.000002	.000015
21.OIL & GREASE	.002347	.000177
22.PHENOLS	.000000	.000000
23.BRD CARBON	.000000	.000000
24.NITROGEN OXD	.000477	.000516
25.SULFUR OXIDE	.015806	.019456
26.CARBON MONOX	.005976	.004853
27.PARTICULATES	.001448	.002310
28.ALDEHYDES	.000042	.000080
29.HYDROCARBONS	.001242	.000788
30.SOLID WASTE	.024839	.098467

.005 tons of BOD, .009 tons of suspended solids, .005 tons of settleable solids, .002 tons of oil and grease, .002 tons of nitrogen oxides, .016 tons of sulfur oxides, .002 tons of carbon monoxide, .004 tons of particulates and .644 tons of solid wastes.

It can be observed from Table 2 that though some of the sectors were not contributing to pollution directly through their production process, nevertheless, indirectly they caused other sectors to do so through their supporting activities. The construction industry sector 7 does not produce BOD directly, yet through the round of economic activities by the supporting industries .001 tons of BOD is produced for each $1,000 increase in construction.

The trade off between income and the environment is given in the matrix presented in Table 3. The entries represent the physical quantities of pollutants generated through $1,000 increase in income of the various sectors. Again, using sector 8 as an example, a $1,000 increase in income in the Food Processing industry will cause a contribution of .257 (MGY) of waste water, .007 tons of nitrogen, .014 tons of BOD, .024 tons of suspended solids, .012 tons of settleable solids, .006 tons of oil and grease, .005 tons of nitrogen oxide, .040 tons of sulfur oxide, .004 tons of carbon monoxide, .011 tons of particulates, .001 tons of hydrocarbons, and 1.653 tons of solid waste.

Looking at this from another point, the limitation in environmental pollution by the quantities listed will necessarily cause a $1,000 decrease in income. This fact in a sense is a prime example of what is meant by the term "trade off" between the economy and the environment.

Table 4 gives the self multipliers' matrix. The entries are obtained by dividing each element in Table 2 by its corresponding element in Table 1. For instance in Sector 8, waste water use in Table 2 is .100 tons while in Table 1, it is .075 tons. Therefore,

$$\frac{.100}{.075} \approx 1.329.$$

TABLE 3

TYPE I ENVIRONMENTAL-INCOME INTERDEPENDENCE MATRIX (TONS)
(ENVIRONMENTAL CHANGE PER $1,000 CHANGE IN INCOME)
MISSISSIPPI COASTAL REGION, 1977

	1	2	3	4	5	6	7	8	9
1.WASTE WATER	.462368	.002153	.061330	.315979	.007529	.358111	.038103	.257476	.104834
2.CHLORINE	.000004	.000002	.000026	.000013	.000004	.000012	.000010	.000128	.000047
3.NITROGEN	.000038	.000030	.001246	.000233	.000191	.000194	.000220	.006999	.000772
4.SULFIDES	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
5.FLUORIDE	.000004	.000005	.000005	.000024	.000003	.000009	.000003	.000004	.000006
6.PHOSPHATE	.000002	.000000	.000001	.000000	.000003	.000003	.000008	.000001	.000001
7.HEAVY METALS	.000000	.000000	.000000	.000001	.000000	.000000	.000000	.000000	.000000
8.ZINC	.000004	.000000	.000000	.000000	.000000	.000000	.000001	.000000	.000198
9.CADMIUM	.000001	.000000	.000000	.000000	.000000	.000001	.000002	.000000	.000000
10.IRON	.000002	.000001	.000001	.000000	.000001	.000003	.000004	.000001	.000001
11.CHROMIUM	.000000	.000000	.000000	.000000	.000000	.000000	.000001	.000000	.000198
12.ALUMINUM	.000003	.000000	.000001	.000000	.000003	.000003	.000008	.000001	.000001
13.COPPER	.000000	.000000	.000000	.000000	.000000	.000000	.000001	.000000	.000000
14.NICKEL	.000001	.000000	.000000	.000000	.000000	.000001	.000002	.000000	.000000
15.LEAD	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
16.FECAL COLIFM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
17.BOD	.000182	.000120	.002605	.001013	.000408	.000912	.001013	.013655	.002584
18.COD	.000010	.000012	.000014	.000063	.000008	.000023	.000007	.000010	.000016
19.SUS SOLIDS	.000298	.000185	.004531	.001346	.000717	.000521	.005985	.024122	.007043
20.SETT SOLIDS	.000007	.000008	.002020	.000058	.000290	.000005	.000005	.011937	.000006
21.OIL & GREASE	.000066	.000059	.001174	.000497	.000178	.000440	.000427	.006085	.000251
22.PHENOLS	.000000	.000000	.000000	.000000	.000000	.000000	.000001	.000000	.000000
23.GRS CARBON	.000001	.000001	.000001	.000005	.000001	.000002	.000001	.000001	.000001
24.NITROGEN OXD	.004469	.001284	.001797	.002567	.000538	.002159	.002359	.005459	.057040
25.SULFUR OXIDE	.003689	.002533	.019849	.019907	.004178	.143840	.010841	.040241	.063470
26.CARBON MONOX	.010134	.011195	.005665	.029533	.001552	.024795	.026912	.004051	.004317
27.PARTICULATES	.001505	.014062	.065577	.386164	.001340	.015375	.009787	.011312	.006872
28.ALDEHYDES	.000112	.000130	.000193	.000151	.000063	.007715	.000086	.000294	.000440
29.HYDROCARBONS	.001318	.001446	.000949	.003854	.000255	.010004	.003435	.001028	.001052
30.SOLID WASTE	.078760	.021907	14.744175	.321752	.058289	.072342	.121431	1.652938	.188015

TABLE 3 (CONT)

	10	11	12	13	14	15	16	17	18
1.WASTE WATER	.056830	.252758	.022605	.184592	.494304	.078849	2.144403	.031842	.011565
2.CHLORINE	.000002	.000005	.000010	.000005	.000009	.000044	.000013	.000012	.000007
3.NITROGEN	.002266	.000183	.000155	.002200	.000129	.000982	.000046	.000274	.000116
4.SULFIDES	.000000	.000000	.000000	.000029	.000000	.000000	.000000	.000000	.000000
5.FLUORIDE	.000003	.000010	.000006	.003520	.000008	.000005	.000001	.000013	.000005
6.PHOSPHATE	.000001	.000001	.000001	.000001	.000002	.000339	.000007	.000007	.000001
7.HEAVY METALS	.000000	.000001	.000000	.000180	.000000	.000000	.000000	.000001	.000000
8.ZINC	.000000	.000000	.000000	.000000	.000000	.000042	.000015	.000002	.000000
9.CADMIUM	.000000	.000000	.000000	.000008	.000000	.000072	.000001	.000002	.000000
10.IRON	.000001	.000002	.000001	.000639	.000002	.000141	.000002	.000006	.000001
11.CHROMIUM	.000000	.000000	.000000	.000009	.000000	.000021	.000001	.000002	.000000
12.ALUMINUM	.000001	.000001	.000001	.000001	.000002	.000359	.000006	.000007	.000001
13.COPPER	.000000	.000000	.000000	.000000	.000000	.000038	.000001	.000001	.000000
14.NICKEL	.000000	.000000	.000000	.000000	.000000	.000084	.000001	.000002	.000000
15.LEAD	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000008	.000000
16.FECAL COLIFM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
17.BOD	.007277	.014688	.001503	.003638	.006175	.000570	.000399	.001012	.000541
18.COD	.000008	.000026	.000014	.009139	.000020	.000013	.000004	.000033	.000014
19.SUS SOLIDS	.012070	.047808	.003122	.009414	.095631	.002603	.000681	.002060	.000794
20.SETT SOLIDS	.000004	.000005	.000004	.000018	.000006	.000006	.000001	.000032	.000018
21.OIL & GREASE	.001414	.000259	.000362	.001796	.002195	.001075	.000081	.000468	.000862
22.PHENOLS	.000027	.000001	.000000	.000004	.000000	.000000	.000000	.000000	.000000
23.ORG CARBON	.000001	.000002	.000001	.000726	.000002	.000001	.000000	.000003	.000001
24.NITROGEN OXD	.002482	.004720	.001322	.050043	.019791	.006203	.014036	.021304	.007971
25.SULFUR OXIDE	.014230	.042251	.025181	.054944	.074862	.033456	.007063	.036865	.014416
26.CARBON MONOX	.009549	.015276	.012527	.014809	.016524	.019140	.006241	.021106	.020644
27.PARTICULATES	.113559	.025446	.003688	.005591	.167908	.019575	.001684	.008068	.018206
28.ALDEHYDES	.000190	.000382	.000133	.000332	.000685	.000372	.000041	.000260	.001703
29.HYDROCARBONS	.001440	.002446	.117274	.007337	.002741	.002776	.000837	.002838	.003880
30.SOLID WASTE	.608370	.146588	.139156	.268594	.313378	2.118108	.243960	.206213	.038778

TABLE 3 (CONT)

	19	20	21	22	23	24	25	26	27
1.WASTE WATER	.011312	.012634	.042106	.034699	.009208	.009424	.011134	.013435	.018794
2.CHLORINE	.000006	.000006	.000050	.000054	.000010	.000006	.000014	.000018	.000022
3.NITROGEN	.000110	.000155	.000749	.000308	.000187	.000106	.000217	.000306	.000362
4.SULFIDES	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
5.FLUORIDE	.000005	.000002	.000002	.000002	.000002	.000002	.000005	.000004	.000004
6.PHOSPHATE	.000001	.000001	.000000	.000000	.000000	.000001	.000001	.000000	.000000
7.HEAVY METALS	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
8.ZINC	.000000	.000000	.000000	.000000	.000001	.000000	.000001	.000000	.000000
9.CADMIUM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
10.IRON	.000001	.000001	.000001	.000001	.000000	.000001	.000001	.000001	.000001
11.CHROMIUM	.000000	.000000	.000000	.000000	.000001	.000000	.000001	.000000	.000000
12.ALUMINUM	.000001	.000001	.000000	.000000	.000000	.000001	.000001	.000000	.000000
13.COPPER	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
14.NICKEL	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
15.LEAD	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
16.FECAL COLIFY	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
17.BOD	.000489	.000642	.003646	.003934	.000720	.000506	.001061	.001336	.001625
18.COD	.000014	.000005	.000006	.000006	.000004	.000004	.000014	.000011	.000011
19.SUS SOLIDS	.000754	.001996	.003841	.004130	.000939	.001168	.001296	.001599	.001892
20.SETT SOLIDS	.000028	.000004	.000053	.000054	.000056	.000005	.000003	.000102	.000101
21.OIL & GREASE	.000236	.000265	.001815	.001959	.000348	.000241	.000524	.000688	.000801
22.PHENOLS	.000000	.000001	.000000	.000000	.000000	.000000	.000000	.000000	.000000
23.ORG CARBON	.000001	.000000	.000000	.000000	.000000	.000000	.000001	.000001	.000001
24.NITROGEN OXD	.008359	.001305	.001737	.542348	.001903	.000908	.001114	.000641	.000652
25.SULFUR OXIDE	.014448	3.144409	.025243	.189591	.025686	.022356	.024175	.034972	.034952
26.CARBON MONOX	.021156	.005692	.025669	9.768828	.026543	.011785	.011175	.007190	.007376
27.PARTICULATES	.012723	.200929	.002849	.273498	.003185	.003000	.002408	.002849	.003851
28.ALDEHYDES	.001788	.005941	.000074	.000073	.000067	.000067	.000068	.000082	.000082
29.HYDROCARBONS	.003626	.018482	.003470	1.176164	.003445	.001747	.001869	.001122	.001618
30.SOLID WASTE	.034711	.074178	4.457157	.076030	.078250	.046602	.087624	.201982	.701275

TABLE 3 (CONT)

	28	29
1.WASTE WATER	.082383	.009863
2.CHLORINE	.000129	.000008
3.NITROGEN	.001856	.000132
4.SULFIDES	.000000	.000000
5.FLUORIDE	.000002	.000003
6.PHOSPHATE	.000000	.000001
7.HEAVY METALS	.000000	.000000
8.ZINC	.000000	.000000
9.CADMIUM	.000000	.000000
10.IRON	.000000	.000001
11.CHROMIUM	.000000	.000000
12.ALUMINUM	.000000	.000001
13.COPPER	.000000	.000000
14.NICKEL	.000000	.000000
15.LEAD	.000000	.000000
16.FECAL COLIFM	.000000	.000000
17.BOD	.009285	.000607
18.COD	.000004	.000008
19.SUS SOLIDS	.009498	.001337
20.SETT SOLIDS	.000003	.000024
21.OIL & GREASE	.004634	.000288
22.PHENOLS	.000000	.000000
23.ORG CARBON	.000000	.000001
24.NITROGEN OXD	.000941	.000842
25.SULFUR OXIDE	.031204	.031738
26.CARBON MONOX	.011798	.007427
27.PARTICULATES	.002883	.003769
28.ALDEHYDES	.000084	.000130
29.HYDROCARBONS	.002482	.001286
30.SOLID WASTE	.048444	.160626

TABLE 4

TYPE I ENVIRONMENTAL SELF MULTIPLIERS (TONS)
MISSISSIPPI COASTAL REGION, 1977

	1	2	3	4	5	6	7	8	9
1.WASTE WATER (MG				1.041692		1.045713	3.044823	1.328524	1.111051
2.CHLORINE								1.139178	1.203328
3.NITROGEN								1.108112	1.200185
4.SULFIDES									
5.FLUORIDE									
6.PHOSPHATE									
7.HEAVY METALS									
8.ZINC									
9.CADMIUM									1.028248
10.IRON									
11.CHROMIUM									
12.ALUMINUM									1.028167
13.COPPER									
14.NICKEL									
15.LEAD									
16.FECAL COLIFO	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
17.BOD									
18.COD								1.134468	1.335167
19.SUS SOLIDS									
20.SETT SOLIDS						1.035071	2.736050	1.154631	1.177849
21.OIL & GREASE								1.096656	
22.PHENOLS								1.129879	
23.ORG CARBON									
24.NITROGEN OXD									
25.SULFUR OXIDE								1.326324	1.056512
26.CARBON MONOX						1.474708		1.931003	1.548137
27.PARTICULATES		1.163220	1.637340	1.011994		3.325000		22.714294	12.788173
28.ALDEHYDES						1.777451		5.497131	1.628981
29.HYDROCARBONS						1.034567		1.648932	1.303225
30.SOLID WASTE		1.135502				1.341824		5.766397	3.116855
						6.535298	35.768997	1.510540	1.181707

TABLE 4 (CONT)

	10	11	12	13	14	15	16	17	18
1·WASTE WATER	1·187152	1·032655	7·740166	1·052002	1·035154	1·165303	1·011527	3·743752	10·538305
2·CHLORINE	##########	##########	##########	##########	6·124039	1·230147	1·220633	4·444391	3·696984
3·NITROGEN	1·106466	##########	##########	1·048585	##########	1·177493	##########	3·047796	4·215069
4·SULFIDES	##########	##########	##########	1·007521	##########	##########	##########	##########	##########
5·FLUORIDE	##########	##########	##########	1·007521	##########	##########	##########	##########	##########
6·PHOSPHATE	##########	##########	##########	##########	##########	1·042761	3·990197	##########	##########
7·HEAVY METALS	##########	##########	##########	1·007521	##########	##########	##########	##########	##########
8·ZINC	##########	##########	##########	##########	##########	1·044287	1·085526	2·483647	##########
9·CADMIUM	##########	##########	##########	1·024069	##########	1·042912	##########	##########	##########
10·IRON	##########	##########	##########	1·007923	##########	1·049334	##########	9·842096	##########
11·CHROMIUM	##########	##########	##########	1·016505	##########	1·045998	2·060144	1·461664	##########
12·ALUMINUM	##########	##########	##########	##########	##########	1·042756	##########	##########	##########
13·COPPER	##########	##########	##########	##########	##########	1·042777	##########	##########	##########
14·NICKEL	##########	##########	##########	##########	##########	1·042756	##########	##########	##########
15·LEAD	##########	##########	##########	##########	##########	##########	##########	1·031297	##########
16·FECAL COLIFO	·000000	·000000	·000000	·000000	·000000	·000000	·000000	·000000	·000000
17·BOD	1·117204	1·044327	##########	1·159573	1·193101	241·023392	1·668194	4·880238	3·939990
18·COD	##########	##########	##########	1·007521	##########	##########	##########	##########	##########
19·SUS SOLIDS	1·123159	1·023225	##########	1·137924	1·086665	1·628353	2·402858	3·747929	5·779194
20·SETT SOLIDS	##########	##########	##########	##########	##########	##########	##########	##########	##########
21·OIL & GREASE	1·160010	##########	##########	1·129567	1·154254	1·367552	17·598862	4·111731	3·834711
22·PHENOLS	1·058156	##########	##########	1·023149	##########	##########	##########	2·330423	##########
23·ORG CARBON	##########	##########	##########	1·007521	##########	##########	##########	##########	##########
24·NITROGEN OXD	1·874180	1·665824	##########	1·041046	1·138428	1·725714	1·044074	1·138617	1·387686
25·SULFUR OXIDE	1·891097	8·301032	205·133194	2·519541	2·498692	9·291457	9·267618	2·542928	##########
26·CARBON MONOX	135·090149	101·062408	##########	142·552887	68·706329	591·206787	##########	19·163193	2·336040
27·PARTICULATES	1·126337	1·506364	##########	4·968285	1·043563	1·406816	##########	2·656403	1·453897
28·ALDEHYDES	2·488502	2·527769	##########	3·194049	2·850039	11·498142	##########	2·164066	1·284502
29·HYDROCARBONS	20·370344	14·185577	1·049236	1·412572	11·395914	85·742752	##########	23·634644	1·991383
30·SOLID WASTE	1·124566	1·636110	1·458606	1·149164	1·162822	1·060542	1·247133	1·912635	7·085354

TABLE 4 (CONT)

	19	20	21	22	23	24	25	26	27
1.WASTE WATER	21.229431	3.684496	1.840430	1.390834	3.880094	54.874219	2.775422	2.029817	1.778693
2.CHLORINE	6.862305	39.002426	1.262642	1.248141	2.315331	21.011642	2.081182	1.547929	1.406585
3.NITROGEN	8.240795	##########	1.309252	1.293781	2.804335	24.846219	2.164771	1.847620	1.630381
4.SULFIDES	##########	##########	##########	##########	##########	##########	##########	##########	##########
5.FLUORIDE	##########	##########	##########	##########	##########	##########	##########	##########	##########
6.PHOSPHATE	##########	##########	##########	##########	##########	##########	##########	##########	##########
7.HEAVY METALS	##########	##########	##########	##########	##########	##########	##########	##########	##########
8.ZINC	##########	##########	##########	##########	##########	##########	##########	##########	##########
9.CADMIUM	##########	##########	##########	##########	##########	##########	##########	##########	##########
10.IRON	##########	4.287592	##########	##########	##########	##########	##########	##########	##########
11.CHROMIUM	##########	##########	##########	##########	##########	##########	##########	##########	##########
12.ALUMINUM	##########	##########	##########	##########	##########	##########	##########	##########	##########
13.COPPER	##########	2.393900	##########	##########	##########	##########	##########	##########	##########
14.NICKEL	##########	##########	##########	##########	##########	##########	##########	##########	##########
15.LEAD	##########	##########	##########	##########	##########	##########	##########	##########	##########
16.FECAL COLIFM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
17.BOD	7.331041	441.496582	1.273967	1.260432	2.426541	23.452179	2.113647	1.613979	1.407402
18.COD	##########	##########	##########	##########	##########	##########	##########	##########	##########
19.SUS SOLIDS	11.306343	3.278519	1.342107	1.323080	3.162663	54.084213	2.581593	1.930984	1.697263
20.SETT SOLIDS	##########	##########	##########	##########	##########	##########	##########	##########	##########
21.OIL & GREASE	7.076331	20.377914	1.268225	1.255815	2.344357	22.284134	2.087417	1.589615	1.436897
22.PHENOLS	##########	##########	##########	##########	##########	##########	##########	##########	##########
23.ORG CARBON	##########	##########	##########	##########	##########	##########	##########	##########	##########
24.NITROGEN OXD	1.209046	1.878978	##########	1.000766	##########	##########	##########	##########	##########
25.SULFUR OXIDE	##########	1.028406	##########	1.244241	##########	##########	##########	##########	##########
26.CARBON MONOX	2.071284	9.994811	##########	1.000393	##########	##########	##########	##########	##########
27.PARTICULATES	1.311148	1.050782	##########	1.008228	14.273008	##########	##########	##########	##########
28.ALDEHYDES	1.144796	1.043225	##########	##########	##########	##########	##########	##########	##########
29.HYDROCARBONS	1.774800	1.081843	##########	1.000673	##########	##########	##########	##########	##########
30.SOLID WASTE	14.161171	3.313368	1.006629	3.788598	3.547460	8.868475	1.489274	1.220630	1.049498

TABLE 4 (CONT)

	28	29
1.WASTE WATER	1.102617	28.585739
2.CHLORINE	1.036765	12.480627
3.NITROGEN	1.038002	19.363957
4.SULFIDES	##########################	
5.FLUORIDE	##########################	
6.PHOSPHATE	##########################	
7.HEAVY METALS	##########################	
8.ZINC	##########################	
9.CADMIUM	##########################	
10.IRON	##########################	
11.CHROMIUM	##########################	
12.ALUMINUM	##########################	
13.COPPER	##########################	
14.NICKEL	##########################	
15.LEAD	##########################	
16.FECAL COLIFM	.000000	.000000
17.BOD	1.038404	14.053718
18.COD	##########################	
19.SUS SOLIDS	1.042218	30.985428
20.SETT SOLIDS	##########################	
21.OIL & GREASE	1.036469	13.348211
22.PHENOLS	##########################	
23.ORG CARBON	##########################	
24.NITROGEN OXD	##########################	
25.SULFUR OXIDE	##########################	
26.CARBON MONOX	##########################	
27.PARTICULATES	##########################	
28.ALDEHYDES	##########################	
29.HYDROCARBONS	##########################	
30.SOLID WASTE	2.527438	20.241684

The values presented in the table are not exact due to "rounding-off" of numbers by the computer. If an entry in Table 1 has a zero value, the result in Table 4 is presented by zero also. If on the other hand an entry in Table 1 is zero and its corresponding entry in Table 2 is a positive number, no comparative ratio is calculated and asterisks are printed. In a sense each number in this table is the ratio of the total (direct and indirect) physical output of a particular pollutant to the direct physical output in a given sector. From the nature of ratios, it can be seen that large multipliers correspond to dividing large numbers by considerably smaller numbers. This implies that the industry in question is by itself of lesser "significance" in producing a particular pollutant compared to the supporting industries.

The discussion of the various multipliers so far is for Type I. As was explained in Section II, Type I multipliers are computed by accounting only for the processing sectors. For the Coastal Region of Mississippi, they are composed of 29 sectors. When allowance is made for the Household sector in computing the various multipliers, Type II multipliers are obtained. Therefore, Table 5, Table 6, and Table 7 can be interpreted in the same manner as Table 2, Table 3, and Table 4, respectively. In each case, generally, the induced effect of including the Household sector results in having the value of the multipliers of Type II to be larger than those of Type I.

The computer programming for calculating Tables 1 through 7 was obtained through an adoption of a program by Blaylock and Jones [3]. The program is written as a direct application of the theoretical exposition given Section III.

Tables 8 and 9 present the information available in Tables 5 and 6, respectively, in a different way. Here the sectors are ranked in terms of the environmental factors for each $1,000 of sales in the case of Table 8 and for each $1,000 of income in the case of Table 9. In both situations, the ranking is for Type II multipliers where the induced effect of including the Household

TABLE 5

TYPE II ENVIRONMENTAL-OUTPUT INTERDEPENDENCE MATRIX (TONS)
(ENVIRONMENTAL CHANGE PER $1,000 CHANGE IN FINAL DEMAND
MISSISSIPPI COASTAL REGION, 1977

	1	2	3	4	5	6	7	8	9
1.WASTE WATER	.169131	.006124	.035869	.122878	.007143	.077423	.030262	.107967	.043794
2.CHLORINE	.000009	.000007	.000021	.000013	.000007	.000007	.000018	.000059	.000024
3.NITROGEN	.000152	.000119	.000726	.000230	.000153	.000120	.000339	.002879	.000411
4.SULFIDES	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
5.FLUORIDE	.000002	.000002	.000003	.000009	.000001	.000002	.000002	.000002	.000002
6.PHOSPHATE	.000001	.000000	.000000	.000000	.000000	.000001	.000005	.000001	.000000
7.HEAVY METALS	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
8.ZINC	.000001	.000000	.000000	.000000	.000000	.000000	.000001	.000000	.000070
9.CADMIUM	.000000	.000000	.000000	.000000	.000000	.000000	.000001	.000000	.000000
10.IRON	.000001	.000000	.000001	.000002	.000000	.000001	.000002	.000001	.000001
11.CHROMIUM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000070
12.ALUMINUM	.000001	.000000	.000001	.000000	.000000	.000001	.000005	.000001	.000000
13.COPPER	.000000	.000000	.000000	.000000	.000000	.000000	.000001	.000000	.000000
14.NICKEL	.000000	.000000	.000000	.000000	.000000	.000000	.000001	.000000	.000000
15.LEAD	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
16.FECAL COLIFM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
17.BOD	.000675	.000520	.001922	.001008	.000562	.000543	.001619	.005995	.001524
18.COD	.000004	.000004	.000007	.000024	.000003	.000005	.000005	.000005	.000006
19.SUS SOLIDS	.003520	.002770	.006310	.004056	.002734	.014394	.008652	.013186	.008911
20.SETT SOLIDS	.000042	.000034	.000944	.000063	.000106	.000024	.000066	.004693	.000042
21.OIL & GREASE	.000315	.000250	.000889	.000488	.000265	.000262	.000697	.002696	.000383
22.PHENOLS	.000000	.000000	.000000	.000000	.000000	.000000	.000001	.000000	.000000
23.ORG CARBON	.000000	.000000	.000001	.000002	.000000	.000000	.000000	.000000	.000001
24.NITROGEN OXD	.002376	.001003	.001814	.001784	.000744	.000918	.002572	.003024	.020906
25.SULFUR OXIDE	.015334	.011883	.026478	.021933	.011562	.037670	.028046	.031256	.036459
26.CARBON MONOX	.014387	.013316	.018645	.024165	.009952	.012967	.034962	.015790	.014377
27.PARTICULATES	.002066	.005150	.030938	.142930	.001497	.004048	.007813	.006112	.003859
28.ALDEHYDES	.000072	.000062	.000126	.000089	.000041	.001600	.000098	.000151	.000188
29.HYDROCARBONS	.002165	.001759	.002567	.003187	.001387	.003045	.004571	.002291	.002081
30.SOLID WASTE	.149270	.102941	6.682462	.244660	.105950	.085868	.258157	.778712	.186632

TABLE 5 (CONT)

	10	11	12	13	14	15	16	17	18
1.WASTE WATER	.031008	.033547	.015702	.070990	.200583	.038465	.432835	.018414	.013938
2.CHLORINE	.000010	.000010	.000012	.000010	.000012	.000026	.000010	.000012	.000019
3.NITROGEN	.001077	.000211	.000204	.000902	.000205	.000537	.000129	.000239	.000285
4.SULFIDES	.000000	.000000	.000000	.000009	.000000	.000000	.000000	.000000	.000000
5.FLUORIDE	.000002	.000004	.000002	.001223	.000003	.000002	.000001	.000005	.000004
6.PHOSPHATE	.000000	.000001	.000001	.000000	.000001	.000132	.000002	.000003	.000001
7.HEAVY METALS	.000000	.000000	.000000	.000062	.000000	.000000	.000000	.000000	.000000
8.ZINC	.000000	.000000	.000000	.000000	.000000	.000017	.000005	.000001	.000000
9.CADMIUM	.000000	.000000	.000000	.000003	.000000	.000028	.000000	.000001	.000000
10.IRON	.000000	.000001	.000001	.000222	.000001	.000098	.000001	.000002	.000001
11.CHROMIUM	.000000	.000000	.000000	.000003	.000000	.000008	.000000	.000001	.000000
12.ALUMINUM	.000000	.000001	.000001	.000000	.000001	.000140	.000002	.000003	.000001
13.COPPER	.000000	.000000	.000000	.000000	.000000	.000015	.000000	.000000	.000000
14.NICKEL	.000000	.000000	.000000	.000000	.000000	.000023	.000000	.000001	.000000
15.LEAD	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000003	.000000
16.FECAL COLIFM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
17.BOD	.003650	.006731	.001202	.001868	.003089	.000901	.000826	.000982	.001452
18.COD	.000004	.000010	.000006	.003178	.000009	.000006	.000002	.000012	.000010
19.SUS SOLIDS	.008824	.021019	.004764	.006652	.041112	.004818	.003045	.004209	.006698
20.SETT SOLIDS	.000048	.000043	.000044	.000045	.000047	.000047	.000034	.000082	.000082
21.OIL & GREASE	.000911	.000400	.000444	.000914	.001183	.000746	.000268	.000465	.000700
22.PHENOLS	.000011	.000000	.000000	.000002	.000000	.000000	.000000	.000000	.000000
23.ORG CARBON	.000000	.000001	.000000	.000252	.000001	.000000	.000000	.000001	.000001
24.NITROGEN OXD	.001938	.002566	.001344	.018184	.008622	.003219	.005362	.008423	.006537
25.SULFUR OXIDE	.022749	.030052	.024157	.032988	.044826	.022668	.013765	.027430	.034688
26.CARBON MONOX	.018636	.018910	.018161	.017821	.020687	.021698	.018493	.020549	.036345
27.PARTICULATES	.080168	.010895	.002990	.003469	.087224	.009344	.001774	.004482	.010552
28.ALDEHYDES	.000114	.000173	.000083	.000147	.000303	.000181	.000039	.000126	.001142
29.HYDROCARBONS	.002548	.002667	.045248	.006239	.002944	.002976	.001664	.002744	.005387
30.SOLID WASTE	.344588	.180202	.160019	.213749	.257573	.961268	.178686	.197276	.243329

TABLE 5 (CONT)

	19	20	21	22	23	24	25	26	27
1.WASTE WATER	.018358	.003477	.030485	.026229	.012737	.008470	.016339	.016944	.018209
2.CHLORINE	.000017	.000003	.000036	.000037	.000014	.000009	.000020	.000021	.000022
3.NITROGEN	.000298	.000059	.000544	.000579	.000247	.000149	.000324	.000358	.000388
4.SULFIDES	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
5.FLUORIDE	.000004	.000000	.000002	.000001	.000001	.000001	.000003	.000003	.000003
6.PHOSPHATE	.000001	.000000	.000000	.000000	.000000	.000000	.000001	.000000	.000000
7.HEAVY METALS	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
8.ZINC	.000000	.000000	.000000	.000000	.000001	.000000	.000000	.000000	.000000
9.CADMIUM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
10.IRON	.000001	.000000	.000000	.000000	.000000	.000000	.000001	.000001	.000001
11.CHROMIUM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
12.ALUMINUM	.000001	.000000	.000000	.000000	.000000	.000001	.000001	.000000	.000000
13.COPPER	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
14.NICKEL	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
15.LEAD	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
16.FECAL COLIFO	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
17.BOD	.001317	.000256	.002654	.002732	.001082	.000667	.001481	.001570	.001723
18.COD	.000010	.000001	.000004	.000004	.000003	.000002	.000008	.000007	.000007
19.SUS SOLIDS	.004194	.001259	.006488	.006676	.004691	.003237	.004831	.005783	.006352
20.SETT SOLIDS	.000084	.000013	.000082	.000081	.000075	.000036	.000042	.000110	.000110
21.OIL & GREASE	.000634	.000118	.001306	.001346	.000821	.000320	.000719	.000763	.000828
22.PHENOLS	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
23.ORG CARBON	.000001	.000000	.000000	.000000	.000000	.000000	.000001	.000001	.000001
24.NITROGEN OXD	.006297	.000387	.001992	.262509	.001849	.000954	.001808	.001504	.001814
25.SULFUR OXIDE	.032162	.341844	.032150	.081660	.028872	.018519	.023930	.038262	.038377
26.CARBON MONOX	.034039	.004526	.030622	.720720	.027699	.014338	.028135	.022288	.028456
27.PARTICULATES	.010100	.022026	.003862	.133788	.003326	.002192	.003589	.003690	.003702
28.ALDEHYDES	.001110	.000647	.000082	.000080	.000070	.000047	.000085	.000089	.000089
29.HYDROCARBONS	.008007	.002504	.004101	.568596	.003647	.001960	.003398	.003054	.003313
30.SOLID WASTE	.228233	.046159	2.366363	.203555	.186760	.116779	.229583	.279967	.536446

TABLE 5 (CONT)

	28	29	30
1.WASTE WATER	.061750	.018171	.019780
2.CHLORINE	.000077	.000019	.000023
3.NITROGEN	.001141	.000324	.000355
4.SULFIDES	.000000	.000000	.000000
5.FLUORIDE	.000001	.000002	.000001
6.PHOSPHATE	.000000	.000001	.000001
7.HEAVY METALS	.000000	.000000	.000000
8.ZINC	.000000	.000000	.000000
9.CADMIUM	.000000	.000000	.000000
10.IRON	.000000	.000001	.000000
11.CHROMIUM	.000000	.000000	.000000
12.ALUMINUM	.000000	.000001	.000001
13.COPPER	.000000	.000000	.000000
14.NICKEL	.000000	.000000	.000000
15.LEAD	.000000	.000000	.000000
16.FECAL COLIFY	.000000	.000000	.000000
17.BOD	.005585	.001439	.001741
18.COD	.000003	.000006	.000002
19.SUS SOLIDS	.009743	.004789	.009737
20.SETT SOLIDS	.000089	.000084	.000114
21.OIL & GREASE	.002771	.000490	.000837
22.PHENOLS	.000000	.000000	.000000
23.ORG CARBON	.000000	.000001	.000000
24.NITROGEN OXD	.001445	.001930	.002306
25.SULFUR OXIDE	.036081	.043991	.040024
26.CARBON MONOX	.024463	.024926	.036496
27.PARTICULATES	.003663	.004998	.004383
28.ALDEHYDES	.000089	.000136	.000092
29.HYDROCARBONS	.003701	.003764	.004855
30.SOLID WASTE	.200193	.311042	.346747

TABLE 6

TYPE II ENVIROMENTAL-INCOME INTERDEPENDENCE MATRIX (TONS)
(ENVIRONMENTAL CHANGE PER $1,000 CHANGE IN INCOME)
MISSISSIPPI COASTAL REGION, 1977

	1	2	3	4	5	6	7	8	9
1.WASTE WATER	.362757	.016502	.061025	.252617	.020547	.284317	.041293	.208602	.093633
2.CHLORINE	.000020	.000018	.000036	.000027	.000020	.000026	.000024	.000114	.000052
3.NITROGEN	.000326	.000320	.001235	.000473	.000441	.000441	.000463	.005563	.000878
4.SULFIDES	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
5.FLUORIDE	.000004	.000004	.000005	.000019	.000003	.000007	.000003	.000003	.000005
6.PHOSPHATE	.000003	.000001	.000001	.000001	.000001	.000003	.000006	.000001	.000001
7.HEAVY METALS	.000000	.000000	.000000	.000001	.000000	.000000	.000000	.000000	.000000
8.ZINC	.000003	.000000	.000000	.000000	.000000	.000001	.000001	.000000	.000145
9.CADMIUM	.000001	.000000	.000000	.000000	.000000	.000001	.000001	.000000	.000000
10.IRON	.000002	.000001	.000001	.000004	.000001	.000002	.000003	.000001	.000001
11.CHROMIUM	.000001	.000000	.000000	.000000	.000000	.000000	.000001	.000000	.000149
12.ALUMINUM	.000003	.000001	.000001	.000001	.000001	.000003	.000007	.000001	.000001
13.COPPER	.000000	.000000	.000000	.000000	.000000	.000000	.000001	.000000	.000000
14.NICKEL	.000001	.000000	.000000	.000000	.000000	.000001	.000002	.000000	.000000
15.LEAD	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
16.FECAL COLIFM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
17.BOD	.001447	.001400	.003270	.002072	.001617	.001996	.002072	.011583	.003254
18.COD	.000009	.000011	.000012	.000049	.000008	.000019	.000007	.000009	.000014
19.SUS SOLIDS	.007880	.007465	.010735	.008329	.007865	.052860	.011806	.028475	.011824
20.SETT SOLIDS	.000091	.000092	.001605	.000129	.000304	.000090	.000089	.009067	.000930
21.OIL & GREASE	.000681	.000674	.001513	.001004	.000744	.000941	.000951	.005208	.000819
22.PHENOLS	.000000	.000000	.000000	.000000	.000000	.000000	.000001	.000000	.000000
23.ORG CARBON	.000001	.000001	.000001	.000004	.000001	.000002	.000001	.000001	.000001
24.NITROGEN OXD	.005097	.002701	.003087	.003667	.002140	.003359	.003510	.005842	.044651
25.SULFUR OXIDE	.032889	.032019	.045048	.045091	.033257	.138336	.038270	.040390	.077867
26.CARBON MONOX	.038083	.035881	.031721	.049679	.028627	.046114	.047704	.030507	.030706
27.PARTICULATES	.004430	.013878	.052637	.293840	.004306	.014866	.010661	.011809	.008842
28.ALDEHYDES	.000154	.000167	.000215	.000183	.000117	.005874	.000134	.000291	.000400
29.HYDROCARBONS	.004444	.004741	.004367	.006553	.003847	.011181	.006837	.004487	.004444
30.SOLID WASTE	.320198	.277382	11.369161	.502980	.304785	.315389	.352262	1.504537	.398697

TABLE 6 (CONT)

	10	11	12	13	14	15	16	17	18
1.WASTE WATER	.057640	.205051	.031890	.153765	.386785	.074206	1.629786	.038839	.023883
2.CHLORINE	.000019	.000021	.000025	.000021	.000024	.000050	.000027	.000024	.000021
3.NITROGEN	.002002	.000435	.000414	.001953	.000395	.001036	.000332	.000504	.000385
4.SULFIDES	.000000	.000000	.000000	.000019	.000000	.000000	.000000	.000000	.000000
5.FLUORIDE	.000003	.000008	.000005	.002649	.000006	.000004	.000002	.000010	.000008
6.PHOSPHATE	.000001	.000001	.000001	.000091	.000002	.000255	.000004	.000006	.000001
7.HEAVY METALS	.000000	.000000	.000000	.000135	.000000	.000000	.000000	.000001	.000000
8.ZINC	.000000	.000000	.000000	.000000	.000000	.000032	.000012	.000002	.000000
9.CADMIUM	.000000	.000000	.000000	.000006	.000000	.000065	.000001	.000001	.000000
10.IRON	.000001	.000002	.000001	.000481	.000002	.000107	.000002	.000005	.000001
11.CHROMIUM	.000000	.000000	.000000	.000007	.000000	.000016	.000001	.000002	.000000
12.ALUMINUM	.000001	.000001	.000001	.000001	.000002	.000271	.000005	.000006	.000001
13.COPPER	.000000	.000000	.000000	.000000	.000000	.000028	.000000	.000001	.000000
14.NICKEL	.000000	.000000	.000000	.000000	.000000	.000043	.000001	.000001	.000000
15.LEAD	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000006	.000000
16.FECAL COLIFM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
17.BOD	.006785	.013566	.002441	.004047	.005956	.001739	.001410	.002071	.001717
18.COD	.000008	.000021	.000012	.004877	.000017	.000011	.000004	.000026	.000018
19.SUS SOLIDS	.016407	.043296	.009675	.014409	.079276	.009284	.007838	.008876	.007823
20.SETT SOLIDS	.000088	.000089	.000089	.000097	.000090	.000090	.000087	.000110	.000097
21.OIL & GREASE	.001494	.000825	.000902	.001981	.002281	.001439	.000491	.000982	.000828
22.PHENOLS	.000021	.000001	.000000	.000003	.000000	.000000	.000000	.000000	.000000
23.ORG CARBON	.000001	.000002	.000001	.000546	.000001	.000001	.000000	.000002	.000001
24.NITROGEN OXD	.003603	.005286	.002730	.039386	.016625	.006402	.013800	.017764	.007732
25.SULFUR OXIDE	.042324	.061902	.049059	.071452	.086438	.055307	.038428	.057850	.048240
26.CARBON MONOX	.034643	.038952	.036884	.038400	.039891	.041859	.038154	.043336	.040991
27.PARTICULATES	.093251	.022443	.006073	.007504	.129628	.018026	.004565	.009366	.012481
28.ALDEHYDES	.000212	.000357	.000169	.000319	.000585	.000280	.000101	.000265	.001351
29.HYDROCARBONS	.004736	.005493	.091887	.009173	.005715	.005741	.004282	.005784	.008301
30.SOLID WASTE	.718628	.371189	.365898	.662984	.496679	1.854520	.444451	.416050	.287819

TABLE 6 (CONT)

	19	20	21	22	23	24	25	26	27
1.WASTE WATER	.023353	.024388	.046562	.040989	.021810	.021972	.023259	.024990	.024765
2.CHLORINE	.000022	.000022	.000055	.000058	.000024	.000022	.000028	.000031	.000034
3.NITROGEN	.000380	.000414	.000861	.000905	.000423	.000377	.000461	.000528	.000570
4.SULFIDES	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
5.FLUORIDE	.000008	.000002	.000002	.000002	.000002	.000002	.000005	.000004	.000004
6.PHOSPHATE	.000001	.000001	.000001	.000001	.000001	.000001	.000001	.000001	.000001
7.HEAVY METALS	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
8.ZINC	.000000	.000000	.000000	.000000	.000001	.000000	.000001	.000000	.000000
9.CADMIUM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
10.IRON	.000001	.000001	.000001	.000001	.000001	.000001	.000001	.000001	.000001
11.CHROMIUM	.000000	.000000	.000000	.000000	.000001	.000000	.000001	.000000	.000000
12.ALUMINUM	.000001	.000001	.000001	.000001	.000001	.000001	.000001	.000001	.000001
13.COPPER	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
14.NICKEL	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
15.LEAD	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
16.FECAL COLIFM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
17.BOD	.001678	.001793	.004053	.004270	.001852	.001691	.002108	.002315	.002532
18.COD	.000012	.000005	.000006	.000006	.000005	.000005	.000012	.000010	.000010
19.SUS SOLIDS	.007893	.008827	.010216	.010433	.008032	.008204	.008300	.008529	.008749
20.SETT SOLIDS	.000107	.000089	.000126	.000127	.000128	.000090	.000058	.000162	.000162
21.OIL & GREASE	.000807	.000829	.001995	.002104	.000892	.000811	.001024	.001125	.001232
22.PHENOLS	.000000	.000001	.000000	.000000	.000000	.000000	.000000	.000000	.000000
23.ORG CARBON	.000001	.000000	.000000	.000000	.000000	.000000	.000001	.000001	.000001
24.NITROGEN OXI	.008024	.002717	.003042	.010236	.003147	.002418	.002573	.002217	.002226
25.SULFUR OXIDE	.040384	2.397408	.049106	.127614	.049439	.046934	.048302	.056425	.056411
26.CARBON MONOX	.043376	.031741	.046771	7.177274	.047429	.036326	.035867	.032868	.033008
27.PARTICULATES	.012870	.154473	.005441	.209071	.005694	.005555	.005110	.005442	.005443
28.ALDEHYDES	.001418	.004539	.000125	.000125	.000120	.000120	.000121	.000131	.000131
29.HYDROCARBONS	.006381	.017858	.006263	.888570	.006245	.004967	.004833	.004504	.004870
30.SOLID WASTE	.287016	.316711	3.614349	.318104	.319796	.295962	.326827	.412867	.788622

TABLE 6 (CONT)

	28	29	30
1.WASTE WATER	.076865	.022302	.014882
2.CHLORINE	.000114	.000023	.000017
3.NITROGEN	.001694	.000397	.000297
4.SULFIDES	.000000	.000000	.000000
5.FLUORIDE	.000002	.000003	.000001
6.PHOSPHATE	.000001	.000001	.000000
7.HEAVY METALS	.000000	.000000	.000000
8.ZINC	.000000	.000000	.000000
9.CADMIUM	.000000	.000000	.000000
10.IRON	.000001	.000001	.000000
11.CHROMIUM	.000000	.000000	.000000
12.ALUMINUM	.000001	.000001	.000000
13.COPPER	.000000	.000000	.000000
14.NICKEL	.000000	.000000	.000000
15.LEAD	.000000	.000000	.000000
16.FECAL COLIFM	.000000	.000000	.000000
17.BOD	.008296	.001766	.001310
18.COD	.000008	.000008	.000002
19.SUS SOLIDS	.014472	.008332	.007326
20.SETT SOLIDS	.000088	.000104	.000086
21.OIL & GREASE	.004116	.000847	.000630
22.PHENOLS	.000000	.000000	.000000
23.ORG CARBON	.000000	.000001	.000000
24.NITROGEN OXD	.002443	.002368	.001735
25.SULFUR OXIDE	.053551	.053992	.030113
26.CARBON MONOX	.036335	.033047	.027459
27.PARTICULATES	.005449	.004134	.003298
28.ALDEHYDES	.000132	.000167	.000070
29.HYDROCARBONS	.005458	.004620	.003653
30.SOLID WASTE	.297348	.381752	.260900

STOP 0
CPU = .7439 CSU= 00:02:00

TABLE 7

TYPE II ENVIRONMENTAL SELF MULTIPLIERS (TONS)
MISSISSIPPI COASTAL REGION, 1977

	1	2	3	4	5	6	7	8	9
1.WASTE WATER	##########	##########	##########	1.106498##########	##########	1.103470	4.760532	1.430586	1.321280
2.CHLORINE	##########	##########	##########	##########	##########	##########	##########	1.341784	1.792813
3.NITROGEN	##########	##########	##########	##########	##########	##########	##########	1.170708	1.818036
4.SULFIDES	##########	##########	##########	##########	##########	##########	##########	##########	##########
5.FLUORIDE	##########	##########	##########	##########	##########	##########	##########	##########	##########
6.PHOSPHATE	##########	##########	##########	##########	##########	##########	##########	##########	##########
7.HEAVY METALS	##########	##########	##########	##########	##########	##########	##########	##########	##########
8.ZINC	##########	##########	##########	##########	##########	##########	##########	##########	1.028883
9.CADMIUM	##########	##########	##########	##########	##########	##########	##########	##########	##########
10.IRON	##########	##########	##########	##########	##########	##########	##########	##########	##########
11.CHROMIUM	##########	##########	##########	##########	##########	##########	##########	##########	1.028850
12.ALUMINUM	##########	##########	##########	##########	##########	##########	##########	##########	##########
13.COPPER	##########	##########	##########	##########	##########	##########	##########	##########	##########
14.NICKEL	##########	##########	##########	##########	##########	##########	##########	##########	##########
15.LEAD	##########	##########	##########	##########	##########	##########	##########	##########	##########
16.FECAL COLIFM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
17.BOD	##########	##########	##########	##########	##########	##########	##########	1.879123	2.234776
18.COD	##########	##########	##########	##########	##########	##########	##########	##########	##########
19.SUB SOLIDS	##########	##########	##########	##########	##########	1.201592	7.208600	1.620684	2.806228
20.SETT SOLIDS	##########	##########	##########	##########	##########	##########	##########	1.107139##########	
21.OIL & GREASE	##########	##########	##########	##########	##########	##########	##########	1.285316##########	
22.PHENOLS	##########	##########	##########	##########	##########	##########	##########	##########	##########
23.ORG CARBON	##########	##########	##########	##########	##########	##########	##########	##########	##########
24.NITROGEN OXD	##########	##########	##########	##########	##########	##########	##########	1.886604	1.099224
25.SULFUR OXIDE	##########	##########	##########	##########	##########	1.885063##########		3.851598	2.524388
26.CARBON MONOX	##########	##########	##########	##########	##########	8.219140##########		227.342529	120.903149
27.PARTICULATES	##########	1.499572	1.746783	1.022978##########		2.284184##########		7.627140	2.708523
28.ALDEHYDES	##########	##########	##########	##########	##########	1.046957##########		2.167001	1.578961
29.HYDROCARBONS	##########	##########	##########	##########	##########	1.932886##########		32.987823	17.800046
30.SOLID WASTE	##########	##########	1.162171##########	##########	##########	37.861771	137.914627	1.827434	3.420746

TABLE 7 (CONT)

	10	11	12	13	14	15	16	17	18
1.WASTE WATER	1.569908	1.113467	14.512960	1.184727	1.076576	1.457630	1.020847	6.069332	28.56[illegible]
2.CHLORINE	##########	##########	##########	##########	21.585022	1.862355	3.419566	12.753097	15.41705
3.NITROGEN	1.299824	##########	##########	1.237031	##########	1.451516	##########	7.440701	18.60849
4.SULFIDES	##########	##########	##########	1.007756	##########	##########	##########	##########	##########
5.FLUORIDE	##########	##########	##########	1.007756	##########	##########	##########	##########	##########
6.PHOSPHATE	##########	##########	##########	##########	##########	1.044369	4.284213	##########	##########
7.HEAVY METALS	##########	##########	##########	1.007756	##########	##########	##########	##########	##########
8.ZINC	##########	##########	##########	##########	##########	1.050451	1.103633	2.774611	##########
9.CADMIUM	##########	##########	##########	1.038508	##########	1.044534	##########	##########	##########
10.IRON	##########	##########	##########	1.008505	##########	1.052073	##########	10.470572	##########
11.CHROMIUM	##########	##########	##########	1.040895	##########	1.056407	2.382366	1.825105	##########
12.ALUMINUM	##########	##########	##########	##########	##########	1.044381	##########	##########	##########
13.COPPER	##########	##########	##########	##########	##########	1.044378	##########	##########	##########
14.NICKEL	##########	##########	##########	##########	##########	1.044381	##########	##########	##########
15.LEAD	##########	##########	##########	##########	##########	##########	##########	1.033919	##########
16.FECAL COLIFO	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.00000[illegible]
17.BOD	1.384495	1.153283	##########	1.714528	1.466428	977.072995	8.935882	13.278002	16.61772
18.COD	##########	##########	##########	1.007756	##########	##########	##########	##########	##########
19.SUS SOLIDS	2.029198	1.231615	##########	2.314821	1.131183	7.718650	36.767258	21.460388	76.67678
20.SETT SOLIDS	##########	##########	##########	##########	##########	##########	##########	##########	##########
21.OIL & GREASE	1.[illegible]	##########	##########	1.656201	1.594546	2.432307	199.870941	11.474126	16.02861
22.PHENOLS	1.090687	##########	##########	1.038076	##########	##########	##########	2.456623	##########
23.ORG CARBON	##########	##########	##########	1.007756	##########	##########	##########	##########	##########
24.NITROGEN OXD	3.618328	2.479630	##########	1.089018	1.271074	2.367238	1.217090	1.261862	1.7890[illegible]
25.SULFUR OXIDE	6.504762	4.480807	531.181394	4.354938	3.834600	20.397247	61.784439	5.303812	##########
26.CARBON MONOX	651.401367	342.518066	##########	493.870361	220.458374	1718.520996	##########	52.299927	6.46688
27.PARTICULATES	1.167631	1.765857	##########	8.863439	1.070806	1.721839	##########	4.099554	1.97807
28.ALDEHYDES	3.989676	3.139065	##########	4.083382	3.234236	14.352250	##########	2.934248	1.35482
29.HYDROCARBONS	89.064611	48.306122	1.086424	2.347334	31.583298	236.707993	##########	64.103165	4.73833
30.SOLID WASTE	1.765562	0.504496	5.093348	2.632793	2.449539	1.234171	3.019826	5.128922	76.75804

TABLE 7 (CONT)

	19	20	21	22	23	24	25	26	27
1.WASTE WATER	58.349960	9.462797	2.705004	2.183678	12.215410	169.123082	7.706100	5.018213	3.992844
2.CHLORINE	31.412247	187.940231	1.835669	1.771599	7.833909	96.022156	5.382337	3.521811	2.874879
3.NITROGEN	37.848160	##########	1.999940	1.926946	9.463377	116.212924	6.103683	4.234977	3.412490
4.SULFIDES	##########	##########	##########	##########	##########	##########	##########	##########	##########
5.FLUORIDE	##########	##########	##########	##########	##########	##########	##########	##########	##########
6.PHOSPHATE	##########	##########	##########	##########	##########	##########	##########	##########	##########
7.HEAVY METALS	##########	##########	##########	##########	##########	##########	##########	##########	##########
8.ZINC	##########	##########	##########	##########	##########	##########	##########	##########	##########
9.CADMIUM	##########	##########	##########	##########	##########	##########	##########	##########	##########
10.IRON	##########	8.896991	##########	##########	##########	##########	##########	##########	##########
11.CHROMIUM	##########	##########	##########	##########	##########	##########	##########	##########	##########
12.ALUMINUM	##########	##########	##########	##########	##########	##########	##########	##########	##########
13.COPPER	##########	3.159035	##########	##########	##########	##########	##########	##########	##########
14.NICKEL	##########	##########	##########	##########	##########	##########	##########	##########	##########
15.LEAD	##########	##########	##########	##########	##########	##########	##########	##########	##########
16.FECAL COLIFM	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000	.000000
17.BOD	33.447739	1639.546143	1.882299	1.818258	8.291197	104.072723	5.582828	3.716420	2.918683
18.COD	##########	##########	##########	##########	##########	##########	##########	##########	##########
19.SUS SOLIDS	157.398398	19.257553	4.744081	4.442599	35.959518	504.937500	21.982117	13.689548	10.438704
20.SETT SOLIDS	##########	##########	##########	##########	##########	##########	##########	##########	##########
21.OIL & GREASE	32.170898	84.757294	1.853185	1.791923	7.983843	99.700439	5.423578	3.611391	2.938044
22.PHENOLS	##########	##########	##########	##########	##########	##########	##########	##########	##########
23.ORG CARBON	##########	##########	##########	##########	##########	##########	##########	##########	##########
24.NITROGEN OXD	1.606378	8.198201	##########	1.005015	##########	##########	##########	##########	##########
25.SULFUR OXIDE	##########	1.041488	##########	1.631145	##########	##########	##########	##########	##########
26.CARBON MONOX	5.644364	74.084335	##########	1.004069	##########	##########	##########	##########	##########
27.PARTICULATES	1.742884	1.073705	##########	1.024387	33.914642	##########	##########	##########	##########
28.ALDEHYDES	1.287102	1.059451	##########	##########	##########	##########	##########	##########	##########
29.HYDROCARBONS	4.181418	1.366036	##########	1.004708	##########	##########	##########	##########	##########
30.SOLID WASTE	155.432080	18.802658	1.083867	21.069794	19.262253	49.536133	7.383009	3.316244	1.868457

TABLE 7 (CONT)

	28	29	30
1.WASTE WATER	1.429360	85.916290	3.145632
2.CHLORINE	1.219062	49.747818	2.109146
3.NITROGEN	1.269089	63.247650	2.399970
4.SULFIDES	##########	##########	##########
5.FLUORIDE	##########	##########	##########
6.PHOSPHATE	##########	##########	##########
7.HEAVY METALS	##########	##########	##########
8.ZINC	##########	##########	##########
9.CADMIUM	##########	##########	##########
10.IRON	##########	##########	##########
11.CHROMIUM	##########	##########	##########
12.ALUMINUM	##########	##########	##########
13.COPPER	##########	##########	##########
14.NICKEL	##########	##########	##########
15.LEAD	##########	##########	##########
16.FECAL COLIFM	.000000	.000000	.000000
17.BOD	1.233123	54.389709	2.167774
18.COD	##########	##########	##########
19.SUS SOLIDS	2.151184	254.555664	1.501826
20.SETT SOLIDS	##########	##########	##########
21.OIL & GREASE	1.223713	52.138496	2.159228
22.PHENOLS	##########	##########	##########
23.ORG CARBON	##########	##########	##########
24.NITROGEN OXD	##########	##########	##########
25.SULFUR OXIDE	##########	##########	##########
26.CARBON MONOX	##########	##########	##########
27.PARTICULATES	##########	##########	##########
28.ALDEHYDES	##########	##########	##########
29.HYDROCARBONS	##########	##########	##########
30.SOLID WASTE	20.619720	43.940643	1.778925

TABLE 8

RANKING OF POLLUTANT QUANTITIES PER $1,000 OUTPUT CATEGORY BY SECTOR
TYPE II ENVIRONMENTAL - OUTPUT
MISSISSIPPI COASTAL REGION, 1977

Rank	Waste Water (MGY)	Chlorine (Tons)	Nitrogen (Tons)	Sulfides (Tons)	Flouride (Tons)	Phosphate (Tons)	Heavy Metals (Tons)	Zinc (Tons)	Cadmium (Tons)	Iron (Tons)	Chromium (Tons)
1	16	28	8				13	9	15	13	9
2	14	8	28					15	13	15	15
3	1	22	10					16	7	4	13
4	4	21	13					1	17	7	17
5	8	15	3					7		17	
6	11	9	27					17		1	
7	6	27	21					23		3	
8	13	30	15							6	
9	28	26	9							8	
10	9	3	30							9	
11	15	25	27							11	
12	3	29	26							12	
13	10	18	7							14	
14	21	7	18							16	
15	7	19	25							18	
16	22	23	29							19	
17	18	4	19							25	
18	30	2	23							26	
19	17	14	17							27	
20	19	17	4							29	
21	27	10	11								
22	29	11	14								
23	26	13	12								
24	25	16	5								
25	12	1	1								
26	23	24	24								
27	24	2	16								
28	5	5	6								
29	2	6	2								
30	20	20	20								

TABLE 8 (Cont)

Rank	Nitrogen Oxide (Tons)	Sulfur Oxide (Tons)	Carbon Monoxide (Tons)	Particulates (Tons)	Aldehydes (Tons)	Hydro-Carbons (Tons)	Solid Waste (Tons)
1	22	20	22	4	6	22	3
2	9	22	30	22	18	12	21
3	13	14	18	14	28	18	15
4	14	29	7	10	20	29	8
5	17	30	19	3	14	30	27
6	18	27	21	20	9	7	10
7	19	26	23	11	15	13	30
8	7	6	29	18	28	21	29
9	30	9	25	19	8	29	26
10	16	28	28	15	13	28	7
11	21	18	4	7	29	23	14
12	15	25	27	8	3	25	4
13	23	13	26	2	17	27	18
14	29	19	15	29	10	4	25
15	25	21	14	17	7	26	19
16	4	8	17	30	30	6	13
17	28	11	11	6	4	15	22
18	11	23	3	9	26	14	28
19	8	15	10	27	27	17	17
20	27	7	12	26	28	11	23
21	26	17	13	28	25	3	9
22	1	3	1	25	12	10	11
23	10	12	8	21	21	20	12
24	3	10	9	13	22	1	16
25	12	4	24	23	1	8	1
26	24	24	2	12	23	9	24
27	2	1	6	24	2	24	5
28	6	16	16	1	24	2	2
29	5	2	5	16	5	16	6
30	20	5	20	5	16	5	20

TABLE 8 (Cont)

Rank	Aluminum (Tons)	Copper (Tons)	Nickel (Tons)	Lead (Tons)	BOD (Tons)	COD (Tons)	Suspended Solids (Tons)	Settleable Solids (Tons)	Oil & Grease (Tons)	Phenols (Tons)	Organic Carbon (Tons)
1	15	15	15	17	11	13	14	8	28	10	13
2	7	7	7		8	4	11	3	8	13	4
3	17		17		28	17	6	30	22	7	3
4	16				10	11	8	26	21		9
5	1				14	18	28	27	14		11
6	3				22	19	30	5	13		14
7	6				21	14	10	19	10		17
8	8				3	25	7	29	3		18
9	11				13	3	29	18	27		19
10	12				30	26	18	21	30		25
11	14				27	27	21	22	26		26
12	18				26	9	22	23	15		27
13	19				9	12	13	7	25		29
14	24				7	15	3	4	18		
15	25				25	29	19	25	7		
16	29				18	6	27	28	29		
17	30				29	7	9	17	19		
18					19	8	25	10	23		
19					12	1	26	14	4		
20					23	2	15	15	17		
21					4	10	12	13	12		
22					17	21	23	12	11		
23					15	22	17	11	9		
24					1	5	4	1	24		
25					24	23	1	9	1		
26					16	28	24	24	16		
27					5	16	16	2	5		
28					6	24	2	16	6		
29					2	30	5	6	2		
30					20	20	20	20	20		

TABLE 9

RANKING OF POLLUTANT QUANTITIES PER $1,000 INCOME CATEGORY BY SECTOR
TYPE II ENVIRONMENTAL - INCOME
MISSISSIPPI COASTAL REGION, 1977

Rank	Waste Water (MGY)	Chlorine (Tons)	Nitrogen (Tons)	Sulfides (Tons)	Flouride (Tons)	Phosphate (Tons)	Heavy Metals (Tons)	Zinc (Tons)	Cadmium (Tons)	Iron (Tons)	Chromium (Tons)
1	16	8	8				13	9	15	13	9
2	14	28	10				4	15	13	15	15
3	1	22	13				17	16	1	17	13
4	6	21	28					1	6	4	17
5	4	9	3					17	7	7	1
6	8	15	15					6	16	1	7
7	11	3	22					7	17	6	16
8	13	27	9					23		11	23
9	9	26	21					25		14	25
10	28	25	27							16	
11	15	4	26							2	
12	3	16	17							3	
13	10	6	4							5	
14	21	17	7							8	
15	7	12	25							9	
16	22	7	5							10	
17	17	14	6							12	
18	12	23	11							18	
19	27	18	23								
20	26	29	2								
21	20	19	20								
22	19	20	29								
23	18	24	14								
24	25	11	18								
25	29	13	19								
26	24	1	24								
27	23	5	16								
28	5	10	1								
29	2	2	2								
30	30	30	30								

TABLE 9 (Cont)

Rank	Aluminum (Tons)	Copper (Tons)	Nickel (Tons)	Lead (Tons)	BOD (Tons)	COD (Tons)	Suspended Solids (Tons)	Settleable Solids (Tons)	Oil & Grease (Tons)	Phenols (Tons)	Organic Carbons (Tons)
1	15	15	15	17	11	13	14	8	8	10	13
2	7	7	7		8	4	6	3	28	13	4
3	17	17	1		28	17	11	5	14	7	6
4	16		6		10	11	8	26	22	11	11
5	1		16		14	6	10	27	21	20	17
6	6		17		22	14	28	4	13		1
7	14				21	9	13	23	10		2
8	2				13	18	9	22	3		3
9	3				3	19	7	21	15		5
10	4				9	25	3	17	27		7
11	5				27	3	22	19	26		8
12	8				12	12	21	29	25		9
13	9				26	2	12	13	4		10
14	10				25	15	15	18	17		12
15	11				4	26	17	2	6		14
16	12				7	27	20	1	7		15
17	13				17	1	27	6	12		18
18	18				6	8	26	9	23		19
19	19				23	5	4	14	29		25
20	20				20	10	29	15	20		26
21	21				29	29	25	24	18		27
22	22				15	7	24	7	11		29
23	23				18	21	23	11	9		
24	24				24	22	18	12	24		
25	25				19	20	19	20	19		
26	26				5	23	5	10	5		
27	27				16	24	16	25	16		
28	28				1	28	30	28	21		
29	29				2	16	1	16	2		
30					30	30	2	30	30		

TABLE 9 (Cont)

Rank	Nitrogen Oxide (Tons)	Sulfer Oxide (Tons)	Carbon Monoxide (Tons)	Particulates (Tons)	Aldehydes (Tons)	Hydro-Carbons (Tons)	Solid Waste (Tons)
1	22	20	22	4	6	22	3
2	9	6	4	22	20	12	21
3	13	22	7	20	19	20	15
4	17	14	23	14	18	6	8
5	14	9	21	10	14	13	27
6	16	13	6	3	9	4	10
7	19	11	19	11	11	19	4
8	18	8	17	15	15	18	14
9	15	17	18	7	13	21	13
10	4	26	15	6	8	23	16
11	11	27	14	2	17	7	17
12	7	15	11	19	3	17	26
13	23	29	13	18	10	15	9
14	8	28	12	8	4	14	29
15	1	23	28	17	12	28	11
16	21	21	24	9	2	11	12
17	6	12	2	13	29	24	7
18	10	25	25	29	1	27	25
19	12	24	1	12	7	25	1
20	2	4	10	23	28	2	23
21	25	3	29	24	26	10	22
22	28	10	27	28	27	1	20
23	24	19	26	27	21	29	6
24	3	18	16	26	22	26	5
25	20	7	20	21	25	9	28
26	29	16	3	25	23	8	24
27	27	5	9	16	24	3	18
28	26	1	8	1	5	16	19
29	5	2	5	5	16	5	2
30	30	3	30	30	30	30	30

sector among the producing sectors is taken into account.

For instance, in Table 8 with .000077 tons of chlorine per $1,000 of induced sales, Sector 28, the Other Services sector, ranks the highest followed by a contribution of .000059 tons by Sector 8, the Food Processing sector, for every $1,000 of its induced sales. On the other hand, Table 9 presents corresponding type of information when accounting for $1,000 of induced income. Taking chlorine as an example with a production of .000114 tons per $1,000 of induced income, Sectors 8 and 28 rank the highest followed by Sector 22 with .000058 tons for each $1,000 of induced income.

IV. SOME PRACTICAL USES OF THE MODEL

The model discussed in Section III can be used in a variety of useful ways depending on the nature of inquiry as regards to the interplay between the economy and the environment in the Coastal Region of Mississippi. In this section, some examples either factual or hypothetical will be presented. The examples given are by no means exhaustive. However, they will display the appropriate techniques and computational procedures necessary to adopt the results contained in Section III:

Topics to be discussed are:

1. Environmental requirements to sustain self-sufficiency in related industries.

2. Environmental requirements due to expansion of exports in selected industries.

3. Environmental requirements due to attracting new industries.

The examples that are given here are for the calculation of environmental effects due to output. Similar procedures are used if the relationship is desired between income and the environment.

A. Self-Sufficiency

If the Coastal Region desires to be self-sufficient in a particular industry, it means that all imports of the product of that industry would be replaced by local production. For instance, assume that self-sufficiency is desired in the Food Processing (Sector 8), Lumber and Wood (Sector 10), Chemical/Petroleum (Sector 13) and the Primary/Fabricated Metals (Sector 15). Then from the Transaction Matrix Table of the Input-Output model [10] reproduced in Appendix A, the magnitudes of imports to be affected are $40,408,000, $4,572,000, $107,549,000 and $2,515,800, respectively.

The direct environmental requirements (pollution produced) by such an endeavor can be calculated using coefficients of columns 8, 10, 13 and 15 for each of the environmental factors. These calculations are presented in Table 10. The table shows that waste water to be dumped into the environment as a consequence is approximately 3,050 (MGY), 91 (MGY), 6,555 (MGY) and 664 (MGY) for the Food Processing, Lumber and Wood, Chemical/Petroleum and Primary/Fabricated Metals, respectively. On the other hand the magnitudes of suspended solids are approximately 383 tons, 20 tons, 309 tons and 16 tons.

When the direct and indirect environmental requirements are desired, Table 3 is the appropriate source for the necessary coefficients. The environmental factors are provided in Columns 8, 10, 13 and 15 in a similar manner. The physical magnitudes are presented in Table 11. It can be observed from Table 11 that the magnitudes of pollutants are larger than those in Table 10. This is expected due to the fact that the coefficients in Table 3 account for the direct output of pollutants by the particular producing sectors as well as the pollutants of the supporting sectors. For instance, waste water magnitudes are 4051 (MGY), 105 (MGY), 6895 (MGY) and 773 (MGY) for the four sectors examined.

In a similar approach, the induced environmental impact can be obtained from coefficients of Table 5. This table as was explained earlier accounts for the inclusion of the Household sector as an integral member of the economic activity of the region. Total physical values of the environmental factors are given in Table 12. Here, the values are even higher than those in Table 11. It should be mentioned again that the physical magnitudes in Table 12 are obtained by multiplying the amounts of inputs in the Transaction Matrix of the Input-Output model in Appendix A by the coefficients given in Table 5.

B. Expansion of Exports

Another use of the model is for the case when expansion of exports

TABLE 10

DIRECT ENVIRONMENTAL IMPACT OF OUTPUT REQUIRED
FOR SELF-SUFFICIENCY
MISSISSIPPI COASTAL REGION

Environmental Factors	Food Processing	Lumber Wood	Chemical Petroleum	Prim-FAB Metal
Waste Water	3049.632	90.882	6555.004	663.894
Chlorine	1.778			.352
Nitrogen	99.404	3.790	78.403	8.176
Sulfides			6.668	
Flouride				
Phosphate				
Heavy Metals				
Zinc				.403
Cadmium			.323	.679
Iron			23.661	1.333
Chromium			.323	.201
Aluminum				3.271
Copper				.352
Nickel				.780
Lead				
Fecal Coliform				
BOD	189.392	12.052	117.228	.025
COD			338.887	
Suspended Solids	382.719	19.888	309.096	15.673
Settleable Solids	171.290			
Oil & Grease	84.736	2.254	59.367	7.724
Phenols		.046	.108	
Organic Carbon			26.887	
Nitrogen Oxide	64.774	2.451	1795.746	35.272
Sulfer Oxide	327.911	15.883	814.684	35.372
Carbon Monoxide	2.788	.133	3.872	.327
Particulates	32.367	196.427	42.052	136.532
Aldehydes	2.788	.133	3.872	.327
Hydrocarbons	2.788	.133	194.018	.327
Solid Waste	17218.778	1001.085	8731.581	19595.415

TABLE 11

DIRECT AND INDIRECT ENVIRONMENTAL IMPACT OF INCREASED OUTPUT
FOR SELF-SUFFICIENCY TYPE I - SELECTED SECTORS
MISSISSIPPI COASTAL REGION

Environmental Factors	Food Processing	Lumber Wood	Chemical Petroleum	Prim-FAB Metal
Waste Water	4051.468	105.161	6895.289	773.609
Chlorine	2.020	.005	.215	.428
Nitrogen	110.112	4.193	82.167	9.636
Sulfides				
Flouride				
Phosphate				
Heavy Metals			6.668	
Zinc				.403
Cadmium			.323	.704
Iron			23.876	1.384
Chromium			.323	.201
Aluminum				3.522
Copper				.377
Nickel				.830
Lead				
Fecal Coliform				
BOD	214.849	13.465	135.942	5.585
COD	.162	.014	341.361	.126
Suspended Solids	379.593	22.334	351.685	25.535
Settleable Solids	187.816	.005	.538	.059
Oil & Grease	95.767	2.615	67.111	10.541
Phenols		.050	.215	
Organic Carbon			27.102	
Nitrogen Oxide	94.716	7.265	1952.982	885.562
Sulfer Oxide	633.193	30.033	2052.573	328.538
Carbon Monoxide	63.764	17.671	553.232	187.779
Particulates	177.997	221.244	280.860	192.056
Aldehydes	4.647	.352	12.368	3.648
Hydro Carbons	16.163	2.665	274.035	27.246
Solid Waste	26009.660	1125.786	10106.380	20781.791

TABLE 12

INDUCED ENVIRONMENTAL IMPACT OF INCREASED OUTPUT FOR SELF-SUFFICIENCY - TYPE II SELECTED SECTORS MISSISSIPPI COASTAL REGION

Environmental Factors	Food Processing	Lumber Wood	Chemical Petroleum	Prim-FAB Metal
Waste Water	4362.609	141.750	7634.043	971.350
Chlorine	2.384	.046	1.075	.654
Nitrogen	116.335	4.924	97.009	13.510
Sulfides				
Flouride				
Phosphate				
Heavy Metals			6.668	
Zinc				.428
Cadmium			.323	.704
Iron	.040		.876	1.384
Chromium			.323	.210
Aluminum	.040			3.522
Copper				.377
Nickel				.830
Lead				
Fecal Coliform				
BOD	242.246	16.688	200.902	22.667
COD	.202	.018	341.468	.151
Suspended Solids	532.779	40.352	.416	121.085
Settleable Solids	189.635	.219	4.840	1.182
Oil & Grease	108.940	4.165	98.300	18.768
Phenols		.050	.215	
Organic Carbon			27.102	
Nitrogen Oxide	.871	22.567	2261.971	169.691
Sulfer Oxide	1262.992	104.090	3547.826	721.230
Carbon Monoxide	638.042	85.204	1916.631	545.878
Particulates	246.974	229.354	372.657	235.076
Aldehydes	6.102	.521	15.810	4.554
Hydrocarbons	92.575	11.649	455.470	74.870
Solid Waste	31466.194	1767.480	22988.491	24184.084

is contemplated by an existing industry. Assume that a 10 percent increase in exports is ecpected for the Food Processing sector. Then from the Transaction Matrix of the Input-Output model given in Appendix A, such an expansion amounts to $7,378,000.

For this example, only the induced environmental impacts are calculated. Therefore, the environmental factors can be obtained by using the coefficients of Column 8 of Table 5. Every number in that column is therefore to be multiplied by 7,378,000. The results of such calculations are given in Table 13.

C. Attraction of New Industries

The attraction of a new industry to a region would have a multiple effect over the other producing sectors. First, through the economic interrelationships, all sectors in the region will expand their outputs to meet the new demands. From the Columns of The Technical Coefficient Matrix of the Input-Output model [10] Table 2, page 11, the expansion in sales of all sectors can be calculated.

Assume that a new Food Processing industry wishes to locate its operations in the Mississippi Coastal Region. Then Column 8 of the table presents the proportion of immediate sales of each sector. Through these proportions actual values of sales are calculated and are shown in Table 14.

In order to obtain estimates of pollution that will be caused by all sectors, Table 2 through Table 4 might be used depending on the type of information desired. For this example, the induced effects utilizing the coefficients of Table 5 are calculated and are shown in Table 15. Similarly, if a new plant in the Chemical-Petroleum sector wishes to locate in the region, actual anticipated sales are shown in Table 14 and estimates of anticipated pollution is shown in Table 16. A comparison of the economic-ecologic trade-off between the two types of industries, the Food Processing and the Chemical-Petroleum can be made through an analysis of Tables 14, 15, and 16. For ease of comparison, it is assumed here that the anticipated potential for both industries is of a magnitude of a million dollars.

TABLE 13

INDUCED (TYPE II) ENVIRONMENTAL IMPACT IN A
10% EXPORT EXPANSION (THOUSANDS OF 1972 DOLLARS)
THE FOOD PROCESSING SECTOR
MISSISSIPPI COASTAL ZONE

Environmental Factors	(Tons)
Waste Water (MGY)	796558.39
Chlorine	435.30
Nitrogen	21241.26
Sulfides	
Flouride	
Phosphate	
Heavy Metals	
Zinc	
Cadmium	
Iron	7.38
Chromium	516.46
Aluminum	
Copper	
Nickel	
Lead	
Fecal Coliform	
BOD	11244.07
COD	44.27
Suspended Solids	43611.36
Settleable Solids	309.88
Oil & Grease	2825.77
Phenols	
Organic Carbons	7.38
Nitrogen Oxide	171280.27
Sulfur Oxide	268994.50
Carbon Monoxide	106073.50
Particulates	28471.70
Aldehydes	1387.06
Hydrocarbons	15353.62
Solid Waste	1376970.80

TABLE 14

INPUTS REQUIRED FOR A MILLION DOLLAR NEW INDUSTRY
IN THE FOOD PROCESSING AND CHEMICAL-PETROLEUM SECTORS
MISSISSIPPI COASTAL REGION (THOUSANDS OF 1972 DOLLARS)

Sectors	Sales To Food Processing	Sales To Chemicals-Petroleum
Fisheries	72470	
Forestry		4170
Livestock	22390	
Crops	11370	110
Ag. Forestry, Fish. Srv.		
Mining		1430
Construction	4620	14470
Food Processing	83490	810
Apparel & Finished		
Lumber & Wood	290	740
Paper and Allied	4840	4230
Printing & Publishing	1630	160
Chemicals & Petroleum	730	7230
Stone, Clay & Glass	5130	2120
Primary & Fab. Metals	1720	710
Transportation Equip.	20	
Miscellaneous MFG.	1400	2770
Water Transportation	8830	16920
Other Trans. & Warehousing	6460	32750
Communication & Public Util.	13700	29030
Eating & Drinking Places	4110	2410
Service Stations		780
Wholesale & Retail Trade	31610	18530
Finance, Insur., Real Estate	9980	27110
Hotels, Motels & Lodging	1290	1180
Medical Services	90	150
Educational Services	100	170
Other Services	16480	1760
State & Local Gov't	1750	2370
Households	268980	268940

TABLE 15

INDUCED ENVIRONMENTAL IMPACT ATTRIBUTABLE TO A MILLION DOLLAR EXPANSION IN THE FOOD PROCESSING INDUSTRY
MISSISSIPPI COASTAL REGION
(TONS PER YEAR)

Environmental Factors	Fisheries	Forestry	Livestock	Crops	Ag., Forestry Fish. Serv.	Mining	Construction	Food Processing	Apparel & Finished
Waste Water*	7824.151		2417.314	1227.551			498.794	9013.914	
Chlorine	4.276		1.321	.671			.273	4.926	
Nitrogen	208.641		64.461	32.734			13.301	240.368	
Sulfides									
Flouride									
Phosphate									
Heavy Metals									
Zinc									
Cadmium									
Iron	.072		.022	.011			.005	.083	
Chromium									
Aluminum	.072		.022	.011			.005	.083	
Copper									
Nickel									
Lead									
BOD	434.458		134.228	68.163			27.697	500.523	
COD	.362		.112	.057			.023	.417	
Sus. Solids	955.517		295.212	149.913			60.915	1100.816	
Sett. Solids	340.102		105.076	53.359			21.682	391.819	
Oil & Grease	195.379		60.363	30.654			12.456	225.089	
Phenols									
Org. Carbon									
Nitrogen Oxide	403.296		124.600	63.274			25.710	464.622	
Sulfur Oxide	2265.122		699.822	356.006			144.403	2609.563	
Carbon Monoxide	1144.301		353.538	179.532			72.950	1318.307	
Particulates	442.937		136.848	69.493			28.237	510.291	
Aldehydes	10.943		3.381	1.717			.698	12.607	
Hydrocarbons	166.029		51.295	26.049			10.584	191.276	
Solid Waste	56433.259		17435.362	8869.530			3597.649	65014.665	

*Million gallons per year.

TABLE 15 (CONT)

Environmental Factors	Lumber & Wood	Paper & Allied	Printing & Publishing	Chemicals-Petroleum	Stone, Clay & Glass	Primary & Fabri. Metals	Transportation Equipment	Miscellaneous MFG.
Waste Water	31.310	522.546	175.981	78.814	553.855	185.698	2.159	151.150
Chlorine	.017	.286	.096	.043	.303	.101	.001	.083
Nitrogen	.835	13.934	4.693	2.102	14.769	4.952	.058	4.031
Sulfides								
Flouride								
Phosphate								
Heavy Metals								
Zinc								
Cadmium								
Iron		.005	.002	.001	.005	.002		.001
Chromium								
Aluminum		.005	.002	.001	.005	.002		.001
Copper								
Nickel								
Lead								
Fecal Coliform								
BOD	1.739	29.016	9.772	4.376	30.754	10.311	.120	8.393
COD	.001	.024	.008	.004	.026	.009		.007
Sus. Solids	3.824	63.815	21.492	9.625	67.639	22.678	.264	18.459
Sett. Solids	1.361	22.714	7.650	3.426	24.075	8.072	.094	6.570
Oil & Grease	.782	13.049	4.394	1.968	13.830	4.637	.054	3.774
Phenols								
Org. Carbon								
Nitrogen Oxide	1.614	26.935	9.071	4.062	28.548	9.572	.111	7.791
Sulfur Oxide	9.064	151.279	50.947	22.817	160.343	53.760	.625	43.758
Carbon Monoxide	4.579	76.424	25.738	11.527	81.033	27.159	.316	22.106
Particulates	1.772	29.582	9.963	4.462	31.355	10.513	.122	8.557
Aldehydes	.044	.731	.246	.110	.775	.260	.003	.211
Hydrocarbons	.664	11.088	3.734	1.672	11.753	3.941	.046	3.207
Solid Waste	225.826	3768.966	1269.301	568.460	3994.793	1339.385	15.574	1090.197

TABLE 15 (CONT)

Environmental Factors	Water Transportation	Other Transp. Warehousing	Communications & Pub. Utilities	Eating & Drinking Places	Service Stations	Wholesale Retail Trade	Finance, Ins. Real Estate
Waste Water	953.322	697.447	1479.107	443.732		3412.742	1077.481
Chlorine	.521	.381	.808	.242		1.865	.589
Nitrogen	25.422	18.598	39.442	11.833		91.005	28.732
Sulfides							
Flouride							
Phosphate							
Heavy Metals							
Zinc							
Cadmium							
Iron	.009	.006	.014	.004		.032	.010
Chromium							
Aluminum	.009	.006	.014	.004		.032	.010
Copper							
Nickel							
Lead							
Fecal Coliform							
BOD	52.936	38.728	82.132	24.639		189.502	59.830
COD	.044	.032	.069	.021		.158	.050
Sus Solids	116.424	85.175	180.635	54.190		416.778	131.586
Sett. Solids	41.439	30.317	64.294	19.288		148.346	46.836
Oil & Grease	23.806	17.416	36.935	11.081		85.221	26.906
Phenols							
Organic Carbon							
Nitrogen Oxide	49.139	39.950	76.241	22.872		175.910	55.539
Sulfur Oxide	275.990	201.914	428.207	128.462		988.002	311.935
Carbon Monoxide	139.426	102.003	216.323	64.897		499.122	157.584
Particulates	53.969	39.484	83.734	25.120		193.200	60.998
Aldehydes	1.333	.975	2.069	.621		4.773	1.507
Hydrocarbons	20.230	14.800	31.387	9.416		72.419	22.864
Solid Waste	6876.027	5030.480	10668.354	3200.506		24615.086	7771.546

TABLE 15 (Cont)

Environmental Factors	Hotels, Motels Lodging	Medical Services	Educational Services	Other Services	State and Local Government	Households
Waste Water	139.274	9.717	.796	1779.247	188.937	29040.157
Chlorine	.076	.005	.006	.972	.103	15.870
Nitrogen	3.714	.259	.288	47.446	5.038	774.393
Sulfides						
Flouride						
Phosphate						
Heavy Metals						
Zinc						
Cadmium						
Iron	.001			.016	.002	.269
Chromium						
Aluminum	.001			.016	.002	.269
Copper						
Nickel						
Lead						
Fecal Coliform						
BOD	7.734	.540	.600	98.798	10.491	1612.535
COD	.006		.001	.082	.009	1.345
Suspended Solids	17.009	1.187	1.319	217.289	23.074	3546.501
Settleable Solids	6.054	.422	.469	77.341	8.213	1262.323
Oil & Grease	3.478	.243	.270	44.430	4.718	725.170
Phenols						
Organic Carbon						
Nitrogen Oxide	7.179	.501	.557	91.711	9.739	1496.874
Sulfur Oxide	40.320	2.813	3.126	515.099	54.698	8407.239
Carbon Monoxide	20.369	1.421	1.579	260.219	27.633	4247.194
Particulates	7.884	.550	.611	100.726	10.696	1644.006
Aldehydes	.195	.014	.015	2.488	.264	40.616
Hydrocarbons	2.955	.206	.229	37.756	4.009	616.233
Solid Waste	1004.538	70.084	77.871	12833.174	1362.746	209457.954

TABLE 16

INDUCED ENVIRONMENTAL IMPACT ATTRIBUTABLE TO A MILLION DOLLAR EXPANSION
IN THE CHEMICALS-PETROLEUM INDUSTRY
INDUSTRY SECTORS

Environmental Factors	Fisheries	Forestry	Livestock	Crops	Ag., Forestry Fish Svr.	Mining	Construction	Food Processing	Apparel & Finished	Lumber Wood
Waste Water		295.995		7.808		101.504	1027.110	57.495		52.527
Chlorine		.042		.001		.014	.145	.008		.007
Nitrogen		3.761		.099		1.290	13.052	.731		.667
Sulfides										
Flouride										
Phosphate										
Heavy Metals		.259		.007		.089	.897	.050		.046
Zinc										
Cadmium		.013				.004	.043	.002		.002
Iron		.926		.024		.317	3.212	.180		.164
Chromium		.013				.004	.043	.002		.002
Aluminum										
Copper										
Nickel										
Lead										
Fecal Colifm										
BOD		7.790		.205		2.671	27.030	1.513		1.382
COD		13.240		.349		4.540	45.942	2.572		2.350
Suspended Solids		27.739		.732		9.512	96.254	5.388		4.922
Settleable Solids		.188		.005		.064	.651	.036		.033
Oil & Grease		3.811		.101		1.307	13.226	.740		.676
Phenols		.008				.003	.029	.002		.001
Organic Carbon		1.051		028		.360	3.646	.204		.186
Nitrogen Oxide		87.703		2.314		30.076	304.333	17.036		15.564
Sulfur Oxide		137.560		3.629		47.173	477.336	26.720		24.411
Carbon Monoxide		74.314		1.960		25.484	257.870	14.435		13.188
Particulates		14.449		.381		4.955	50.139	2.807		2.564
Aldehydes		.613		.016		.210	2.127	.119		.109
Hydro carbons		17.660		.466		.056	61.280	3.430		3.134
Solid Waste		891.333		23.512		305.661	3092.948	173.137		158.174

TABLE 16 (Cont)

Environmental Factors	Paper Allied	Printing Publishing	Chemicals Petroleum	Stone, Clay & Glass	Primary & Fab. Metals	Transportation Equipment	Miscellaneous MFG.	Water Transportation	Other Trans. Warehousing
Waste Water	300.254	11.357	513.200	150.482	50.397		196.620	1201.015	2324.661
Chlorine	.042	.002	.072	.021	.007		.028	.169	.328
Nitrogen	3.815	.144	6.521	1.912	.640		2.499	15.262	29.541
Sulfides									
Flouride									
Phosphate									
Heavy Metals	.262	.010	.448	.131	.044		.172	1.049	2.031
Zinc									
Cadmium	.013		.022	.006	.002		.008	.051	.098
Iron	.939	.036	1.605	.471	.158		.615	3.756	7.271
Chromium	.013		.022	.006	.002		.008	.051	.098
Aluminum									
Copper									
Nickel									
Lead									
Fecal Coliform									
BOD	7.902	.299	13.506	3.960	1.326		5.174	31.607	61.177
COD	13.430	.508	22.955	6.731	2.254		8.795	53.721	103.961
Suspended Solids	28.138	1.064	48.094	14.102	4.723		18.426	112.552	217.853
Settleable Solids	.190	.007	.325	.095	.032		.125	.761	1.474
Oil & Grease	3.866	.146	6.608	1.938	.649		2.532	15.465	29.934
Phenols	.008		.014	.004	.001		.006	.034	.066
Organic Carbon	1.066	.040	1.822	.534	.179		.698	4.264	8.253
Nitrogen Oxide	88.965	3.365	152.061	44.588	14.933		58.259	355.861	688.798
Sulfur Oxide	139.539	5.278	238.503	69.935	23.421		91.377	558.157	1080.357
Carbon Monoxide	75.383	2.851	128.846	37.781	12.653		49.364	301.531	583.638
Particulates	14.657	.554	25.052	7.346	2.460		9.598	58.628	113.479
Aldehydes	.622	.024	1.063	.312	.104		.407	2.487	4.814
Hydro Carbons	17.914	.678	30.619	8.978	3.007		11.731	71.656	138.696
Solid Waste	904.158	34.200	1545.405	453.148	151.762		592.085	3616.633	7000.280

TABLE 16 (Cont)

Educational Factors	Communication & Pub. Util.	Eating & Drink. Places	Service Stations	Wholesale Retail Trade	Fin., Ins. Real Est.	Hotel, Motel Lodging	Medical Services	Educational Services	Other Services	State & Local Gov't	Households
Waste Water	2060.607	171.067	55.366	1315.296	1924.322	83.759	10.647	12.067	124.928	168.227	19089.899
Chlorine	.290	.024	.008	.185	.271	.012	.002	.022	.018	.024	2.689
Nitrogen	26.185	2.174	.704	16.714	24.453	1.064	.135	.153	1.588	2.138	242.584
Sulfides											
Flouride											
Phosphate											
Heavy Metals	1.800	.149	.048	1.149	1.681	.073	.009	.011	.109	.147	16.674
Zinc											
Cadmium	.087	.007	.002	.056	.081	.004		.001	.005	.007	.807
Iron	6.445	.535	.173	4.114	6.018	.262	.033	.038	.391	.526	59.705
Chromium	.087	.007	.002	.056	.081	.004		.001	.005	.007	.807
Aluminum											
Copper											
Nickel											
Lead											
Fecal Colifm											
BOD	54.228	4.502	1.457	34.614	50.641	2.204	.280	.318	3.288	4.427	502.380
COD	92.170	7.652	2.477	58.833	86.074	3.747	.476	.540	5.588	7.525	853.885
Sus. Solids	193.108	16.031	5.189	123.262	180.336	7.849	.998	1.131	11.708	15.765	1788.989
Sett. Solids	1.306	.108	.035	.834	1.220	.053	.007	.008	.079	.107	12.102
Oil & Grease	26.533	2.203	.713	16.936	24.779	1.079	.137	.155	1.609	2.166	245.811
Phenols	.058	.005	.002	.037	.054	.002			.004	.005	.538
Org. Carbon	7.316	.602	.197	4.670	6.832	.297	.038	.043	.444	.597	67.773
Nitrogen Oxd	610.559	50.687	16.405	389.723	570.178	24.818	3.155	3.575	37.016	49.846	5656.346
Sulfur Oxide	357.642	79.501	25.731	611.268	894.305	38.926	4.948	5.608	58.059	78.182	8871.793
Carbon Monox	517.344	42.949	13.900	339.223	483.127	21.029	2.673	3.030	31.365	42.236	4792.780
Particulates	100.589	8.351	2.703	64.206	93.936	4.089	.520	.589	6.098	8.212	931.877
Aldehydes	4.267	.354	.115	2.724	3.985	.173	.022	.025	.259	.348	39.534
Hydrocarbons	122.942	10.206	3.303	78.475	114.811	4.997	.635	.720	7.454	10.037	1138.961
Solid Waste	6205.133	515.135	166.724	3960.769	5794.735	252.224	32.062	36.337	376.198	506.585	57485.656

V. EVALUATION OF THE MODEL

Evidence indicates that intense economic activities contribute significantly to air, water, and land waste. The extensive outflow of such residuals creates concern among the public as well as the government.

The establishment of many governmental agencies involved with the environment encouraged legislators to enact controls that would ensure the reduction of waste or at least the transforming of waste to lesser harmful substances. In order to aid the legislative and regulative agencies in forming regulations, an understanding of the interactions between the economy and the environment is prerequisite.

This study, which is the result of three years' effort, is in principle primarily concerned with how the economic activity of the Coastal Region of Mississippi generates waste loadings. This is done through quantification of the discharges to show how the economic interactions cause their generation. The study therefore does not attempt to determine the significance of harm to the environment in any manner other than the economic basis.

The model follows accepted procedures that have been in development and use for many years. The abundance of publications in the type of approach attests to its popularity and acceptability by economists concerned in regional inquiries. The theoretical basis is sound, and the information it yields could be invaluable to those who seek to make decisions on rational foundations.

This report along with the other two, [10] and [11], present a systematic approach for the economic-ecologic interactions in the Coastal Region of Mississippi. A great deal of time and effort was spent in collecting and assimilating data from primary and secondary sources. However, in many instances, lack of data in usable form made it imperative to use value

judgements and intelligent guesses. Therefore, when one reads these reports, these facts should be borne in mind.

The researchers do not wish to comment on the magnitude of the pollution problem in the Coastal Region in the sense as to whether or not it is acute enough to discourage further industrial expansion. The reason for this is the unavailability of the proper ecologic data in terms of the upper limits of pollutants which the environment of the region can handle naturally. However, the information provided by these reports would be of great help to those who are in a position to make decisions relative to the expansion of economic activity in the region.

As environmental data become more available in the future, an updating of the model might be desired. In this case, the effort required for such an endeavor would be considerably less than the current research because of the lessons learned.

APPENDICES

APPENDIX A

TRANSACTIONS MATRIX
MISSISSIPPI COASTAL REGION, 1972
(Thousands of Dollars)

OUTPUT [SALES] / INPUT [PURCHASES]	FISHERIES	FORESTRY	LIVESTOCK PRODUCTS	CROPS & AGRI-CULTURAL	AG FORESTRY, FISH SVC	MINING	CONSTRUCTION	FOOD PROCESSING	APPAREL & FINISHED	LUMBER & WOOD
	1	2	3	4	5	6	7	8	9	10
1 FISHERIES	150.	0.	0.	0.	0.	0.	0.	7235.	0.	0.
2 FORESTRY	0.	250.	0.	0.	0.	0.	0.	0.	108.	4094.
3 LIVESTOCK PRODUCTS	0.	0.	411.	24.	0.	0.	0.	2235.	0.	0.
4 CROPS & AGRICULTURAL	0.	0.	204.	0.	0.	0.	0.	1135.	0.	0.
5 AG FORESTRY,FISH SVC	219.	145.	157.	119.	0.	0.	352.	0.	0.	0.
6 MINING	0.	0.	0.	0.	0.	0.	1245.	0.	1.	1.
7 CONSTRUCTION	0.	0.	42.	20.	0.	271.	48.	461.	25.	35.
8 FOOD PROCESSING	0.	0.	715.	0.	27.	0.	0.	8335.	0.	0.
9 APPAREL & FINISHED	0.	0.	0.	0.	0.	0.	0.	0.	262.	0.
10 LUMBER & WOOD	0.	0.	0.	0.	4.	11.	5006.	29.	4.	1261.
11 PAPER & ALLIED	0.	0.	0.	0.	0.	0.	111.	483.	49.	13.
12 PRINTING/PUBLISHING	0.	0.	0.	0.	0.	0.	41.	163.	2.	15.
13 CHEMICAL/PETRO/OTHER	11.	7.	4.	11.	1.	12.	111.	73.	14.	9.
14 STONE,CLAY &GLASS	1.	1.	1.	1.	0.	91.	4296.	512.	0.	17.
15 PRIMARY/FAB METALS	54.	4.	2.	0.	1.	33.	3858.	172.	6.	21.
16 TRANSPORTATION EQUIP	3024.	0.	0.	0.	0.	1.	2.	2.	0.	2.
17 MISCELLANEOUS MFG	36.	24.	2.	4.	4.	45.	917.	140.	506.	12.
18 WATER TRANSPORTATION	161.	107.	19.	24.	0.	121.	0.	882.	0.	174.
19 OTHER TRANSP/WHSE	212.	141.	155.	31.	20.	159.	414.	645.	117.	228.
20 COMMUNICATION/PU UTL	2.	1.	42.	21.	2.	212.	599.	1368.	156.	86.
21 EATING & DRINKING	19.	13.	23.	8.	2.	44.	1004.	410.	0.	21.
22 SERVICE STATIONS	6.	4.	0.	3.	0.	4.	324.	0.	0.	7.
23 WHOLESALE/RETAIL	146.	97.	181.	53.	14.	106.	7729.	3156.	382.	165.
24 FINANCE/INS/REAL EST	100.	66.	112.	108.	39.	526.	1202.	996.	190.	62.
25 HOTEL,MOTEL,LODGING	0.	0.	0.	0.	0.	0.	0.	129.	5.	0.
26 MEDICAL SERVICES	0.	0.	0.	0.	0.	1.	19.	9.	1.	0.
27 EDUCATIONAL SERVICES	0.	0.	7.	0.	0.	1.	21.	10.	2.	1.
28 OTHER SERVICES	23.	15.	46.	94.	0.	246.	7230.	1645.	272.	121.
29 STATE/LOCAL GOV'T	3.	1.	2.	0.	0.	8.	139.	175.	48.	7.
ENDOGENOUS TOTALS	4167.	876.	2125.	531.	114.	2262.	34670.	30400.	2150.	6350.
30 HOUSEHOLDS	2795.	1855.	977.	372.	391.	1084.	51352.	26854.	2667.	4205.
31 FEDERAL GOV'T	336.	223.	117.	45.	139.	446.	4017.	2176.	524.	532.
32 IMPORTS	4602.	4946.	941.	634.	1023.	5796.	29361.	40408.	4574.	4572.
TOTAL PURCHASES	11900.	7900.	4160.	1582.	1667.	9488.	119400.	99838.	9915.	15659.

APPENDIX A (Cont)

TRANSACTIONS MATRIX
MISSISSIPPI COASTAL REGION, 1972
(Thousands of Dollars)

SECTOR	PAPER & ALLIED	PRINTING & PUBLISHING	CHEMICAL/PETROL/ OTHER	STONE, CLAY & GLASS	PRIMARY/FAB METALS	TRANSPORTATION EQUIP	MISCELLANEOUS MFG	WATER TRANS-PORTATION	OTHER TRANS-PORTATION/WHSE	COMMUNICATION/ PUBLIC UTILITIES	EATING & DRINK-ING	SERVICE STATIONS	WHOLESALE/RETAIL
	11	12	13	14	15	16	17	18	19	20	21	22	23
1	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	800.	0.	32.
2	2500.	0.	881.	0.	0.	0.	4.	25.	0.	0.	0.	0.	0.
3	0.	0.	0.	0.	0.	0.	9.	1.	0.	0.	0.	0.	0.
4	0.	0.	23.	0.	0.	0.	24.	3.	0.	0.	2.	0.	99.
5	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	26.	0.	155.
6	0.	0.	301.	363.	0.	0.	5.	3.	5.	321.	0.	0.	51.
7	615.	28.	3056.	210.	451.	715.	139.	664.	869.	792.	110.	36.	850.
8	0.	0.	172.	0.	0.	0.	58.	25.	98.	0.	136.	44.	1049.
9	0.	0.	0.	0.	0.	864.	42.	0.	24.	0.	0.	0.	1128.
10	3043.	1.	156.	61.	167.	1218.	189.	0.	1.	900.	18.	6.	142.
11	0.	284.	894.	179.	105.	139.	126.	12.	15.	0.	0.	0.	10.
12	128.	160.	34.	1.	34.	75.	13.	5.	6.	54.	45.	5.	118.
13	217.	8.	1528.	35.	62.	138.	96.	53.	69.	12.	18.	6.	90.
14	34.	0.	447.	107.	88.	597.	92.	7.	9.	0.	16.	5.	121.
15	150.	12.	151.	62.	2221.	5948.	509.	31.	41.	45.	14.	4.	106.
16	0.	0.	0.	0.	15.	5052.	165.	106.	139.	1.	17.	6.	132.
17	264.	13.	586.	81.	356.	2764.	848.	35.	45.	20.	41.	14.	319.
18	2095.	57.	3573.	744.	3478.	2566.	318.	0.	4022.	93.	0.	0.	266.
19	2745.	75.	6917.	476.	1937.	362.	417.	5271.	0.	253.	216.	69.	659.
20	1675.	114.	6133.	745.	1483.	1915.	472.	406.	531.	3093.	753.	243.	5795.
21	209.	14.	509.	46.	187.	493.	107.	61.	80.	16.	0.	61.	1478.
22	67.	4.	164.	15.	60.	159.	34.	20.	26.	5.	62.	0.	476.
23	1605.	107.	3915.	357.	1436.	3797.	821.	472.	618.	120.	1480.	472.	0.
24	921.	203.	5727.	328.	603.	1535.	472.	605.	792.	273.	1218.	392.	9372.
25	87.	6.	250.	8.	36.	138.	19.	16.	21.	43.	44.	14.	338.
26	6.	0.	32.	2.	6.	16.	5.	4.	3.	2.	6.	2.	45.
27	6.	4.	35.	3.	6.	18.	5.	4.	3.	3.	7.	2.	48.
28	1733.	275.	3718.	544.	1491.	2175.	1013.	734.	962.	789.	1725.	555.	4722.
29	112.	107.	500.	40.	79.	342.	65.	902.	1181.	2604.	555.	179.	4268.
TOT.	18212.	1472.	39702.	4907.	14301.	31026.	6067.	9465.	9560.	9469.	7309.	2115.	31913.
30	21797.	1614.	56807.	4478.	14865.	140840.	7699.	10959.	14361.	9442.	10096.	3238.	77705.
31	1564.	332.	7170.	493.	960.	37227.	1234.	378.	1111.	4520.	1151.	371.	8863.
32	39465.	2585.	107849.	7314.	25158.	314529.	13622.	4268.	7818.	98446.	7943.	2818.	85484.
TOT.	81038.	6003.	211228.	17192.	55284.	523622.	28622.	25070.	32850.	121867.	26499.	8542.	203965.

APPENDIX A (Cont)

TRANSACTIONS MATRIX
MISSISSIPPI COASTAL REGION, 1972
(Thousands of Dollars)

SECTOR	FINANCE/INS/REAL ESTATE	HOTEL, MOTEL, LODGING	MEDICAL SERVICES	EDUCATIONAL SERVICES	OTHER SERVICES	STATE/LOCAL GOV'T	TOTAL INTER-INDUSTRY DEMAND	FINAL DEMAND				TOTAL OUTPUT
								HOUSEHOLDS	FED. GOV'T CIVILIAN	FEDERAL GOV'T MILITARY	EXPORTS	
	24	25	26	27	28	29		30	31	32	33	
1	0.	0.	0.	0.	0.	0.	8217.	1110.	0.	73.	2500.	11900.
2	34.	0.	0.	0.	0.	0.	7896.	4.	0.	0.	0.	7900.
3	0.	0.	4.	0.	16.	0.	2700.	1361.	15.	73.	71.	4160.
4	0.	1.	0.	0.	16.	45.	1552.	24.	1.	3.	2.	1582.
5	0.	0.	0.	0.	23.	16.	1252.	229.	15.	168.	3.	1667.
6	0.	0.	0.	0.	0.	273.	2669.	132.	0.	1453.	5204.	9458.
7	6473.	382.	682.	731.	639.	18334.	36685.	41394.	9020.	12003.	20298.	119400.
8	13.	3.	389.	414.	0.	55.	11533.	13524.	1.	1000.	73780.	99838.
9	0.	122.	15.	20.	9.	67.	2557.	550.	524.	889.	5395.	9915.
10	23.	10.	0.	0.	0.	50.	12302.	246.	0.	45.	3046.	15659.
11	0.	0.	0.	0.	38.	47.	2505.	10.	0.	0.	78523.	81038.
12	98.	5.	5.	217.	893.	95.	2212.	2404.	287.	380.	720.	6003.
13	24.	61.	56.	59.	45.	127.	2957.	10.	2.	3.	208256.	211228.
14	16.	34.	5.	5.	128.	17.	6588.	861.	105.	365.	9473.	17392.
15	25.	48.	1.	2.	34.	26.	13581.	180.	10.	50.	41463.	55284.
16	63.	8.	0.	1.	491.	42.	9269.	1744.	0.	502647.	9922.	523622.
17	116.	248.	69.	74.	429.	91.	8103.	3016.	10.	95.	17468.	28622.
18	0.	0.	0.	0.	206.	511.	19417.	367.	0.	95.	5261.	25070.
19	969.	227.	155.	169.	663.	3795.	27395.	1550.	250.	750.	2905.	32850.
20	1601.	896.	1698.	1811.	3901.	5773.	41525.	57566.	4753.	16013.	2010.	121867.
21	144.	87.	63.	67.	303.	102.	5541.	7423.	43.	242.	13250.	26499.
22	46.	28.	20.	22.	98.	33.	1687.	4100.	46.	224.	2485.	8542.
23	1105.	665.	484.	516.	2335.	782.	33126.	149982.	425.	2075.	18357.	203965.
24	9072.	1853.	1500.	1600.	3165.	3270.	46702.	57098.	170.	830.	6100.	110900.
25	158.	534.	114.	122.	225.	39.	2366.	1163.	43.	207.	25288.	29067.
26	74.	16.	0.	156.	28.	15.	448.	32644.	258.	810.	1500.	35660.
27	78.	18.	166.	0.	30.	31714.	32192.	619.	5205.	0.	0.	38016.
28	1877.	1434.	1194.	1272.	2414.	1755.	40074.	39986.	425.	2075.	10939.	93499.
29	1947.	156.	419.	446.	1507.	314.	16106.	63637.	75.	362.	61237.	141417.
TOT.	23350.	6836.	7050.	7704.	17636.	67488.	399157.					
30	23246.	12707.	15626.	16456.	40869.	54354.		0.	127800.	187146.	89765.	1034842.
31	5561.	1353.	1664.	1774.	4351.	43.		149781.	15.	82.	641107.	879660.
32	58743.	8171.	1132C.	11482.	30643.	19532.		145199.	84.	0.	0.	1149360.
TOT.	110900.	29067.	3866C.	38016.	93499.	141417.		897874.	149582.	740078.	1356328.	5135882.

APPENDIX B

PHYSICAL QUANTITIES OF WATER EFFLUENTS, AIR POLLUTION, AND SOLID WASTE MISSISSIPPI COASTAL REGION

Sector Number	Sector Name	Waste Water (MGY)	PH (Scientific Unit)	Temperature (°Farenheit)	Chlorine (Tons/yr)	Nitrogen (Tons/yr)	Sulfides (Tons/yr)	Flouride (Tons/yr)	Phosphate (Tons/yr)
1.	Fisheries								
2.	Forestry								
3.	Livestock Products								
4.	Crops & Agricultural	175.634							
5.	Ag, Forestry, Fish Svc.								
6.	Mining	633.600							
7.	Construction	759.000	7.1						
8.	Food Processing	7,534.839	7.5	74.9	4.372	245.560			
9.	Apparel & Finished	328.634	7.5	74.0	.135	2.246			
10.	Lumber & Wood	311.268	6.9	63.3		12.979			
11.	Paper & Allied	7,245.000	7.1	82.0					
12.	Printing & Publishing	6.495							
13.	Chemical & Petro. & Other	12,874.239	7.8	69.8		153.936	1.811	256.363	
14.	Stone, Clay & Glass	3,240.408	8.5	76.5	.010				
15.	Primary & Fab. Metals	1,458.868	7.9	80.0	.777	17.983			7.004
16.	Transportation Equip.	324,804.460	7.6	82.7	1.586				.271
17.	Miscellaneous Equip.	86.848	7.9	71.2	.028	.919			
18.	Water Transportation	17.500			.031	.438			
19.	Other Transportation	10.335			.018	.259			
20.	Communication & Pu.Utl.	44.832	7.8		.002				
21.	Eating and Drinking	298.636			.519	7.472			
22.	Service Stations	102.600			.179	2.568			
23.	Wholesale & Retail	212.670			.370	5.321			
24.	Finance, Ins.& Real Est.	5.685			.010	.142			
25.	Hotel, Motel, Lodging	61.628			.107	1.542			
26.	Medical Services	120.421			.210	3.013			
27.	Educational Services	173.364			.302	4.317			
28.	Other Services	3,385.135			5.887	84.696			
29.	State & Local Gov't.	29.910			.053	.749			
30.	Households	5,205.740			8.943	136.383			
	TOTAL	369,127.735			23.539	680.523	1.811	256.363	7.275

MGY = Million gallons per year.

APPENDIX B (Cont)

PHYSICAL QUANTITIES OF WATER EFFLUENTS, AIR POLLUTION, AND SOLID WASTE MISSISSIPPI COASTAL REGION

Sector Number	Heavy Metals (Tons/yr)	Zinc (Tons/yr)	Cadmium (Tons/yr)	Iron (Tons/yr)	Chromium (Tons/yr)	Aluminum (Tons/yr)	Copper (Tons/yr)	Nickel (Tons/yr)	Lead (Tons/yr)	Fecal Coliform (#/ML)
1										
2										
3										
4										
5										
6										
7										
8										
9		.671			.671					1,926,425.279
10										
11										
12										
13	13.081		.576	46.498	.626					
14										7,069.778
15		.869	1.508	2.907	.431	7.429	.778	1.736		
16		2.168			.109					
17		.009		.006	.013					24,041.845
18									.077	5,752.584
19										49.000
20				.003						28.938
21							.001			4,440.405
22										836.181
23										287.280
24										595.476
25										15.918
26										172.559
27										337.179
28										485.419
29										9,476.376
30										83.748
										14,417.008
TOTAL	13.081	3.717	2.084	49.414	1.850	7.429	.779	1.736	.077	

ML = Milliliter

APPENDIX B (Cont)

PHYSICAL QUANTITIES OF WATER EFFLUENTS,
AIR POLLUTION, AND SOLID WASTE
MISSISSIPPI COASTAL REGION

Sector Number	BOD (Tons/yr)	COD (Tons/yr)	Suspended Solids (Tons/yr)	Settleable Solids (Tons/yr)	Oil & Grease (Tons/yr)	Phenols (Tons/yr)	Organic Carbon (Tons/yr)	Nitrogen Oxide (Tons/yr)	Sulfur Oxides (Tons/yr)
1									
2									
3									
4									
5									
6			113.302						189.006
7			143.290						
8	467.941		812.232	423.188	209.382			160.014	810.204
9	6.760		20.885					188.576	143.200
10	41.284		68.110		7.727	.160		8.394	54.393
11	473.000		1,383.000					83.874	543.504
12									.273
13	230.190	665.498	607.011		116.628	.314	52.836	3,526.913	1,600.000
14	36.655		632.101		12.902			117.970	203.310
15	.051		34.469		16.951			77.500	77.702
16	36.655		47.370		.703			2,306.791	116.658
17	2.117		5.613		1.161	.002		191.053	148.027
18	2.190		2.190		1.095			91.599	
19	1.293		1.293		.647			128.768	
20	.019		7.965		.170			9.083	40,000.000
21	37.359		37.359		18.680				
22	12.836		12.836		6.418			8,813.096	427.640
23	26.606		26.606		13.303				
24	.711		.711		.356				
25	7.710		7.710		3.855				
26	15.065		15.065		7.533				
27	21.689		21.689		10.844				
28	423.480		423.480		211.740				
29	3.742		3.742		1.871				
30	664.920		5,367.271		320.961				
TOTAL	2,512.273	665.498	9,795.300	423.188	962.927	.476	52.836	15,703.631	44,313.917

APPENDIX B (Cont)

PHYSICAL QUANTITIES OF WATER EFFLUENTS,
AIR POLLUTION, AND SOLID WASTE
MISSISSIPPI COASTAL REGION
1977

Sector Number	Carbon Monoxide (Tons/yr)	Particulates (Tons/yr)	Aldehydes (Tons/yr)	Total Hydro-carbons (Tons/yr)	Solid Waste (Tons/yr)
1					
2		27.133			
3		73.680			23,919.900
4		221.037			
5					
6	14.450	16.762	14.450	14.450	21.450
7					223.500
8	6.934	80.007	6.934	6.934	42,543.280
9	1.179	14.143	1.179	1.179	540.950
10	.448	672.758	.448	.448	3,428.700
11	4.474	500.000	4.474	4.474	2,652.000
12				250.000	212.170
13	7.622	82.567	7.623	381.077	17,148.971
14	1.632	1,091.850	1.632	1.632	1,828.800
15	.698	300.000	.698	.698	43,060.350
16					29,942.900
17	11.246	31.014	1.225	1.225	1,100.900
18	140.921	133.874	21.138	28.184	80.523
19	198.104	188.199	29.716	39.621	47.541
20	7.445	2,500.000	74.450	223.349	292.695
21					57,854.160
22	40,160.945	1,115.582		4,834.188	82.524
23		20.000			1,977.570
24					261.441
25					903.870
26					3,010.520
27					13,002.297
28					907.764
29					687.930
30					161,377.920
TOTAL	40,556.098	7,068.606	163.967	5,787,459	407,110.626

BIBLIOGRAPHY

BIBLIOGRAPHY

1. Ayres, R.V. and Kneese, A. V. "Production, Consumption and Externalities," The American Economic Review, LIX, June 1969, 282-97.

2. Blaylock, J.E. and Jones, L.L. An Analysis of Economic-Environmental Interrelations on The Lower Rio Grande Region of Texas. Texas Agricultural Experiment Station, Texas A & M University. July, 1973.

3. Blaylock, J.E. and Jones, L.L. Economic and Ecological Input-Output Model. Agricultural Economics Program and Model Documentation 73-2, Texas A & M University, July 1973.

4. Daly, H.E., "On Economics as a Life Science." Journal of Political Economy. Vol. 76, No. 3, May/June 1968, pp. 392-406.

5. Feld, S. and N. Rorholm. Economics Growth and the Generation of Waterborne Wastes. Marine Technical Report No. 12, University of Rhode Island, Kingston, 1973.

6. Hite, James and Lauren Environmental Planning: An Economic Analysis. New York: Praeger Publishers, 1972.

7. Isard, Walter. Ecologic-Economic Analysis for Regional Development. New York: The Free Press, 1972.

8. Laurent, E.A. and J.C. Hite. Economic-Ecologic Analysis in the Charleston Metropolitan Region: An Input-Output Study. Water Resources Research Institute, Report No. 19, Clemson University, April 1971.

9. Leontief, Wassily, "Environmental Repercussions and the Economic Structure: An Input-Output Approach," Review of Economics and Statistics. Vol 25. June 1970, 262-71.

10. Nissan, E., Daniel, D. L., Williams, D. C., and Green, T. G. Linkages Between the Economy and the Environment of the Coastal Zone of Mississippi, Part I: Input-Output Model. Bureau of Business Research, University of Southern Mississippi, March 1978.

11. Nissan, E., Williams, D.C. and Green, T. Linkages Between the Economy and Environment of the Coastal Zone of Mississippi, Part II: Environmental Model. Bureau of Business Research, University of Southern Mississippi, June 1979.

12. Roberts, K. J. and R. B. Retting. Linkages Between the Economy and the Environment. Agriculture Experiment Station Bulletin No. 618, Oregon State University, May 1975.

13. Victor, Peter. Pollution: Economy and Environment. London: George Allen & Unwin LTd, 1972.