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An Analysis of Economic-Environmental Interrelations in the Lower Rio Grande Region of Texas

James E. Blaylock
Texas A&M University

Lonnie L. Jones
Texas A&M University

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AN ANALYSIS OF ECONOMIC-ENVIRONMENTAL INTERRELATIONS IN THE LOWER RIO GRANDE REGION OF TEXAS

James E. Blaylock
Lonnie L. Jones, Ph.D.
Department of Agricultural Economics and Rural Sociology
Texas Agricultural Experiment Station
Texas A&M University

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This report presents the basic results of an analysis of interrelationships of economic change and environmental impacts in the Lower Rio Grande Valley. The analytical method employed is an input-output model augmented to include environmental factors that are a part of the economic production process. Detailed information is presented on total dollar sales, purchases, exports and imports for 78 economic sectors and levels of use and/or output of 16 environmental factors. Direct and indirect effects on the environment of each sector's level of production are estimated. Trade-offs between economic factors and environmental factors are estimated in the form of environmental-income, environmental-employment and environmental-output multipliers. Economic and environmental impacts of possible, selected developments are presented.

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The authors gratefully aknowledge the assistance of several agencies during the conduct of this study. Principal among these were: the Texas Air Control Board, Texas Water Quality Board, Texas Water Development Board, Texas Highway Department, Texas Agricultural Experiment Station and Texas Municipal League. Information and counsel provided by these agencies were most valuable in this analysis.

The content of this report is of primary use as planning information for decision-makers responsible for orderly development of the economy and the physical environment of the State. The report is technical in nature and as such is intended chiefly for research analysists of state agencies, private businesses and university faculties as opposed to the general public.

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Glossary of Terms

The following terms were used in the tables presenting the economic-environmental data.

1.	NO-X	Nitrogen Oxides
2.	SO-X	Sulphur Oxides
3.	HC	Hydrocarbons
4.	CO	Carbon Monoxide
5.	PART.	Particles
6.	HS	Hydrogen Sulfide
7.	H-2SO-4	Sulphuric Acid
8.	FL	Gaseous Fluoride
9.	BOD	Biological Oxygen Demand
10.	COD	Chemical Oxygen Demand
11.	TSS	Total Suspended Solids
12.	VSS	Volatile Suspended Solids
13.	S-SOL	Settling Solids
14.	S. Waste (L)	Solid Wastes (in liquid form)
15.	S. Waste (S)	Solid Wastes (in solid form)

AN ANALYSIS OF ECONOMIC AND ENVIRONMENTAL INTERRELATIONS IN THE LOWER RIO GRANDE REGION OF TEXAS

by

James E. Blaylock and Lonnie L. Jones*

INTRODUCTION

Environmental quality and changes in the eco-system are much discussed topics. The rising interest and importance of these problems is implied by the increasing expenditures by governments to study and control changes imposed upon the environment by activities of man and the assurances by industries of either their non-polluting nature or their efforts in that direction.

Any economy that provides goods and services to consumers within it uses resources. Certain of these resources are fixed in supply and are sufficiently scarce as to not be freely available. Some means of allocation among competing uses is required. Natural resources are usually considered to be such things as land, water, minerals, forests, etc. This category also includes air and physical space (i.e., those things given to us initially with no production cost). These resources were, at one time, considered to be plentiful and, in so far as production and consumption was concerned, virtually free goods.

The increasing utilization of these resources has lowered their supply to the extent that there is a need for determining their value in alternative end uses and a corresponding need for some method of allocation. For example, the question of the appropriate "trade-offs" between the production of goods and services and protection of the environment for recreational, asthetic and other uses is of critical concern.

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*Research Associate and Associate Professor, Department of Agricultural Economics and Rural Sociology, Texas Agricultural Experiment Station, Texas A&M University.

There are some special characteristics of natural resource goods, that makes the allocation through familiar private market channels difficult. First, production of certain natural resources is not economically or technically feasible. Moreover, the difficulty of excluding the use of certain resources (such as air and water) from those who do not pay for them, along with the lack of property rights assigned to them, precludes the formation of conventional markets with accompanying prices for the resources. This presents special problems in an economic system where production sectors supply what is demanded and prices allocate the product among the demanders.

Some natural resources are consumed as inputs in the same manner as other production inputs. Others (eg. air) are used as the dumping ground for the by-products of production. In either case, the use of these resources is linked directly to the production of goods and services in the economy. Due to the factors mentioned above that restrict some of these resources from being allocated through private markets, the expedient of government acting as an agent for the consumer has been initiated. Through its powers of legislation, it votes for more or less resource use in lieu of the consumer's dollar vote in the market. Until it is possible to allocate these resources or their substitutes via market operations, government representatives must allocate them according to their view of the relevant social welfare function.

Centralized control and decision making requires a significant increase in centralized information over that required for market control. Technical information is needed to find what alternatives are possible, and trade-off information is necessary to decide which alternative is optimal. Both the legislative advisory agency and the consumer need this type of knowledge if they are interested in choosing from among the possible courses of action.

The purpose of this study is to provide information on the interrelationships between the output of the producing sectors and the use of environmental resources in the Rio Grande Valley Region of Texas. The Rio Grande Valley was recently the subject of an economic study done for the Office of the Govenor[1]. The study presented data from the economy in an input-output model. This model allowed economic forecasts to be made for the region with respect to future growth. It is augmented by the present report so that environmental aspects of economic growth can be considered as well.

This report brings out the linkages between the economy and the environment and emphasizes that a change in one accompanies a change in the other. To accomplish this, estimates in the form of pollution produced and resources utilized per dollar of output, employment and income are presented. Environmental-economic multipliers are generated for each combination of environmental category and economic sector. Finally, ecological alternatives are discussed for hypothesized economic projections.

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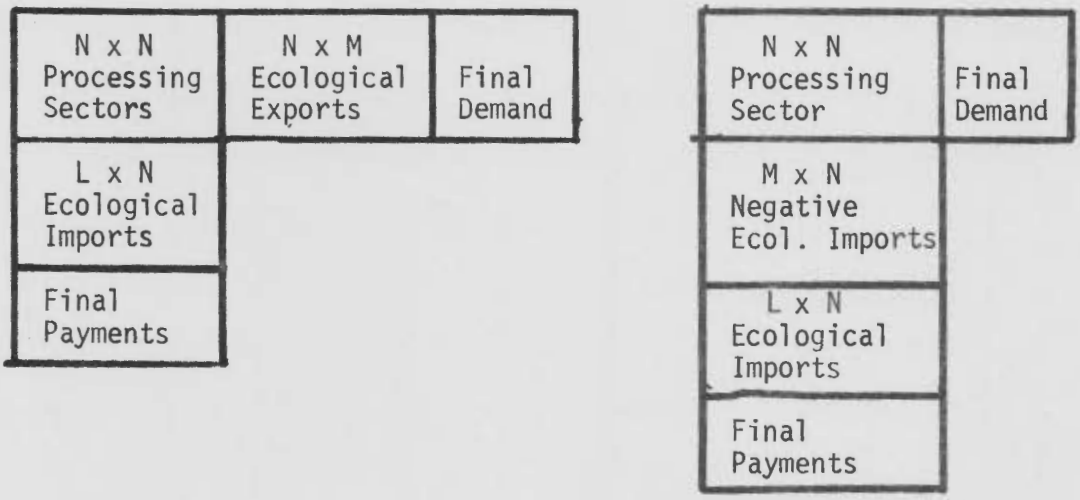
[1] Murrell, Joe C. Jr. et al, An Input-Output Model of the Lower Rio Grande Region of Texas, Office of the Governor, Division of Planning Coordination, State of Texas, April 1972.

METHODOLOGY

In developing the data needed for an economic analysis of the Rio Grande Valley, a 78 x 78 input-output matrix was constructed. The processing sector within the matrix was contained in rows and columns 1 through 71 with the remaining seven rows and columns as final payments and final demand, respectively. The processing sector of this model is used along with an environmental sector to provide the relations needed for both economic and ecologic projections of the Rio Grande region.

Environmental sectors are usually introduced into an input-output model as ecological imports of resources for inputs and exports of production by-products. (See Figure 1a)



(a) (b)

FIGURE 1

This technique was developed by Martin and Carter[2], who utilized only the L x N

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[2]Martin, William E., and Harold O. Carter, A California Interindustry Analysis Emphasizing Agriculture (Part I and II), Giannini Foundation, Res. Rep. 278, Feb. 1968.

ecological imports. Laurent and Hite completed the model by adding the N x M ecological exports[3]. To calculate the multipliers desired, an environmental sector was formed by transposing the ecological export sector to form an M x N matrix of negative imports. The environmental sector is thus made up of an (M + L) x N matrix containing positive and negative resource requirements, (see Figure 1b).

RESOURCE-OUTPUT MULTIPLIERS

Along with an increase in output to meet a change in final demand, environmental requirements also increase according to the economic-resource linkages within the region. The ratio of total resource requirements to the total output of a particular sector shows the direct resource requirement per dollar unit of output. But this direct resource requirement is only a partial measure of the total impact on the economy. The output in the whole economy will increase by an amount greater than the change in the original sector because of the interdependence among the region's economic sectors. This leads to indirect resource requirements for the interdependent sectors.

The ratio of the total resource requirements to the direct requirement represents the resource multiplier. Thus, the resource multiplier, whether positive or negative, measures the total change in resource requirements throughout the economy resulting from a one unit change in final demand in a particualr sector.

The above concept can be presented more concisely in mathematical form.

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[3]Laurent, Eugene A. and James C. Hite, Economic-Ecologic Analysis in the Charleston Metropolitan Region: An Input-Output Study. Clemson University, Clemson, South Carolina, Water Resources Research Institute, Report No. 19, April, 1971.

The relationship of resource requirement and output is assumed as

(1) $r_{kj} = b_{kj} x_j$

where r_{kj} = amount of primary resource k required by sector j,

x_j = output of sector j, and

b_{kj} = a constant - use of resource k per dollar output in sector j.

The technical coefficients b_{kj} are thus derived from a single observation of the resource requirement for the jth sector by

(2) $b_{kj} = r_{kj}/x_j$

Let R_k = total requirement for resource k

(3) $$R_k = \sum_{j=1}^{n} r_{kj} = \sum_{j=1}^{n} b_{kj} x_j$$

$$= b_{k1} x_1 + b_{k2} x_2 + \ldots + b_{kn} x_n$$

k = 1, 2, ... n negative resources plus 1, 2, ... m positive resources

or, expanding this equation, the demand for resources 1 through m is

(4) $$R_1 = b_{11} x_1 + b_{12} x_2 + \ldots + b_{1n} x_n$$

$$\begin{matrix} R_2 \\ \vdots \\ R_m \end{matrix} = \begin{matrix} b_{21} x_1 + b_{22} x_2 + \ldots + b_{2n} x_n \\ \vdots \\ b_{m1} x_1 + b_{m2} x_2 + \ldots + b_{mn} x_n \end{matrix}$$

In matrix notation,

(5) $R = BX$

where $R = \begin{bmatrix} R_1 \\ R_2 \\ \vdots \\ R_m \end{bmatrix}$ $B = \begin{bmatrix} b_{11} & b_{12} & \cdots & b_{1n} \\ b_{21} & b_{22} & \cdots & b_{2n} \\ \vdots & \vdots & & \vdots \\ b_{m1} & b_{m2} & \cdots & b_{mn} \end{bmatrix}$ $X = \begin{bmatrix} X_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix}$

The development of the input-output model provided the information contained in the equation,

(6) $X = (1-A)^{-1}Y$

where $(1-A)^{-1}$ = the matrix of economic interdependence coefficients.

Y = final demand vector.

Substituting this expression for output into the matrix equation for the resource vector we obtain

(7) $R = B(1-A)^{-1}Y$

$= PY$ where $p = B(1-A)^{-1}$

The matrix P shows the direct and indirect effect of a change in final demand in a given sector on the specified resources. Let P_{kj} be an element of the matrix P. Then, for every dollar's worth of final demand for products of sector j, P_{kj} units of resource k are required directly by producing sector j and indirectly through requirements induced in other sectors of the economy. The P matrix, therefore, contains the resource-output multipliers. These can be expressed as

(8) $P_{kj} = {}^{\partial r_k}/_{\partial y_j}$

RESOURCE-INCOME MULTIPLIERS

The trade off between resources and income can be found by using the total income effect and the resource-output multiplier. The total income effect is usually found as the first step in generating income multipliers. If households are exogenous to the processing sector then the total income effect is

$$(9) \quad Z = W(1-A)^{-1}$$

where Z = a vector of multipliers indicating the change in wages in a sector for a dollar change in output for that sector.

$$= \partial W / \partial y$$

W = the sector of wages paid per dollar of output.

The type I resource-income multipliers are then found by dividing each resource-output multiplier by the total income effect of the appropriate sector.

$$R_Z = P_{kj} / Z_j$$

where Z_j = the jth element of vector Z.

R_Z = matrix of resource-income multipliers

When the households sector is made endogenous to the processing sector, the procedure is similar to the above. However, the vector Z is calculated directly in the inversion process that yields the interdependence coefficients. By using the household row of the inverted matrix, we obtain the type II resource-income multipliers. The difference between type I multiplier as described above and type II multiplier is that the induced spending of households is included in the latter. The type I is, therefore, an approximation of the more complete type II multiplier. Both type I and type II multipliers are presented in the analysis sections of this report.

RESOURCE-EMPLOYMENT MULTIPLIERS

Multipliers for resources and employment interrelations are calculated in the same manner as the type I resource-income multipliers. In place of the income vector Z, a vector of employment coefficients is used. These coefficients are found by dividing the total employment of a sector by that sector's total output. The resulting vector will then contain elements which are the average number of employees per dollar of output. Total change in employment for the economy is then estimated by the equation,

$$(10) \quad E = L(1-A)^{-1}$$

where E = the total effect on employment for a dollar change in each industry's output

L = the vector of direct employment coefficients

Then, resource-employment interrelations are calculated from,

$$(11) \quad R_E = {}^{P_{kj}}/_{E_j}$$

where R_E = a k x j matrix of multipliers indicating the change in resource usage for a unit change in each industry's employment.

RESOURCE-RESOURCE MULTIPLIERS

The relationship between the amount of a resource an industry uses (or produces in the case of negative resources) and that which it causes to be used through its purchases of inputs may be similarily estimated from the model. This "resource-resource" multiplier is calculated by dividing the resource-output multiplier for a particular economic sector and resource category by the corresponding sector's resource use per dollar of output.

That is

$$(12) \quad R_R = {}^{P_{kj}}/_{b_{kj}}$$

where R_R = a k x j matrix of resource multipliers relating the total change in resource k use in economy for each one unit change in sector j.

DATA SOURCES AND HANDLING

The data requirements for the economic-ecologic analysis are indicated in the mathematical presentation of the model. The matrix B in equation 5 is made up of the elements b_{kj} shown in equation 2. To obtain these elements, it is necessary to estimate average amounts of resources used per dollar of each sector's output. This was done by using the 1967 sector output figures from the Rio Grande study and collecting amounts of pollution produced and resources used by sectors for the same period[1]. The b_{kj} ratio is obtained by dividing total pollution (or resource) by total output for each environmental and economic sector.

The pollution factors and resources used were categorized into four main groups. These are air pollution, water pollution, solid waste and water use. Water use is a single, positive resource sector. The other three are expressed as negative resource uses. The air pollution category is composed of nitrogen oxides, sulphur oxides, hydrocarbons, carbon monoxide, particles, hydrogen sulfide, hydrochloric acid, and fluorides. Water pollution is composed of biological oxygen demand, chemical oxygen demand, suspended solids, volatile solids, and settling solids. Finally, solid waste is divided between liquids and solids that are disposed of on land.

DATA SOURCES

Where possible, primary data were collected for the entire population of resource users. However, it was necessary in some cases to make use of secondary data and samples from a population of users.

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[1] 1967 data was not always available. In such cases figures for the closest year to it were taken.

The major sources of primary data were state agencies responsible for monitoring and managing environmental resources. These included the Texas Air Control Board, the Texas Water Quality Board, and the Texas Water Development Board. Other sources were the Texas Highway Department and the Texas Municipal League.

The Water Quality Board provided data in two areas--liquid effluent and industrial solid waste. The liquid effluent data is from their self-reporting system. Since 1970 all producers of effluent have been required by law to have a permit and report regularly the amount of effluent produced. The industrial solid waste information collected from the Water Quality Board is from a statewide survey which samples firms in standard industrial classifications (S.I.C.) for construction, manufacturing, and transportation.

Data obtained from the Air Control Board was taken from their canvass of the 6,000 firms in Texas who produce emissions. As with the Water Quality Board, response is required by law.

The Water Development Board provided information from records kept since 1966 on municipal and industrial water usage. This agency also provided data in published form on agricultual water use.

Various supplementary sources were also used. Traffic data for the Rio Grande Valley was provided by the Texas Highway Department in order to augment the Air Control Board's information. The Texas Municipal League's report on solid waste in Texas[2] was used to supplement the Water Quality Board's data. Finally various sources of conversion factors[3] were used to complete the data requirements.

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[2] Municipal Solid Waste Management in Texas, Texas Municipal League, Austin Texas, Jan., 1972.

[3] Data conversions made in the analysis are presented in the next section.

DATA HANDLING

For use in the input-output model, the environmental data was arranged according to the format shown in figure 2.

ARRANGEMENT OF ECONOMIC AND ENVIRONMENTAL DATA FOR INCLUSION IN THE INPUT-OUTPUT ANALYSIS

Environmental factors	Economic Sectors								
	Agri.	Mining	Const.	Manuf.	Transp.	Utilities	Commerce	House-holds	Final Demand
	1-12	13	14-16	17-34	35-39	40-42	43	44	45-50
Air Emissions 1 . . . 8									
Water Effluent 9 . . . 13									
Solid Waste 14 15									
Water Use 16									

Figure 2

The economic sectors used in the present analysis were the same as those used in the Rio Grande Valley study. The basic unit for aggregation was the four digit Standard Industrial Classification[4]. These were grouped into twelve separate I-O sectors for agriculture, one for mining, three for construction, etc. (figure 2.) Due to the nature of the resource data collected, one change had to be made in the economic data. Economic data representing the 28 commercial sectors were consolidated to form one input-output sector. The sum of the original sectors for wholesale, retail, F.I.R.E., and services reduces I-O sectors 43-71 in the original model to the single sector 43 (figure 2). Now, instead of a 78 x 78 economic matrix[5], a 50 x 50 matrix is used.

The cells in figure 2 for emissions and I-O sectors 13-34 were filled by data from the Air Control Board's convass by required questionnaire. As collected it was identified by each firm's SIC number and broken into the eight emission categories. The emissions themselves are expressed in tons per year for the year 1969. The data for the needed counties was consolidated by I-O sector, and the appropriate sectors were then aggregated.

The tons per year of emissions for sectors 13-34, is supplemented with the pollution factors produced in the incineration of solid waste. A major portion of the solid waste data came from the survey forms of the Water Quality Board. The amount of solid waste burned for each sampled firm by SIC was taken in the form of tons per year. The forms also contained information on the number of employees for each firm which allowed an average amount of pollution per employee to be calculated. With the model's assumption of fixed production coefficients, it was possible to use this average with the total number of people

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[4] Standard Industrial Classification Manual 1967, Superintendent of Document, U.S. Government Printing Office, 1967.

[5] For a complete description of each sector see Murrell, J. C. Jr. op. cit.

employed by that industry in the region to arrive at a total amount of pollution produced for the year.

Transportation emissions are calculated from three sources. These sources are the Air Control Board's Emission Summary[6] for air and rail traffic in the area, the Texas Highway Department's traffic count data, and the Water Quality Board's solid waste survey forms.

The Air Control Board's summary is an emissions inventory compiled from their survey and other sources. Emissions from air and rail operations were obtained from this source in tons per year of each relevant category. Diesel trucks and auto emissions were calculated from traffic count data and conversion coefficients obtained from the Environmental Protection Agency[7].

Vehicle miles per day in the Rio Grande Valley were taken from Highway Department data and converted to the number of gallons consumed using an average miles per gallon figure of 10.83 supplied by the Highway Department. Diesel fuel burned was estimated by the Highway Department as 10% of total gallons, therefore, this amount was reported from the total. EPA conversion factors in terms of grams/mile for autos and pounds/1000 gal for diesel were used to obtain the pounds of each pollutant produced. These figures were then converted to tons per year.

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[6] Emissions Inventory Summary, Texas Air Control Board, Unpublished tables combining survey data and generated data to yield total emissions in Texas.

[7] Compilation of Air Pollutant Emission Factors, U.S. Environmental Protection Agency, Research Triangle, North Carolina, Feb. 1972.

In a more concise form the procedure is

$$a_i(mpg) \cdot g/B(\Gamma) = A_i$$

a_i = conversion coefficient for emission factor in grams per auto mile

mpg = local average miles per gallon

g = gallons of fuel burned.

B = conversion constant of 457.14 grams per pound

Γ = ratio of 365/2000 to change lbs/day to tons/year.

A_i = tons/year of emission factor i for autos

The pollutants from diesel operation is found by converting the gallons burned using the EPA conversion coefficients for this particular fuel. The procedure is somewhat simpler since the coefficients are in the form of pounds per thousand gallons burned. Therefore,

$$d_i(g/1000)\ (\Gamma) = D_i$$

where d_i = conversion coefficient for emission factor i in lbs./1000 gallons

D_i = tons/year of emission factor i for diesels

The diesel emission figures were allocated to sector 35 for highway motor freight, while auto emissions were credited to the commercial sector. This sector contains auto sales & service along with gasoline sales to auto owners.

Finally, the transportation section's incineration of solid waste was calculated from the Water Quality Board forms. The procedure is the same as outlined for sectors 13-34.

Pollutants from the operation of the utility sector were obtained from the Air Control inventory summary. Auto emissions were the only entries in the

commercial sector. The lack of data for commercial use of private incinerators implies its insignificance. For this reason it is excluded. Also no data was collected for household uses of incinerators. Although the EPA states that 50 per cent of all waste generated in the U.S. is burned, the Texas Municipal League indicates almost none is incinerated in Texas. The validity of this could not be checked completely in the time period available. However, a related study indicates that the Texas Municipal League estimates are probably applicable for Texas[8].

WATER POLLUTION FACTORS

With the exception of agriculture, data for water effluent was obtained from the Water Quality Board self-reporting records. These records are computerized and present private and public flows of effluent into the water of the Rio Grande Valley. For each dumping unit examples of the data used are illustrated in tables 1 and 2.

TABLE I: EXAMPLE DATA FOR EFFLUENT GENERATED BY FIRMS

MONTH	FLOW	TSS	VSS	BOD	COD
1	1.050	82	57	33	200
2	.98	112	90	36	147
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
12	1.23	135	123	36	156

[8] J. P. Hall & L. L. Jones, "Costs of Solid Waste Management in Rural Communities in Texas," T.A.10189, Department of Agricultural Economics, Texas A&M University, Nov., 1972.

TABLE 2: EXAMPLE DATA FOR EFFLUENT GENERATED BY MUNICIPALITIES

MONTH	FLOW	BOD	TSS	S-SOL
1	.499	43	17	39
2	.338	35	107	41
⋮	⋮	⋮	⋮	⋮
12	.562	38	105	40

The flows per month for each firm in a twelve month period are multiplied by a constant 8.34 and then by each effluent factor. The sum of the results for each pollutant over the twelve months gives the pounds per year dumped by the particular firm. For example, from table I,

$$TSS_j = (1.05)(8.34)82 + (.98)(8.34)112 + \ldots + (1.23)(8.34)135$$

where TSS = lbs/yr of total suspended solids for firm j

Converting lbs/yr to tons per year and summing the output of each pollution factor over all firms within individual I-O sectors gives the water pollution entries for each industry.

A similar procedure is followed for municipalities. The main difference is that the total for each pollutant is summed into a single I-O sector. Rather than placing this data in the governmental sector, a procedure was followed that would attribute, as much as possible, each pollutant to its source. The most significant source of public effluent is sewage. Although the government performs the service of collecting and processing sewage such that the effluent is a by-product of its operation, households are the major source of demand for the service. The linkages between projections of final demand changes due to population growth and the production of these effluents are more direct if they are made via households.

The agricultural contribution to water pollution comes through land run-off carrying soil into the rivers and streams. Total suspended solids in the form of soil in run-off water was found using agricultural land use and run-off conversion factors provided by the Soil Conservation Society of America[9]. Agricultural land use in the Rio Grande Valley was obtained from the census reports[10] and Texas County Statistics[11]. The different crops grown were classified according to the similarity of their root and stalk structure to that of corn, soybeans, wheat, or grass, the only crops for which run-off data were available. Conversion factors for straight row planting rather than contour planting were used.

Sediment coefficients in the form of pounds per acre per year were multiplied by the number of acres in each crop category. Pounds of sediment were converted to tons and allocated to each I-O sector according to the crops planted on the type of acreage used to generate the figure.

Another water pollutant due to agriculture is the run-off of herbicides, pesticides and fertilizers. For completeness, these should also be included in the model. However, insufficient data on these factors exist, and they were omitted.

SOLID WASTE FACTORS

There are many and conflicting estimates of the average tons of solid

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[9] A Primer on Agricultual Pollution, Soil Conservation Society of America, Ankeny, Iowa.

[10] 1969 Census of Agriculture, U.S. Department of Commerce, Volume I Area Reports, Part 37, section 2, June 1972.

[11] Texas Crop and Livestock Reporting Service, 1970 Texas County Statistics, Texas Department of Agriculture.

waste generated per person per year[12]. All of the estimates are from reputable sources using the best techniques at their disposal. It was not feasible to generate new estimates from primary data. Therefore, this study uses primary industrial data collected by the Water Quality Board and a per capita figure from the Department of environmental Engineering at Texas A&M. Of the averages available to choose from, these were chosen for completeness and the extent to which they allowed disaggregation.

Solid wastes attributable to I-O sector 13 through 39 are taken directly from the survey forms used by the Water Quality Board. The information used from these forms is by SIC number, the number of employees, tons or gallons[13] generated, and disposal method. Solid waste that was burned was kept separate and allocated to the air emission sectors. Also, that solid waste, such as wood and metal, that was salvaged was not considered as a pollution factor but as an input in some sector of the economy.

The quantities of solid wastes in tons and gallons are aggregated via the SIC numbers to the I-O sector level. Using similarly aggregated employment figures, an average amount of solid waste per employee was found. This average was then multiplied by the total employment in each sector (available from the original Rio Grande Valley input-output report) to obtain an estimated total

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[12]Hann, Roy W. Jr., and Wesley P. James, Coastal Zone Waste Management Study, Environmental Engineering Division, Civil Engineering Department, Texas A&M, Sept. 1972; Solid Waste Management in Texas: Status and Plan, Volume One, Municipal Solid Waste, Texas State Department of Health, 1972; Municipal Solid Waste Management in Texas, op. cit.; Results of the Water Quality Board's solid waste survey.

[13]Liquid disposed of on land was classified as solid waste since it used the same disposal medium as other solid waste.

quantity of solid waste produced for the year.

The agricultural, commercial and household sectors contribution to solid waste was determined by the use of secondary data. The coefficient for the production of solid waste by households (expressed originally in lbs/capita/day) is .456 tons/capita/year. For commercial activity the coefficients vary with the size of the town producing it.

TABLE 3: SOLID WASTE PRODUCTION COEFFICIENTS BY MUNICIPALITY SIZE[14]

MUNICIPAL POPULATION	TONS/CAP/YR
0 -1,000	.2738
1001-10,000	.365
10,001-100,000	.456
100,001+	.639

A breakdown of towns by population is available in the census reports. These reports do not list those towns of size less than 2,500. The use of the above coefficients as they stand would yield results biased downward. An effort was made to compensate by using the average of the coefficients to allow somewhat for the different production rates for towns of varying sizes. This tons/capita/year figure was then used with the total population of the Rio Grande Valley for a total commercial solid waste number for sector 43. The household total was calculated in the same manner using the reported .456 tons/capita/year.

For agricultural production of solid waste, several conversion coefficients were available[15]. These are presented in table 4.

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[14] Hann & James, op. cit.

[15] Ibid.

TABLE 4: AGRICULTURAL SOLID WASTE PRODUCTION COEFFICIENTS[16]

ANIMAL	LBS/HEAD/DAY			
Chickens	0.123	.06	.087	.073
Swine	4.8	.90	1.4	2.2
Beef Cattle	20.5	10.0	-	10.0
Dairy Cattle	35.6	10.0	12.6	-

The averages in column 1 were so out of line with the others that they were discarded. An average of the remaining three is used for each animal.

The use of agricultural solid waste as a further input in production brings up a special problem as to what is pollution and what is not. It was decided that those by-products for which no resources are used for removal will not be classed as pollution. Therefore, those crop wastes that are plowed under or used as feed and those animal wastes that are not removed are not considered. This view eliminates range animals from consideration. Discussions with members of the Texas A&M Agricultural Economics Department indicated that most crop wastes in the Rio Grande Valley is either left in the fields or plowed under for fertilizer. Thus crop wastes are not included in solid waste quantities for agricultural sectors.

Total production of poultry, swine and feed lot cattle for the Rio Grande Valley was combined with the averaged coefficients for animal wastes to produce the total figure desired. These totals are then allocated to the appropriate I-O sectors to complete the solid waste portion of the matrix.

WATER USE

Industrial and municipal water use were supplied from the records of the

[16] Ibid.

Water Development Board in acre feet for 1970. Municipal figures were added and allocated to households. Industrial usage was aggregated by SIC number and allocated to the prescribed I-O sector.

Agricultural water use was found using secondary data. Information on county crop averages was combined with coefficients on per acre water requirements for each crop to produce the total need for each sector.

Texas Water Commission Bulletin 6413[17] presents estimates of crop water requirements for each major crop in the Rio Grande Valley. These requirements are broken into three geographic areas and subdivided as to maximum, average, or minimum needed per crop (see Table 5).

TABLE 5: YEARLY PER ACRE WATER REQUIREMENT PER CROP BY DEPTH IN INCHES

CROP	YEARLY REQUIREMENT	AREA 1	AREA 2	AREA 3
Corn	Maximum	28.8	27.9	25.2
	Average	19.5	16.6	13.6
	Minimum	9.5	4.1	1.8
Citrus	Maximum	36.2	35.4	31.5
	Average	26.3	22.8	18.1
	Minimum	13.7	8.7	6.1

Per acre water requirements in acre feet irrigated cotton and for grain sorghum within each production area were weighted by averages of each crop within each area. This composite, weighted average was then multiplied by total irrigated

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[17] Vandertulip, John J., Louis L. McDaniels, and C. Olen Rucker, Water-Supply Limitations on Irrigation from the Rio Grande in Starr, Hidalgo, Cameron, and Willacy Counties, Texas, Texas Water Commission, Bulletin 6411, Nov. 1964.

cotton acreage in the region to estimate total water use for cotton and grain sorghum.

The total number of acre feet of water used for the region was calculated from data presented in Report 127 of the Texas Water Development Board.[18] Water use for crops other than cotton and grain sorghum (the other irrigated crops sector) was estimated as the differences between this total and estimated water use on cotton and grain sorghum.

DATA LIMITATIONS

The data was collected from the best sources available. Perhaps the severity of its limitations implies that the problem is not yet quite acute enough to provide an incentive for better sources.

The state agencies primary data was excellent. However, the existence of information for the appropriate year (1967) was meager, and use of the closest year available means results biased by an indeterminant amount.

The conflicting coefficients used to generate secondary data provides another degree of uncertainty regarding the results. The use of averages of the coefficients hopefully mitigates the problem, but it is not known to what extent.

Another area of data difficulty is the lack of knowledge concerning some categories. As previously mentioned chemicals used in agriculture leave the application site. While work is being done in the area, it is not known the extent to which it moves through the soil to an unwanted area. The lack of knowledge in this and other areas yields incomplete results.

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[18] Inventories of Irrigation in Texas 1958, 1964, and 1969, Texas Water Development Board, Report 127, May 1971.

Finally, the zeroes found in the direct coefficients table (table 6) and the total resource use table (table A1) do not necessarily mean that none of that resource was used by the particular industry. Where no data was found for an ecologic-economic category, all that could be done was to assume none existed and place a zero in the cell. For example, even though no rail loss from run-off is shown for irrigated crops, the conclusion can not necessarily be drawn that none existed. There is an alternative conclusion possible--no data was found.

ENVIRONMENTAL-ECONOMIC MULTIPLIERS

The eight tables included in this section provide the trade-offs between economic factors and the environment. All of the trade-offs revolve around the relation between production of goods and services to meet consumer demand and resources required by the technology used for that production. Similarly, given the existing set of relative prices, employment and income are directly linked with production and its technology. The following multipliers then are all alternative ways of examining the effects of changes in consumer demand for goods and services.

Table 6 presents the technical relations between production and resource use. The entries give the units of resources used for each $10,000 of output produced and are the elements b_{kj} of the matrix B in equation 5. These average amounts of resources imported from the environment are assumed to be fixed coefficients of production. Therefore, for every $10,000 of irrigated cotton produced in response to consumer demand, 38.640 acre feet of water will be used directly as an input (table 6). Table 6 is then a continuation of the production function presented in the direct requirement matrix of the Rio Grande Valley input-output study.

Just as table 6 provided the direct environmental effect of $10,000 of each sector's output, table 7 presents the total effect. As indicated in the methodology section, secondary (or indirect) effects on resource use result from the interindustry linkages within an economy. The total effect given by the resource-output multipliers include both the direct and the indirect effects. For example, a $10,000 increase in final demand for irrigated cotton results in total water use increases of 38.9188 acre feet by all

Table 6: Resource Use per $10000 of Output

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		IRR COTTON	IRR GRAINS	OTHER IRR	DRYLAND COTTON	DRYLAND FDGRAIN	OTHER DRYLAND
1	NO-X	0.0	0.0	0.0	0.0	0.0	0.0
2	SO-X	0.0	0.0	0.0	0.0	0.0	0.0
3	HC	0.0	0.0	0.0	0.0	0.0	0.0
4	CO	0.0	0.0	0.0	0.0	0.0	0.0
5	PART.	0.0	0.0	0.0	0.0	0.0	0.0
6	HS	0.0	0.0	0.0	0.0	0.0	0.0
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	0.0	0.0	0.0	0.0	0.0	0.0
9	BOD	0.0	0.0	0.0	0.0	0.0	0.0
10	COD	0.0	0.0	0.0	0.0	0.0	0.0
11	TSS	107.406616	435.284912	0.306171	258.109863	1267.844727	148.331131
12	VSS	0.0	0.0	0.0	0.0	0.0	0.0
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	0.0	0.0	0.0	0.0	0.0	0.0
15	S.WASTE(S)	0.0	0.0	0.0	0.0	0.0	0.0
16	WATER USE	38.640244	116.095016	66.786789	0.0	0.0	0.0

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 6: Resource Use per $10000 of Output

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		LIVESTK	DAIRY POULT	AGRI SUPPLY	GINNING	AGRI SERV	FISH
1	NO-X	0.0	0.0	0.0	-0.001922	0.0	0.0
2	SO-X	0.0	0.0	0.0	0.0	0.0	0.0
3	HC	0.0	0.0	0.0	-0.038232	0.0	0.0
4	CO	0.0	0.0	0.0	-0.191158	0.0	0.0
5	PART.	0.0	0.0	0.0	-2.016878	-3.390277	0.0
6	HS	0.0	0.0	0.0	0.0	0.0	0.0
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	0.0	0.0	0.0	0.0	0.0	0.0
9	BOD	0.0	0.0	0.0	0.0	0.0	0.0
10	COD	0.0	0.0	0.0	0.0	0.0	0.0
11	TSS	-16.173248	0.0	0.0	0.0	0.0	0.0
12	VSS	0.0	0.0	0.0	0.0	0.0	0.0
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	0.0	0.0	0.0	0.0	0.0	0.0
15	S.WASTE(S)	-17.862640	-17.559875	0.0	0.0	0.0	0.0
16	WATER USE	0.0	0.0	0.0	0.0	0.058461	0.0

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 6: Resource Use per $10000 of Output

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		PETROL GAS SERV	RES CONSTR	COMM CONSTR	OTHER CONSTR	MEAT PROD	DAIRY MANUF
1	NO-X	-0.764807	0.0	0.0	0.0	0.0	0.0
2	SO-X	-0.000767	0.0	0.0	0.0	0.0	0.0
3	HC	-0.322025	0.0	0.0	0.0	0.0	0.0
4	CO	-0.005849	0.0	0.0	0.0	0.0	0.0
5	PART.	-0.001638	0.0	0.0	0.0	0.0	0.0
6	HS	-0.000099	0.0	0.0	0.0	0.0	0.0
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	0.0	0.0	0.0	0.0	0.0	0.0
9	BOD	-0.000006	0.0	0.0	0.0	0.0	0.0
10	COD	-0.000046	0.0	0.0	0.0	0.0	0.0
11	TSS	-0.000006	0.0	0.0	0.0	-0.005479	-0.231002
12	VSS	-0.000006	0.0	0.0	0.0	0.0	0.0
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	0.0	0.0	0.0	-0.069297	0.0	0.0
15	S.WASTE(S)	0.0	-0.350208	-0.730679	-2.593185	0.0	0.0
16	WATER USE	0.083902	0.0	0.0	0.0	0.012412	0.0

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 6: Resource Use per $10000 of Output

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: PREP FOODS	OTHER FOODS	BEVERAGE	TEXT MILL	WOOD PAPER	PUBL PRINTNG
1	NO-X	-0.028806	-0.029414	0.0	0.0	-0.019665	0.0
2	SO-X	-0.000080	-0.009789	0.0	0.0	0.0	0.0
3	HC	-0.005373	0.0	0.0	0.0	-0.003447	0.0
4	CO	-0.000057	0.0	0.0	0.0	0.0	0.0
5	PART.	-0.002401	-0.018741	0.0	0.0	-0.053276	0.0
6	HS	0.0	0.0	0.0	0.0	0.0	0.0
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	0.0	0.0	0.0	0.0	0.0	0.0
9	BOD	-0.009410	0.0	0.0	0.0	0.0	0.0
10	COD	-0.027309	0.0	0.0	0.0	0.0	0.0
11	TSS	-0.026973	0.0	0.0	0.0	0.0	0.0
12	VSS	-0.009230	-0.000008	-0.000002	-0.000001	-0.000001	-0.000002
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	0.0	0.0	0.0	0.0	0.0	0.0
15	S.WASTE(S)	-0.130020	-0.350008	-1.376257	-0.343107	-0.841343	-0.164650
16	WATER USE	0.285434	0.208516	0.0	0.008307	0.0	0.0

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 6: Resource Use per $10000 of Output

Rio Grande Valley of Texas, 1967

ENVIRONMENTAL[1]		ECONOMIC SECTORS					
	FACTORS	CHEM DRUGS	PETRO PROD	CLAY STONE	CEMENT	FOUND FORGE	FAB STL&METL
1	NO-X	-0.340738	0.0	0.0	-0.099654	0.0	0.0
2	SO-X	-0.286053	0.0	0.0	0.0	0.0	0.0
3	HC	-2.305041	0.0	0.0	-0.007975	0.0	0.0
4	CO	-14.093580	0.0	0.0	-0.019972	0.0	0.0
5	PART.	-0.083679	0.0	0.0	-0.243956	0.0	0.0
6	HS	-0.099981	0.0	0.0	0.0	0.0	0.0
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	0.0	0.0	0.0	0.0	0.0	0.0
9	BOD	-0.002190	-0.000489	0.0	-0.000825	0.0	0.0
10	COD	-0.000170	-0.001125	0.0	-0.016925	-0.158928	0.0
11	TSS	-0.001071	-0.000113	0.0	-0.006060	-0.000894	-1.209604
12	VSS	-0.000021	-0.000089	0.0	-0.001125	-0.000322	0.0
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-5.312506	0.0	0.0	0.0	0.0	0.0
15	S.WASTE(S)	-0.531250	0.0	-0.154790	-0.578125	-93.494080	0.0
16	WATER USE	0.042934	0.0	0.0	0.0	0.904639	0.0

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 6: Resource Use per $10000 of Output

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	MACH EQUIP	ELEC EQUIP	TRANS EQUIP	OTHER MANUF	MOTOR FRGT	WATER TRANSP
		ECONOMIC SECTORS					
1	NO-X	0.0	0.0	0.0	0.0	-3.528066	0.0
2	SO-X	0.0	0.0	0.0	0.0	-0.257570	0.0
3	HC	0.0	0.0	0.0	0.0	-0.354732	0.0
4	CO	0.0	0.0	0.0	0.0	-2.146263	0.0
5	PART.	0.0	0.0	0.0	0.0	-0.002108	0.0
6	HS	0.0	0.0	0.0	0.0	0.0	0.0
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	0.0	0.0	0.0	0.0	0.0	0.0
9	BOD	0.0	0.0	0.0	0.0	0.0	0.0
10	COD	0.0	0.0	0.0	0.0	0.0	0.0
11	TSS	0.0	0.0	0.0	-0.726009	0.0	0.0
12	VSS	0.0	0.0	0.0	0.0	0.0	0.0
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	0.0	0.0	0.0	0.0	0.0	0.0
15	S.WASTE(S)	-0.540001	-0.166513	-0.552005	0.0	-0.963101	-0.499999
16	WATER USE	0.000439	0.0	0.0	0.0	0.0	0.0

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 6: Resource Use per $10000 of Output

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		AIR TRANSP	OTHER TRANSP	COMMUN	GAS SER	ELEC SER	WATER SANIT
1	NO-X	-0.002012	-0.065971	0.0	0.0	-12.975444	0.0
2	SO-X	-1.314845	-0.056904	0.0	0.0	-0.126469	0.0
3	HC	-0.000161	-0.044241	0.0	0.0	-0.154767	0.0
4	CO	-0.000402	-0.061907	0.0	0.0	-0.001739	0.0
5	PART.	-0.320664	-0.012991	0.0	-0.000539	-0.058018	0.0
6	HS	0.0	0.0	0.0	0.0	0.0	0.0
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.003380	0.0	0.0	0.0	0.0	0.0
9	BOD	0.0	-0.000003	0.0	0.0	0.0	0.0
10	COD	0.0	-0.000075	0.0	0.0	-0.000545	0.0
11	TSS	0.0	-0.000003	0.0	0.0	-0.000228	0.0
12	VSS	0.0	-0.000003	0.0	0.0	-0.000079	0.0
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	0.0	0.0	0.0	0.0	0.0	0.0
15	S.WASTE(S)	0.0	-0.161046	0.0	0.0	0.0	0.0
16	WATER USE	0.0	0.0	0.0	0.004733	1.467677	0.0

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 6: Resource Use per $10000 of Output

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: COMMERCE	ECONOMIC SECTORS: HOUSE HOLDS
1	NO-X	-0.219879	0.0
2	SO-X	-0.006113	0.0
3	HC	-0.401425	0.0
4	CO	-2.482388	0.0
5	PART.	-0.010244	0.0
6	HS	0.0	0.0
7	H-2SO-4	0.0	0.0
8	FL	0.0	0.0
9	BOD	-0.000176	-0.000261
10	COD	-0.000000	0.0
11	TSS	-0.000128	-0.000470
12	VSS	-0.000000	0.0
13	S-SOL	0.0	-0.000046
14	S.WASTE(L)	0.0	0.0
15	S.WASTE(S)	-3.006259	-2.228746
16	WATER USE	0.0	0.916697

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 7: Type I Resource - Final Demand Interdependence Matrix,

Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in final demand)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: IRR COTTON	IRR GRAINS	OTHER IRR	DRYLAND COTTON	DRYLAND FDGRAIN	OTHER DRYLAND
1	NO-X	-0.281434	-0.258635	-0.239093	-0.246095	-0.309594	-0.220210
2	SO-X	-0.033498	-0.028173	-0.031287	-0.027672	-0.034711	-0.027119
3	HC	-0.319491	-0.293893	-0.304131	-0.267286	-0.362614	-0.271257
4	CO	-1.879983	-1.708174	-1.807836	-1.566411	-2.108251	-1.605077
5	PART.	-0.400842	-0.359224	-0.118582	-0.241104	-0.206457	-0.168757
6	HS	-0.009965	-0.008125	-0.009508	-0.008238	-0.010231	-0.008113
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000003	-0.000003	-0.000002	-0.000002	-0.000003	-0.000002
9	BOD	-0.000273	-0.000254	-0.000255	-0.000229	-0.000315	-0.000228
10	COD	-0.000187	-0.000387	-0.000139	-0.000959	-0.000296	-0.000132
11	TSS	-108.684860	-436.009766	-3.354338	-259.653809	-1274.324707	-151.880295
12	VSS	-0.000013	-0.000016	-0.000011	-0.000013	-0.000019	-0.000011
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-0.530463	-0.432265	-0.506015	-0.438602	-0.544285	-0.431733
15	S.WASTE(S)	-0.812576	-1.034236	-0.730516	-1.138646	-1.086551	-0.726095
16	WATER USE	38.918762	116.142029	67.680237	0.041302	1.656666	0.033664

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 7: Type I Resource - Final Demand Interdependence Matrix,

Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in final demand)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		LIVESTK	DAIRY POULT	AGRI SUPPLY	GINNING	AGRI SERV	FISH
1	NO-X	-0.248156	-0.422947	-0.303788	-0.848000	-0.330095	-0.090941
2	SO-X	-0.017361	-0.027774	-0.004721	-0.011777	-0.057741	-0.002782
3	HC	-0.143406	-0.230995	-0.112978	-0.103737	-0.450495	-0.049994
4	CO	-0.855422	-1.350065	-0.673821	-0.500111	-2.653242	-0.271363
5	PART.	-0.143386	-0.183152	-0.004219	-2.023034	-3.418752	-0.006046
6	HS	-0.002495	-0.003553	-0.000020	-0.000082	-0.016144	-0.000271
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000001	-0.000002	-0.000001	-0.000001	-0.000017	-0.000000
9	BOD	-0.000095	-0.000159	-0.000056	-0.000034	-0.000405	-0.000047
10	COD	-0.000063	-0.000137	-0.000035	-0.000153	-0.000215	-0.000071
11	TSS	-57.204086	-155.016846	-0.089316	-0.039892	-6.307194	-2.295747
12	VSS	-0.000008	-0.000015	-0.000009	-0.000015	-0.000014	-0.000013
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-0.133511	-0.189741	-0.001109	-0.011576	-0.857942	-0.014372
15	S.WASTE(S)	-22.116440	-18.743973	-0.831034	-0.637490	-1.369430	-0.808917
16	WATER USE	0.221849	0.551810	0.038230	0.092983	0.136490	0.118171

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 7: Type I Resource - Final Demand Interdependence Matrix,

Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in final demand)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: PETROL GAS SERV	RES CONSTR	COMM CONSTR	OTHER CONSTR	MEAT PROD	DAIRY MANUF
1	NO-X	-0.887000	-0.120917	-0.082455	-0.117443	-0.206098	-0.153436
2	SO-X	-0.004899	-0.007604	-0.005588	-0.004447	-0.009833	-0.009876
3	HC	-0.365079	-0.096492	-0.054556	-0.061847	-0.084100	-0.084426
4	CO	-0.097736	-0.566783	-0.302599	-0.353581	-0.493478	-0.491329
5	PART.	-0.002945	-0.008564	-0.009730	-0.014978	-0.072745	-0.064306
6	HS	-0.000316	-0.001785	-0.001382	-0.000464	-0.001273	-0.001254
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000005	-0.000001	-0.000000	-0.000001	-0.000001	-0.000001
9	BOD	-0.000021	-0.000084	-0.000074	-0.000081	-0.000054	-0.000064
10	COD	-0.000085	-0.000355	-0.000605	-0.000962	-0.000041	-0.000066
11	TSS	-0.007583	-0.050998	-0.030591	-0.064541	-31.248550	-54.513168
12	VSS	-0.000008	-0.000025	-0.000039	-0.000061	-0.000005	-0.000011
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-0.011191	-0.094926	-0.073496	-0.094953	-0.068119	-0.066937
15	S.WASTE(S)	-0.102668	-0.793899	-0.924642	-3.084519	-10.911678	-6.576283
16	WATER USE	0.96778	0.015168	0.009508	0.012891	0.143267	0.211215

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 7: Type I Resource - Final Demand Interdependence Matrix,

Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in final demand)

ENVIRONMENTAL[1]		ECONOMIC SECTORS					
	FACTORS	PREP FOODS	OTHER FOODS	BEVERAGE	TEXT MILL	WOOD PAPER	PUBL PRINTNG
1	NO-X	-0.181315	-0.283696	-0.120483	-0.098883	-0.124819	-0.141464
2	SO-X	-0.005212	-0.016423	-0.002328	-0.003913	-0.004996	-0.003941
3	HC	-0.056303	-0.041515	-0.016670	-0.016339	-0.025614	-0.022409
4	CO	-0.287172	-0.192183	-0.090469	-0.022742	-0.107316	-0.115289
5	PART.	-0.016879	-0.048655	-0.001290	-0.002036	-0.055031	-0.001255
6	HS	-0.001028	-0.000668	-0.000136	-0.000028	-0.000413	-0.000019
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000000	-0.000000	-0.000000	-0.000001	-0.000001	-0.000000
9	BOD	-0.009459	-0.000030	-0.000009	-0.000003	-0.000012	-0.000009
10	COD	-0.027372	-0.000059	-0.000009	-0.000024	-0.000016	-0.000013
11	TSS	-1.364543	-33.184357	-0.144238	-0.167812	-0.181752	-0.024048
12	VSS	-0.009230	-0.000008	-0.000002	-0.000001	-0.000001	-0.000002
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-0.054721	-0.035783	-0.007258	-0.001405	-0.021942	-0.001023
15	S.WASTE(S)	-0.523204	-0.572670	-1.501581	-0.392689	-0.910238	-0.300036
16	WATER USE	6.847003	1.892332	0.084365	0,078212	0.019124	0.013221

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 7: Type I Resource - Final Demand Interdependence Matrix,

Rio Grande Valley of Texas, 1967
(Resource change per $10,000 change in final demand)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: CHEM DRUGS	PETRO PROD	CLAY STONE	CEMENT	FOUND FORGE	FAB STL&METL
1	NO-X	-1.171724	-0.492365	-0.937567	-0.332946	-0.297925	-0.072699
2	SO-X	-0.307102	-0.010362	-0.029822	-0.015613	-0.005835	-0.001034
3	HC	-2.431365	-0.229498	-0.115666	-0.051595	-0.044645	-0.011106
4	CO	-14.531571	-0.402609	-0.320659	-0.203541	-0.187239	-0.059145
5	PART.	-0.091074	-0.003860	-0.008777	-0.251294	-0.002696	-0.000638
6	HS	-0.102157	-0.002513	-0.000718	-0.000019	-0.000040	-0.000025
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000005	-0.000003	-0.000002	-0.000000	-0.000000	-0.000000
9	BOD	-0.002253	-0.000553	-0.000038	-0.000853	-0.000016	-0.000005
10	COD	-0.000821	-0.001193	-0.000225	-0.018091	-0.158968	-0.000011
11	TSS	-0.039209	-0.007214	-0.044431	-0.019183	-0.115804	-1.218073
12	VSS	-0.000031	-0.000095	-0.000013	-0.001155	-0.000326	-0.000001
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-5.429294	-0.131028	-0.037660	-0.001016	-0.002027	-0.001354
15	S.WASTE(S)	-1.113648	-0.104301	-0.460505	-1.185156	-93.733917	-0.076035
16	WATER USE	0.137473	0.053970	0.09005	0.011681	0.943642	0.008783

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 7: Type I Resource - Final Demand Interdependence Matrix,

Rio Grande Valley of Texas, 1967
(Resource change per $10,000 change in final demand)

	ENVIRONMENTAL [1] FACTORS	ECONOMIC SECTORS: MACH EQUIP	ELEC EQUIP	TRANS EQUIP	OTHER MANUF	MOTOR FRGT	WATER TRANSP
1	NO-X	-0.057854	-0.081973	-0.090517	-0.303910	-3.888937	-0.128799
2	SO-X	-0.002872	-0.006988	-0.001456	-0.010035	-0.262370	-0.002993
3	HC	-0.014034	-0.039455	-0.033881	-0.052319	-0.434844	-0.085626
4	CO	-0.075249	-0.216819	-0.200399	-0.182149	-2.575891	-0.476538
5	PART.	-0.001118	-0.002178	-0.001277	-0.005595	-0.005681	-0.002645
6	HS	-0.000060	-0.001129	-0.000013	-0.000812	-0.000070	-0.000116
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000004	-0.000005	-0.000000	-0.000001	-0.000001	-0.000001
9	BOD	-0.000008	-0.000030	-0.000017	-0.000025	-0.000047	-0.000060
10	COD	-0.001137	-0.000299	-0.000013	-0.000133	-0.000064	-0.000751
11	TSS	-0.037509	-0.036848	-0.048249	-2.603603	-0.056139	-0.060843
12	VSS	-0.000004	-0.000002	-0.000003	-0.000004	-0.000009	-0.000011
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-0.003269	-0.060085	-0.000703	-0.043357	-0.004440	-0.006404
15	S.WASTE(S)	-1.299097	-0.420848	-0.800778	-0.172410	-1.513282	-1.608435
16	WATER USE	0.069642	0.011413	0.011539	0.034578	0.043096	0.020589

[1] See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 7: Type I Resource - Final Demand Interdependence Matrix,

Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in final demand)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: AIR TRANSP	OTHER TRANSP	COMMUN	GAS SER	ELEC SER	WATER SANIT
1	NO-X	-0.076397	-0.724361	-0.114220	-0.573895	-13.075243	-0.946791
2	SO-X	-1.457348	-0.062634	-0.002826	-0.003509	-0.128071	-0.013150
3	HC	-0.039950	-0.287338	-0.009466	-0.235288	-0.197899	-0.055509
4	CO	-0.130248	-0.172877	-0.044003	-0.099684	-0.075834	-0.249179
5	PART.	-0.355910	-0.016092	-0.001012	-0.002640	-0.058837	-0.009935
6	HS	-0.000286	-0.000236	-0.000008	-0.000203	-0.000039	-0.001179
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.003742	-0.000005	-0.000003	-0.000003	-0.000001	-0.000000
9	BOD	-0.000069	-0.000025	-0.000004	-0.000017	-0.000008	-0.000049
10	COD	-0.000139	-0.000455	-0.000009	-0.000058	-0.000566	-0.000380
11	TSS	-0.011860	-0.054760	-0.006385	-0.009608	-0.009248	-0.014548
12	VSS	-0.000012	-0.000012	-0.000001	-0.000006	-0.000081	-0.000027
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-0.014934	-0.010271	-0.000432	-0.007368	-0.001736	-0.066503
15	S.WASTE(S)	-0.116737	-0.508172	-0.055549	-0.114075	-0.095392	-0.284665
16	WATER USE	0.008653	0.076335	0.012714	0.067471	1.478992	0.107133

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 7: Type I Resource - Final Demand Interdependence Matrix,

Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in final demand)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS COMMERCE
1	NO-X	-0.441806
2	SO-X	-0.011001
3	HC	-0.432652
4	CO	-2.650544
5	PART.	-0.012850
6	HS	-0.000055
7	H-2SO-4	0.0
8	FL	-0.000004
9	BOD	-0.000218
10	COD	-0.000101
11	TSS	-0.346251
12	VSS	-0.000031
13	S-SOL	0.0
14	S.WASTE(L)	-0.003122
15	S.WASTE(S)	-3.259646
16	WATER USE	0.064482

[1]See glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

economic sectors in the region (table 7).

It can be seen that while not every industry is a direct user of a particular resource, the links with other industries in the economy make all sectors influential in resource use. Except for water use, all of the multipliers for irrigated cotton are the result of that industry's use of inputs from other sectors whose production processes include the use of environmental factors[1].

The comparative relationship between income generated and environmental effects is presented in table 8. Each entry in table 8 gives the number of resource units imported from the environment for each $10,000 of income generated in each industry. For example, for each $10,000 of income generated by irrigated cotton, its production generates, directly and indirectly, .502299 tons of nitrogen oxides (table 8). These multipliers give costs in terms physical quantities of the environment factors of every $10,000 increase in income generated by the various industries[2]. Similarly, the cost in terms of income of a limitation of these environmental imports is indicated, ceterus paribus.

Table 9 is similar to table 8. The difference is that the trade-offs between the environmental factors and employment is given. As resource use expands and contracts along with production, so does employment. Again submerging the production aspect and comparing the other two variables, the resource-employment multipliers result.

Table 9 shows the unit change in the use of the selected environmental factors which accompany the addition or subtraction of 10,000 man-years in each

[1]The multipliers for sulphuric acid and settling solids are zero because none of the interrelated industries produce them in any significant amounts.

[2]Technology, prices, and all things other than income & output are assumed constant.

Table 8: Type I Resource - Income Multipliers,

Rio Grande Valley of Texas, 1967
(Resource change per $10,000 change in income)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: IRR COTTON	IRR GRAINS	OTHER IRR	DRYLAND COTTON	DRYLAND FDGRAIN	OTHER DRYLAND
1	NO-X	-0.502299	-0.652469	-0.425453	-0.409946	-0.778448	-0.657563
2	SO-X	-0.059786	-0.071072	-0.055674	-0.046097	-0.087278	-0.080980
3	HC	-0.570222	-0.741413	-0.541185	-0.445246	-0.911763	-0.809994
4	CO	-3.355361	-4.309269	-3.216949	-2.609332	-5.301023	-4.792875
5	PART.	-0.715416	-0.906228	-0.211011	-0.401632	-0.519119	-0.503920
6	HS	-0.017786	-0.020498	-0.016920	-0.013722	-0.025725	-0.024226
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000005	-0.000008	-0.000003	-0.000003	-0.000007	-0.000006
9	BOD	-0.000487	-0.000640	-0.000454	-0.000382	-0.000792	-0.000680
10	COD	-0.000334	-0.000976	-0.000247	-0.001597	-0.000746	-0.000395
11	TSS	-193.978867	-1099.937012	-5.968868	-432.531982	-3204.185059	-453.525391
12	VSS	-0.000022	-0.000039	-0.000019	-0.000021	-0.000047	-0.000032
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-0.946762	-1.090488	-0.900427	-0.730625	-1.368560	-1.289186
15	S.WASTE(S)	-1.450272	-2.609102	-1.299914	-1.896760	-2.732042	-2.168172
16	WATER USE	69.461533	292.995361	120.433426	0.068801	4.165550	0.100523

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 8: Type I Resource - Income Multipliers,

Rio Grande Valley of Texas, 1967
(Resource change per $10,000 change in income)

	ENVIRONMENTAL [1] FACTORS	ECONOMIC SECTORS					
		LIVESTK	DAIRY POULT	AGRI SUPPLY	GINNING	AGRI SERV	FISH
1	NO-X	-0.372698	-2.823393	-0.581892	-1.626426	-0.985375	-0.180028
2	SO-X	-0.026074	-0.185409	-0.009042	-0.022587	-0.172364	-0.005506
3	HC	-0.215377	-1.542016	-0.216404	-0.198963	-1.344785	-0.098969
4	CO	-1.284730	-9.012401	-1.290669	-0.959191	-7.920262	-0.537194
5	PART.	-0.215347	-1.222637	-0.008081	-3.880091	-10.205405	-0.011968
6	HS	-0.003747	-0.023717	-0.000038	-0.000157	-0.048191	-0.000536
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000002	-0.000015	-0.000002	-0.000001	-0.000052	-0.000001
9	BOD	-0.000143	-0.001061	-0.000106	-0.000065	-0.001208	-0.000093
10	COD	-0.000095	-0.000912	-0.000068	-0.000294	-0.000642	-0.000140
11	TSS	-85.912949	-1034.819580	-0.171080	-0.076510	-18.827759	-4.544693
12	VSS	-0.000012	-0.000103	-0.000017	-0.000028	-0.000041	-0.000026
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-0.200516	-1.266621	-0.002125	-0.022202	-2.561066	-0.028450
15	S.WASTE(S)	-33.215958	-125.125946	-1.591804	-1.222677	-4.087920	-1.601343
16	WATER USE	0.333188	3.683626	0.073227	0.178337	0.407439	0.233933

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 8: Type I Resource - Income Multipliers,

Rio Grande Valley of Texas, 1967
(Resource change per $10,000 change in income)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		PETROL GAS SERV	RES CONSTR	COMM CONSTR	OTHER CONSTR	MEAT PROD	DAIRY MANUF
1	NO-X	-2.148686	-0.266922	-0.197708	-0.229177	-0.491343	-0.668908
2	SO-X	-0.011867	-0.016785	-0.013398	-0.008678	-0.023443	-0.043055
3	HC	-0.884375	-0.213003	-0.130812	-0.120688	-0.200497	-0.368057
4	CO	-0.236758	-1.251158	-0.725567	-0.689976	-1.176462	-2.141960
5	PART.	-0.007134	-0.018904	-0.023330	-0.029228	-0.173427	-0.280343
6	HS	-0.000765	-0.003940	-0.003313	-0.000906	-0.003036	-0.005465
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000013	-0.000001	-0.000001	-0.000001	-0.000002	-0.000004
9	BOD	-0.000050	-0.000185	-0.000178	-0.000157	-0.000130	-0.000277
10	COD	-0.000206	-0.000785	-0.001450	-0.001877	-0.000097	-0.000289
11	TSS	-0.018369	-0.112577	-0.073350	-0.125945	-74.497314	-237.651245
12	VSS	-0.000020	-0.000056	-0.000094	-0.000120	-0.000013	-0.000046
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-0.027109	-0.209547	-0.176228	-0.185290	-0.162398	-0.291813
15	S.WASTE(S)	-0.248704	-1.752512	-2.217088	-6.019109	-26.013702	-28.669434
16	WATER USE	0.234438	0.033483	0.022798	0.025116	0.341551	0.920794

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 8: Type I Resource - Income Multipliers,

Rio Grande Valley of Texas, 1967
(Resource change per $10,000 change in income)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: PREP FOODS	OTHER FOODS	BEVERAGE	TEXT MILL	WOOD PAPER	PUBL PRINTNG
1	NO-X	-0.583476	-1.227715	-0.370680	-0.220416	-0.686927	-0.339149
2	SO-X	-0.016773	-0.071071	-0.007164	-0.008723	-0.027494	-0.009447
3	HC	-0.181183	-0.179658	-0.051287	-0.036420	-0.140964	-0.053723
4	CO	-0.924129	-0.831686	-0.278338	-0.050694	-0.590598	-0.278074
5	PART.	-0.054318	-0.210560	-0.003969	-0.004538	-0.302857	-0.003009
6	HS	-0.003308	-0.002891	-0.000420	-0.000062	-0.002272	-0.000046
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000001	-0.000002	-0.000000	-0.000002	-0.000005	-0.000001
9	BOD	-0.030440	-0.000129	-0.000026	-0.000006	-0.000067	-0.000020
10	COD	-0.088085	-0.000257	-0.000029	-0.000054	-0.000088	-0.000031
11	TSS	-4.391142	-143.607590	-0.443766	-0.374063	-1.000250	-0.057652
12	VSS	-0.029702	-0.000036	-0.000005	-0.000002	-0.000006	-0.000004
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-0.176092	-0.154851	-0.022331	-0.003133	-0.120755	-0.002453
15	S.WASTE(S)	-1.683686	-2.478269	-4.619788	-0.875332	-5.009378	-0.719309
16	WATER USE	22.033859	8.189198	0.259557	0.174340	0.105246	0.031696

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 8: Type I Resource - Income Multipliers,

Rio Grande Valley of Texas, 1967
(Resource change per $10,000 change in income)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		CHEM DRUGS	PETRO PROD	CLAY STONE	CEMENT	FOUND FORGE	FAB STL&METL
1	NO-X	-3.149019	-2.121115	-2.182150	-1.424113	-0.711585	-0.227517
2	SO-X	-0.825341	-0.044638	-0.069411	-0.066782	-0.013938	-0.003237
3	HC	-6.534315	-0.988679	-0.269207	-0.220686	-0.106632	-0.034758
4	CO	-39.053726	-1.734444	-0.746322	-0.870606	-0.447215	-0.185100
5	PART.	-0.244763	-0.016628	-0.020429	-1.074862	-0.006440	-0.001995
6	HS	-0.274549	-0.010824	-0.001671	-0.000083	-0.000095	-0.000078
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000013	-0.000012	-0.000004	-0.000002	-0.000001	-0.000001
9	BOD	-0.006056	-0.002383	-0.000088	-0.003648	-0.000038	-0.000016
10	COD	-0.002207	-0.005141	-0.000523	-0.077381	-0.379689	-0.000035
11	TSS	-0.105375	-0.031080	-0.103412	-0.082083	-0.276595	-3.812074
12	VSS	-0.000085	-0.000407	-0.000031	-0.004941	-0.000779	-0.000004
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-14.591275	-0.564471	-0.087652	-0.004346	-0.004841	-0.004238
15	S.WASTE(S)	-2.992940	-0.449330	-1.071808	-5.069278	-223.880722	-0.237958
16	WATER USE	0.369459	0.232502	0.209484	0.049964	2.253861	0.027487

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 8: Type I Resource - Income Multipliers,

Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in income)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: MACH EQUIP	ELEC EQUIP	TRANS EQUIP	OTHER MANUF	MOTOR FRGT	WATER TRANSP
1	NO-X	-0.228814	-0.246326	-0.263776	-0.990836	-8.632811	-0.195827
2	SO-X	-0.011360	-0.021000	-0.004243	-0.032717	-0.582420	-0.004551
3	HC	-0.055505	-0.118562	-0.098732	-0.170575	-0.965284	-0.130186
4	CO	-0.297612	-0.651531	-0.583984	-0.593857	-5.718062	-0.724532
5	PART.	-0.004424	-0.006546	-0.003722	-0.018242	-0.012611	-0.004022
6	HS	-0.000236	-0.003394	-0.000037	-0.002647	-0.000155	-0.000177
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000016	-0.000016	-0.000001	-0.000004	-0.000002	-0.000001
9	BOD	-0.000031	-0.000090	-0.000048	-0.000081	-0.000104	-0.000092
10	COD	-0.004496	-0.000899	-0.000037	-0.000433	-0.000142	-0.001142
11	TSS	-0.148347	-0.110726	-0.140602	-8.488501	-0.124620	-0.092506
12	VSS	-0.000016	-0.000006	-0.000008	-0.000014	-0.000020	-0.000017
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-0.012927	-0.180553	-0.002050	-0.141357	-0.009856	-0.009736
15	S.WASTE(S)	-5.137962	-1.264629	-2.333554	-0.562106	-3.359241	-2.445476
16	WATER USE	0.275437	0.034296	0.033626	0.112736	0.095667	0.031303

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 8: Type I Resource - Income Multipliers,

Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in income)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		AIR TRANSP	OTHER TRANSP	COMMUN	GAS SER	ELEC SER	WATER SANIT
1	NO-X	-0.216918	-1.976037	-0.451387	-1.587651	-60.173508	-2.356837
2	SO-X	-4.137918	-0.170863	-0.011170	-0.009709	-0.589396	-0.032735
3	HC	-0.113433	-0.783852	-0.037410	-0.650914	-0.910750	-0.138178
4	CO	-0.369820	-0.471603	-0.173897	-0.275770	-0.348993	-0.620278
5	PART.	-1.010553	-0.043900	-0.003999	-0.007305	-0.270773	-0.024730
6	HS	-0.000811	-0.000645	-0.000030	-0.000561	-0.000178	-0.002935
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.010626	-0.000014	-0.000013	-0.000010	-0.000003	-0.000001
9	BOD	-0.000197	-0.000069	-0.000016	-0.000046	-0.000037	-0.000123
10	COD	-0.000393	-0.001240	-0.000036	-0.000162	-0.002603	-0.000947
11	TSS	-0.033674	-0.149383	-0.025234	-0.026579	-0.042559	-0.036215
12	VSS	-0.000033	-0.000032	-0.000005	-0.000016	-0.000372	-0.000068
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-0.042404	-0.028020	-0.001708	-0.020383	-0.007991	-0.165545
15	S.WASTE(S)	-0.331456	-1.386280	-0.219525	-0.315584	-0.439002	-0.708614
16	WATER USE	0.024570	0.208239	0.050244	0.186654	6.806464	0.266685

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 8: Type I Resource - Income Multipliers

Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in income)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS COMMERCE
1	NO-X	-1.027187
2	SO-X	-0.025577
3	HC	-1.005903
4	CO	-6.162448
5	PART.	-0.029875
6	HS	-0.000127
7	H-2SO-4	0.0
8	FL	-0.000009
9	BOD	-0.000506
10	COD	-0.000235
11	TSS	-0.805024
12	VSS	-0.000072
13	S-SOL	0.0
14	S.WASTE(L)	-0.007259
15	S.WASTE(S)	-7.578595
16	WATER USE	0.149919

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 9: Resource - Employment Multipliers

Rio Grande Valley of Texas, 1967
(Resource change per 10,000 man years)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: IRR COTTON	IRR GRAINS	OTHER IRR	DRYLAND COTTON	DRYLAND FDGRAIN	OTHER DRYLAND
1	NO-X	-0.369574	-0.221219	-0.118357	-0.326021	-0.271042	-0.158267
2	SO-X	-0.043988	-0.024097	-0.015488	-0.036660	-0.030389	-0.019491
3	HC	-0.419550	-0.251376	-0.150552	-0.354094	-0.317460	-0.194955
4	CO	-2.468759	-1.461055	-0.894923	-2.075144	-1.845722	-1.153584
5	PART.	-0.526379	-0.307256	-0.058701	-0.319409	-0.180748	-0.121287
6	HS	-0.013086	-0.006950	-0.004707	-0.010913	-0.008957	-0.005831
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000004	-0.000003	-0.000001	-0.000002	-0.000003	-0.000001
9	BOD	-0.000359	-0.000217	-0.000126	-0.000304	-0.000276	-0.000164
10	COD	-0.000246	-0.000331	-0.000069	-0.001270	-0.000260	-0.000095
11	TSS	-142.565277	-372.608154	-1.659783	-343.657471	-1114.464355	-109.092270
12	VSS	-0.000017	-0.000013	-0.000005	-0.000017	-0.000016	-0.000008
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-0.696594	-0.369730	-0.250490	-0.581050	-0.476509	-0.310291
15	S.WASTE(S)	-1.067060	-0.884615	-0.361623	-1.508451	-0.951249	-0.521851
16	WATER USE	51.107391	99.339951	33.503357	0.054716	1.450371	0.024195

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 9: Resource - Employment Multipliers

Rio Grande Valley of Texas, 1967
(Resource change per 10,000 man years)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		LIVESTK	DAIRY POULT	AGRI SUPPLY	GINNING	AGRI SERV	FISH
1	NO-X	-0.172264	-0.352615	-0.455380	-0.419932	-0.450604	-0.094603
2	SO-X	-0.012051	-0.023156	-0.007076	-0.005832	-0.078821	-0.002894
3	HC	-0.099549	-0.192583	-0.169355	-0.051371	-0.614959	-0.052007
4	CO	-0.593814	-1.125562	-1.010059	-0.247657	-3.621869	-0.282289
5	PART.	-0.099535	-0.152696	-0.006324	-1.001813	-4.666845	-0.006289
6	HS	-0.001732	-0.002962	-0.000030	-0.000041	-0.022037	-0.000282
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000001	-0.000002	-0.000002	-0.000000	-0.000024	-0.000000
9	BOD	-0.000066	-0.000132	-0.000083	-0.000017	-0.000552	-0.000049
10	COD	-0.000044	-0.000114	-0.000053	-0.000076	-0.000294	-0.000074
11	TSS	-39.687134	-129.090225	-0.133640	-0.019750	-8.601923	-2.387136
12	VSS	-0.000005	-0.000013	-0.000014	-0.000007	-0.000019	-0.000014
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-0.092680	-0.158189	-0.001663	-0.005732	-1.171153	-0.014950
15	S.WASTE(S)	-15.352705	-15.627033	-1.245722	-0.315687	-1.869371	-0.841487
16	WATER USE	0.154002	0.460050	0.057306	0.046045	0.186318	0.122929

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 9: Resource - Employment Multipliers

Rio Grande Valley of Texas, 1967
(Resource change per 10,000 man years)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: PETROL GAS SERV	RES CONSTR	COMM CONSTR	OTHER CONSTR	MEAT PROD	DAIRY MANUF
1	NO-X	-6.017812	-0.210091	-0.171373	-0.182688	-0.239678	-0.180213
2	SO-X	-0.033235	-0.013211	-0.011613	-0.006918	-0.011436	-0.011600
3	HC	-2.476862	-0.167652	-0.113388	-0.096206	-0.097803	-0.099159
4	CO	-0.663086	-0.984772	-0.628919	-0.550014	-0.573882	-0.577073
5	PART.	-0.019980	-0.014879	-0.020222	-0.023299	-0.084598	-0.075528
6	HS	-0.002141	-0.003101	-0.002872	-0.000722	-0.001481	-0.001472
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000037	-0.000001	-0.000001	-0.000001	-0.000001	-0.000001
9	BOD	-0.000140	-0.000145	-0.000155	-0.000125	-0.000063	-0.000075
10	COD	-0.000577	-0.000618	-0.001257	-0.001496	-0.000047	-0.000078
11	TSS	-0.051411	-0.088522	-0.063555	-0.0100318	-36.317993	-63.987747
12	VSS	-0.000055	-0.000044	-0.000081	-0.000096	-0.000006	-0.000013
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-0.075923	-0.164932	-0.152754	-0.147704	-0.079218	-0.078618
15	S.WASTE(S)	-0.696544	-1.379381	-1.921766	-4.798125	-12.689565	-7.723936
16	WATER USE	0.656588	0.26354	0.019762	0.020021	0.166610	0.248075

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 9: Resource - Employment Multipliers

Rio Grande Valley of Texas, 1967

(Resource change per 10,000 man years)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		PREP FOODS	OTHER FOODS	BEVERAGE	TEXT MILL	WOOD PAPER	PUBL PRINTNG
1	NO-X	-0.171380	-0.788708	-0.145862	-0.075285	-0.027287	-0.180114
2	SO-X	-0.004927	-0.045658	-0.002819	-0.002979	-0.001092	-0.005017
3	HC	-0.053218	-0.115416	-0.020181	-0.012440	-0.005599	-0.028531
4	CO	-0.271438	-0.534291	-0.109526	-0.017315	-0.023460	-0.147678
5	PART.	-0.015954	-0.135267	-0.001562	-0.001550	-0.012030	-0.001598
6	HS	-0.000972	-0.001857	-0.000165	-0.000021	-0.000090	-0.000024
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000000	-0.000001	-0.000000	-0.000001	-0.000000	-0.000000
9	BOD	-0.008941	-0.000083	-0.000010	-0.000002	-0.000003	-0.000011
10	COD	-0.025873	-0.000165	-0.000011	-0.000018	-0.000003	-0.000016
11	TSS	-1.289469	-92.213272	-0.174596	-0.127796	-0.039732	-0.030611
12	VSS	-0.008724	-0.000023	-0.000002	-0.000001	-0.000000	-0.000002
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-0.051722	-0.099479	-0.008787	-0.001070	-0.004797	-0.001303
15	S.WASTE(S)	-0.494538	-1.592088	-1.817883	-0.298979	-0.198987	-0.382008
16	WATER USE	6.471853	5.260898	0.102136	0.059548	0.004181	0.016833

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 9: Resource - Employment Multipliers

Rio Grande Valley of Texas, 1967
(Resource change per 10,000 man years)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		CHEM DRUGS	PETRO PROD	CLAY STONE	CEMENT	FOUND FORGE	FAB STL&METL
1	NO-X	-2.431467	-4.080760	-0.467559	-0.652294	-1.350817	-0.144094
2	SO-X	-0.637274	-0.085878	-0.014872	-0.030589	-0.026458	-0.002050
3	HC	-5.045371	-1.902094	-0.057682	-0.101082	-0.202422	-0.022014
4	CO	-30.154724	-3.336852	-0.159911	-0.398768	-0.848958	-0.117230
5	PART.	-0.188990	-0.031990	-0.004377	-0.492325	-0.012225	-0.001264
6	HS	-0.211989	-0.020824	-0.000358	-0.000038	-0.000180	-0.000049
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000010	-0.000022	-0.000001	-0.000001	-0.000002	-0.000000
9	BOD	-0.004676	-0.004585	-0.000019	-0.001671	-0.000072	-0.000010
10	COD	-0.001704	-0.009891	-0.000112	-0.035443	-0.720773	-0.000022
11	TSS	-0.081330	-0.059751	-0.022155	-0.037573	-0.524302	-2.413838
12	VSS	-0.000065	-0.000784	-0.000007	-0.002263	-0.001478	-0.000002
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-11.266429	-1.085970	-0.018781	-0.001991	-0.009190	-0.002684
15	S.WASTE(S)	-2.310952	-0.864454	-0.229651	-2.321906	-424.997559	-0.150707
16	WATER USE	0.285272	0.447304	0.044885	0.022885	4.278556	0.017409

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 9: Resource - Employment Multipliers

Rio Grande Valley of Texas, 1967

(Resource change per 10,000 man years)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: MACH EQUIP	ELEC EQUIP	TRANS EQUIP	OTHER MANUF	MOTOR FRGT	WATER TRANSP
1	NO-X	-0.147544	-0.070488	-0.120485	-0.442777	-2.214634	-0.172226
2	SO-X	-0.007325	-0.006009	-0.001938	-0.014620	-0.149412	-0.004002
3	HC	-0.035791	-0.033927	-0.045098	-0.076225	-0.247631	-0.114496
4	CO	-0.191906	-0.186441	-0.266746	-0.265378	-1.466893	-0.637211
5	PART.	-0.002852	-0.001873	-0.001700	-0.008152	-0.003235	-0.003537
6	HS	-0.000152	-0.000971	-0.000017	-0.001183	-0.000040	-0.000155
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000010	-0.000005	-0.000000	-0.000002	-0.000001	-0.000001
9	BOD	-0.000020	-0.000026	-0.000022	-0.000036	-0.000027	-0.000081
10	COD	-0.002899	-0.000257	-0.000017	-0.000194	-0.000036	-0.001004
11	TSS	-0.095629	-0.031682	-0.064192	-3.792692	-0.031956	-0.081267
12	VSS	-0.000010	-0.000002	-0.000004	-0.000006	-0.000005	-0.000015
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-0.008336	-0.051667	-0.000936	-0.063169	-0.002529	-0.008563
15	S.WASTE(S)	-3.313048	-0.361884	-1.065898	-0.251190	-0.861769	-2.150746
16	WATER USE	0.177607	0.009814	0.015359	0.050378	0.024542	0.027531

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 9: Resource - Employment Multipliers

Rio Grande Valley of Texas, 1967

(Resource change per 10,000 man years)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		AIR TRANSP	OTHER TRANSP	COMMUN	GAS SER	ELEC SER	WATER SANIT
1	NO-X	-0.099604	-1.635965	-0.216289	-4.256105	-41.564240	-1.129983
2	SO-X	-1.900037	-0.141457	-0.005352	-0.026027	-0.407119	-0.015695
3	HC	-0.052086	-0.648953	-0.017926	-1.744940	-0.629091	-0.066249
4	CO	-0.169813	-0.390441	-0.083326	-0.739272	-0.241064	-0.297392
5	PART.	-0.464023	-0.036345	-0.001916	-0.019582	-0.187033	-0.011857
6	HS	-0.000372	-0.000534	-0.000015	-0.001504	-0.000123	-0.001407
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.004879	-0.000012	-0.000006	-0.000026	-0.000002	-0.000000
9	BOD	-0.000090	-0.000057	-0.000008	-0.000124	-0.000026	-0.000059
10	COD	-0.000181	-0.001027	-0.000017	-0.000434	-0.001798	-0.000454
11	TSS	-0.015459	-0.123635	-0.012090	-0.071184	-0.029386	-0.017360
12	VSS	-0.000015	-0.000026	-0.000002	-0.000043	-0.000257	-0.000032
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-0.019471	-0.023198	-0.000818	-0.054641	-0.005520	-0.079370
15	S.WASTE(S)	-0.152197	-1.147704	-0.105189	-0.846003	-0.303236	-0.339744
16	WATER USE	0.011282	0.172401	0.24075	0.500374	4.701496	0.127862

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 9: Resource - Employment Multipliers

Rio Grande Valley of Texas, 1967

(Resource change per 10,000 man years)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS COMMERCE
1	NO-X	-0.732344
2	SO-X	-0.018236
3	HC	-0.717169
4	CO	-4.393579
5	PART.	-0.021300
6	HS	-0.000091
7	H-2SO-4	0.0
8	FL	-0.000006
9	BOD	-0.000361
10	COD	-0.000167
11	TSS	-0.569413
12	VSS	-0.000051
13	S-SOL	0.0
14	S.WASTE(L)	-0.005176
15	S.WASTE(S)	-5.403235
16	WATER USE	0.106887

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

industrial sector. For example, other things being equal, each 10,000 man-year increase in employment in the feedgrains industry is accompanied by a hydrocarbon emissions increase of .31746 tons per year, total suspended solids by 217.6896 tons, water use by 2.5998 acre feet, etc. (column 5, table 9).

The coefficients in tables 7, 8, and 9 were calculated with households considered exogenous to the analytical model. That is, the resource use attributable to consumption by households was not included, nor was the effect from industrial output induced by secondary consumer spending. Table 10 provides the resource-output multipliers obtained when households were made indogenous to the model. Hence, the total effect on the environment as shown by the elements of table 10 consists of the direct, indirect, and induced effects of a change in final demand in a particular industry.

The interpretation of this table is the same as for table 7. Any change in final demand produces a new level of resource use. This new level is found by multiplying each environmental entry times the amount of change in final demand in each sector and adding or subtracting it from the previous level.

Table 11 presents resource-income multipliers calculated to include the induced effect of consumer spending. Each entry can be either larger or smaller than its counterpart in table 8 that was formed with households considered exogenous. The difference depends on the altered interrelations of resource use per dollar of final demand relative to those for income per dollar of final demand caused by the inclusion of the household sector.

For example, for each additional $10,000 of income generated for irrigated cotton, the required production creates a total of .812922 tons of nitrogen oxide (table 11) when households are included as compared to .502299 tons (table 8) when they are not. Continuing down the column, it is found that each $10,000 increment in income generates .059733 tons of sulfur oxides, .653461

Table 10: Type II Resource - Final Demand Interdependence

Matrix, Rio Grande Valley of Texas, 1967
(Resource change per $10,000 change in final demand)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: IRR COTTON	IRR GRAINS	OTHER IRR	DRYLAND COTTON	DRYLAND FDGRAIN	OTHER DRYLAND
1	NO-X	-0.606547	-0.488645	-0.565179	-0.594428	-0.540364	-0.414530
2	SO-X	-0.044569	-0.036005	-0.042392	-0.039534	-0.042570	-0.033737
3	HC	-0.487567	-0.412803	-0.472711	-0.447367	-0.481918	-0.371717
4	CO	-2.868053	-2.407216	-2.798872	-2.625054	-2.809606	-2.195651
5	PART.	-0.409636	-0.365445	-0.127403	-0.250526	-0.212699	-0.174013
6	HS	-0.010224	-0.008308	-0.009768	-0.008515	-0.010415	-0.008268
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000013	-0.000011	-0.000012	-0.000013	-0.000010	-0.000008
9	BOD	-0.000561	-0.000458	-0.000544	-0.000538	-0.000520	-0.000400
10	COD	-0.000392	-0.000532	-0.000344	-0.001178	-0.000442	-0.000254
11	TSS	-110.213058	-437.089844	-4.887311	-261.291504	-1275.406250	-152.793396
12	VSS	-0.000030	-0.000028	-0.000028	-0.000031	-0.000031	-0.000021
13	S-SOL	-0.000034	-0.000024	-0.000034	-0.000037	-0.000024	-0.000020
14	S.WASTE(L)	-0.544258	-0.442024	-0.519852	-0.453382	-0.554077	-0.439978
15	S.WASTE(S)	-3.930489	-3.240093	-3.857776	-4.479251	-3.299706	-2.589676
16	WATER USE	39.852310	116.802216	68.616409	1.041601	2.319363	0.591688

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 10: Type II Resource - Final Demand Interdependence

Matrix, Rio Grande Valley of Texas, 1967
(Resource change per $10,000 change in final demand)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		LIVESTK	DAIRY POULT	AGRI SUPPLY	GINNING	AGRI SERV	FISH
1	NO-X	-0.634511	-0.509869	-0.606722	-1.150533	-0.524476	-0.384056
2	SO-X	-0.030518	-0.030734	-0.015037	-0.022079	-0.064361	-0.012763
3	HC	-0.343143	-0.275932	-0.269588	-0.260143	-0.550987	-0.201528
4	CO	-2.029621	-1.614236	-1.594487	-1.419575	-3.244002	-1.162189
5	PART.	-0.153837	-0.185503	-0.012413	-2.031213	-3.423995	-0.013974
6	HS	-0.002803	-0.003622	-0.000261	-0.000323	-0.016298	-0.000504
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000014	-0.000005	-0.000011	-0.000010	-0.000024	-0.000010
9	BOD	-0.000437	-0.000236	-0.000324	-0.000302	-0.000577	-0.000307
10	COD	-0.000306	-0.000191	-0.000226	-0.000344	-0.000337	-0.000255
11	TSS	-59.020370	-155.425430	-1.513436	-1.462150	-7.220994	-3.673714
12	VSS	-0.000028	-0.000020	-0.000025	-0.000031	-0.000024	-0.000029
13	S-SOL	-0.000041	-0.000009	-0.000032	-0.000032	-0.000020	-0.000031
14	S.WASTE(L)	-0.149904	-0.193429	-0.013963	-0.024413	-0.866190	-0.026809
15	S.WASTE(S)	-25.821701	-19.577591	-3.736244	-3.538906	-3.233598	-3.619968
16	WATER USE	1.331334	0.801422	0.908156	0.961773	0.694691	0.959903

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 10: Type II Resource - Final Demand Interdependence

Matrix, Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in final demand)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: PETROL GAS SERV	RES CONSTR	COMM CONSTR	OTHER CONSTR	MEAT PROD	DAIRY MANUF
1	NO-X	-1.126533	-0.383775	-0.324451	-0.414797	-0.449490	-0.286537
2	SO-X	-0.013056	-0.016555	-0.013829	-0.014573	-0.018122	-0.014409
3	HC	-0.488913	-0.232384	-0.179662	-0.215573	-0.209929	-0.153236
4	CO	-0.825724	-1.365654	-1.038067	-1.257292	-1.233188	-0.895845
5	PART.	-0.009424	-0.015674	-0.016275	-0.023021	-0.079329	-0.067906
6	HS	-0.000506	-0.001994	-0.001574	-0.000701	-0.001467	-0.001359
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000013	-0.000009	-0.000008	-0.000010	-0.000009	-0.000005
9	BOD	-0.000233	-0.000317	-0.000289	-0.000344	-0.000270	-0.000181
10	COD	-0.000236	-0.000521	-0.000757	-0.001149	-0.000194	-0.000150
11	TSS	-1.133660	-1.286720	-1.168240	-1.462437	-32.392776	-55.138855
12	VSS	-0.000021	-0.000039	-0.000052	-0.000077	-0.000018	-0.000018
13	S-SOL	-0.000025	-0.000028	-0.000025	-0.000031	-0.000026	-0.000014
14	S.WASTE(L)	-0.021354	-0.106079	-0.083764	-0.107570	-0.078447	-0.072585
15	S.WASTE(S)	-2.399870	-3.314779	-3.245447	-5.936227	-13.245871	-7.852751
16	WATER USE	0.784645	0.770012	0.704443	0.866776	0.842210	0.593436

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 10: Type II Resource - Final Demand Interdependence

Matrix, Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in final demand)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		PREP FOODS	OTHER FOODS	BEVERAGE	TEXT MILL	WOOD PAPER	PUBL PRINTNG
1	NO-X	-0.361628	-0.417779	-0.309084	-0.359194	-0.230255	-0.383498
2	SO-X	-0.011353	-0.020989	-0.008751	-0.012778	-0.008586	-0.012183
3	HC	-0.149521	-0.110833	-0.114173	-0.150914	-0.080122	-0.147535
4	CO	-0.835177	-0.599683	-0.663660	-0.813875	-0.427754	-0.851570
5	PART.	-0.021756	-0.052282	-0.006392	-0.009077	-0.057883	-0.007802
6	HS	-0.001171	-0.000775	-0.000286	-0.000235	-0.000497	-0.000212
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000006	-0.000005	-0.000006	-0.000009	-0.000004	-0.000008
9	BOD	-0.009619	-0.000149	-0.000176	-0.000233	-0.000106	-0.000223
10	COD	-0.027486	-0.000144	-0.000128	-0.000188	-0.000082	-0.000165
11	TSS	-2.212219	-33.814667	-1.030871	-1.391563	-0.677420	-1.161869
12	VSS	-0.009239	-0.000016	-0.000012	-0.000015	-0.000007	-0.000015
13	S-SOL	-0.000019	-0.000014	-0.000020	-0.000027	-0.000011	-0.000025
14	S.WASTE(L)	-0.062371	-0.041472	-0.015261	-0.012451	-0.026416	-0.011293
15	S.WASTE(S)	-2.252460	-1.858557	-3.310317	-2.889151	-1.921396	-2.621200
16	WATER USE	7.364803	2.277371	0.625966	0.825744	0.321902	0.708263

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 10: Type II Resource - Final Demand Interdependence

Matrix, Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in final demand)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		CHEM DRUGS	PETRO PROD	CLAY STONE	CEMENT	FOUND FORGE	FAB STL&METL
1	NO-X	-1.387634	-0.627057	-1.186873	-0.468604	-0.540865	-0.258107
2	SO-X	-0.314456	-0.014948	-0.038312	-0.020233	-0.014108	-0.007348
3	HC	-2.542990	-0.299130	-0.244552	-0.121727	-0.170239	-0.106959
4	CO	-15.187782	-0.811961	-1.078348	-0.615830	-0.925576	-0.622635
5	PART.	-0.096914	-0.007503	-0.015521	-0.254963	-0.009268	-0.005653
6	HS	-0.102329	-0.002620	-0.000916	-0.000127	-0.000233	-0.000172
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000012	-0.000007	-0.000010	-0.000005	-0.000008	-0.000006
9	BOD	-0.002445	-0.000673	-0.000259	-0.000973	-0.000231	-0.000170
10	COD	-0.000957	-0.001278	-0.000381	-0.018176	-0.159120	-0.000128
11	TSS	-1.054215	-0.640418	-1.216454	-0.656931	-1.257890	-2.089699
12	VSS	-0.000043	-0.000102	-0.000026	-0.001162	-0.000339	-0.000011
13	S-SOL	-0.000023	-0.000014	-0.000026	-0.000014	-0.000026	-0.000019
14	S.WASTE(L)	-5.438467	-0.136743	-0.048238	-0.006772	-0.012335	-0.009221
15	S.WASTE(S)	-3.184261	-1.396032	-2.851433	-2.486154	-96.063614	-1.854156
16	WATER USE	0.757491	0.440761	0.805937	0.401248	1.641284	0.541217

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 10: Type II Resource - Final Demand Interdependence

Matrix, Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in final demand)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: MACH EQUIP	ELEC EQUIP	TRANS EQUIP	OTHER MANUF	MOTOR FRGT	WATER TRANSP
1	NO-X	-0.204567	-0.275072	-0.289636	-0.481887	-4.150325	-0.510442
2	SO-X	-0.007868	-0.013564	-0.008237	-0.016096	-0.271271	-0.015990
3	HC	-0.089882	-0.139283	-0.136821	-0.144329	-0.569979	-0.282927
4	CO	-0.521135	-0.803679	-0.805556	-0.723050	-3.370314	-1.636415
5	PART.	-0.005087	-0.007401	-0.006663	-0.010409	-0.012751	-0.012968
6	HS	-0.000176	-0.001283	-0.000171	-0.000954	-0.000278	-0.000420
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000009	-0.000012	-0.000007	-0.000007	-0.000009	-0.000013
9	BOD	-0.000138	-0.000201	-0.000193	-0.000182	-0.000278	-0.000398
10	COD	-0.001229	-0.000420	-0.000138	-0.000245	-0.000228	-0.000991
11	TSS	-0.727226	-0.944630	-0.984331	-3.440289	-1.284986	-1.854988
12	VSS	-0.000012	-0.000012	-0.000013	-0.000014	-0.000023	-0.000031
13	S-SOL	-0.000015	-0.000020	-0.000021	-0.000019	-0.000027	-0.000040
14	S.WASTE(L)	-0.009494	-0.068278	-0.009152	-0.050909	-0.015531	-0.022597
15	S.WASTE(S)	-2.706115	-2.272717	-2.710380	-1.879251	-4.020134	-5.268491
16	WATER USE	0.490955	0.565931	0.583344	0.545669	0.793740	1.116544

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 10: Type II Resource - Final Demand Interdependence

Matrix, Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in final demand)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		AIR TRANSP	OTHER TRANSP	COMMUN	GAS SER	ELEC SER	WATER SANIT
1	NO-X	-0.280758	-0.937065	-0.261049	-0.783641	-13.201299	-1.179889
2	SO-X	-1.464304	-0.069877	-0.007827	-0.010652	-0.132365	-0.021088
3	HC	-0.145600	-0.397302	-0.085374	-0.343723	-0.263082	-0.176016
4	CO	-0.751336	-0.819323	-0.490243	-0.737140	-0.459027	-0.957608
5	PART.	-0.361437	-0.021846	-0.004983	-0.008314	-0.062247	-0.016240
6	HS	-0.000448	-0.000406	-0.000125	-0.000370	-0.000139	-0.001365
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.003749	-0.000012	-0.000008	-0.000010	-0.000005	-0.000008
9	BOD	-0.000250	-0.000214	-0.000134	-0.000203	-0.000120	-0.000256
10	COD	-0.000267	-0.000588	-0.000102	-0.000190	-0.000645	-0.000527
11	TSS	-0.972587	-1.054706	-0.696648	-0.995653	-0.601989	-1.110372
12	VSS	-0.000023	-0.000023	-0.000009	-0.000017	-0.000088	-0.000040
13	S-SOL	-0.000021	-0.000022	-0.000015	-0.000022	-0.000013	-0.000024
14	S.WASTE(L)	-0.023606	-0.019297	-0.006662	-0.016267	-0.007086	-0.076393
15	S.WASTE(S)	-2.076612	-2.548067	-1.463680	-2.125601	-1.304579	-2.520152
16	WATER USE	0.595512	0.687154	0.434360	0.669795	1.841063	0.776519

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 10: Type II Resource - Final Demand Interdependence

Matrix, Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in final demand)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: COMMERCE	ECONOMIC SECTORS: HOUSE HOLDS
1	NO-X	-0.691381	-0.580253
2	SO-X	-0.019500	-0.019760
3	HC	-0.561677	-0.299978
4	CO	-3.409051	-1.763490
5	PART.	-0.019600	-0.015695
6	HS	-0.000253	-0.000462
7	H-2SO-4	0.0	0.0
8	FL	-0.000012	-0.000019
9	BOD	-0.000439	-0.000514
10	COD	-0.000258	-0.000365
11	TSS	-1.519525	-2.72784
12	VSS	-0.000044	-0.000031
13	S-SOL	-0.000026	-0.000061
14	S.WASTE(L)	-0.013712	-0.024620
15	S.WASTE(S)	-5.653140	-5.564775
16	WATER USE	0.781179	1.666295

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 11: Type II Resource - Income Multipliers

Rio Grande Valley of Texas, 1967
(Resource change per $10,000 change in income)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		IRR COTTON	IRR GRAINS	OTHER IRR	DRYLAND COTTON	DRYLAND FDGRAIN	OTHER DRYLAND
1	NO-X	-0.812922	-0.925689	-0.755216	-0.743572	-1.020290	-0.929515
2	SO-X	-0.059733	-0.068208	-0.056646	-0.049454	-0.080378	-0.075649
3	HC	-0.653461	-0.782013	-0.631656	-0.559612	-0.909934	-0.833513
4	CO	-3.843900	-4.560228	-3.739969	-3.283689	-5.304965	-4.923384
5	PART.	-0.549014	-0.692299	-0.170241	-0.313384	-0.401608	-0.390195
6	HS	-0.013703	-0.015739	-0.013052	-0.010651	-0.019665	-0.018539
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000018	-0.000020	-0.000017	-0.000017	-0.000020	-0.000019
9	BOD	-0.000752	-0.000867	-0.000727	-0.000673	-0.000981	-0.000896
10	COD	-0.000525	-0.001007	-0.000459	-0.001474	-0.000834	-0.000571
11	TSS	-147.712723	-828.022705	-6.530629	-326.850342	-2408.162109	-342.613525
12	VSS	-0.000040	-0.000053	-0.000037	-0.000039	-0.000058	-0.000047
13	S-SOL	-0.000046	-0.000046	-0.000046	-0.000046	-0.000046	-0.000046
14	S.WASTE(L)	-0.729440	-0.837370	-0.694647	-0.567137	-1.046181	-0.986579
15	S.WASTE(S)	-5.267825	-6.138030	-5.154921	-5.603110	-6.230349	-5.806919
16	WATER USE	53.411942	221.270035	91.688110	1.302942	4.379312	1.326962

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 11: Type II Resource - Income Multipliers

Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in income)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		LIVESTK	DAIRY POULT	AGRI SUPPLY	GINNING	AGRI SERV	FISH
1	NO-X	-0.715602	-2.555916	-0.872691	-1.657058	-1.175679	-0.570919
2	SO-X	-0.034418	-0.154068	-0.021629	-0.031800	-0.144272	-0.018973
3	HC	-0.386997	-1.383219	-0.387768	-0.374671	-1.235105	-0.299582
4	CO	-2.289006	-8.091990	-2.293465	-2.044546	-7.271837	-1.727655
5	PART.	-0.173497	-0.929908	-0.017854	-2.925460	-7.675313	-0.020773
6	HS	-0.003161	-0.018157	-0.000375	-0.000465	-0.036535	-0.000749
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000016	-0.000026	-0.000016	-0.000015	-0.000053	-0.000015
9	BOD	-0.000493	-0.001183	-0.000466	-0.000435	-0.001293	-0.000456
10	COD	-0.000345	-0.000959	-0.000325	-0.000495	-0.000756	-0.000379
11	TSS	-66.563187	-779.130615	-2.176884	-2.105865	-16.186752	-5.461167
12	VSS	-0.000032	-0.000100	-0.000036	-0.000044	-0.000053	-0.000043
13	S-SOL	-0.000046	-0.000046	-0.000046	-0.000046	-0.000046	-0.000046
14	S.WASTE(L)	-0.169062	-0.969639	-0.020084	-0.035160	-1.941674	-0.039852
15	S.WASTE(S)	-29.121719	-98.140335	-5.374108	-5.096920	-7.248514	-5.381272
16	WATER USE	1.501478	4.017443	1.306266	1.385196	1.557236	1.426946

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 11: Type II Resource - Income Multipliers

Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in income)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		PETROL GAS SERV	RES CONSTR	COMM CONSTR	OTHER CONSTR	MEAT PROD	DAIRY MANUF
1	NO-X	-2.049241	-0.636171	-0.584196	-0.607827	-0.804696	-0.938035
2	SO-X	-0.023749	-0.027443	-0.024899	-0.021355	-0.032443	-0.047170
3	HC	-0.889367	-0.385214	-0.323494	-0.315891	-0.375823	-0.501649
4	CO	-1.502049	-2.263796	-1.869110	-1.842383	-2.207704	-2.932729
5	PART.	-0.017143	-0.025982	-0.029305	-0.033734	-0.142018	-0.222304
6	HS	-0.000921	-0.003306	-0.002835	-0.001027	-0.002626	-0.004450
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000024	-0.000015	-0.000015	-0.000015	-0.000016	-0.000017
9	BOD	-0.000424	-0.000525	-0.000520	-0.000504	-0.000484	-0.000594
10	COD	-0.000429	-0.000863	-0.001363	-0.001684	-0.000347	-0.000491
11	TSS	-2.062207	-2.132950	-2.103495	-2.142994	-57.990891	-180.508102
12	VSS	-0.000038	-0.000065	-0.000093	-0.000113	-0.000033	-0.000058
13	S-SOL	-0.000046	-0.000046	-0.000046	-0.000046	-0.000046	-0.000046
14	S.WASTE(L)	-0.038845	-0.175844	-0.150823	-0.157628	-0.140438	-0.237620
15	S.WASTE(S)	-4.365531	-5.494792	-5.843649	-8.698702	-23.713303	-25.707550
16	WATER USE	1.427324	1.276421	1.268397	1.270138	1.507760	1.942731

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 11: Type II Resource - Income Multipliers

Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in income)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		PREP FOODS	OTHER FOODS	BEVERAGE	TEXT MILL	WOOD PAPER	PUBL PRINTNG
1	NO-X	-0.873880	-1.357663	-0.714086	-0.601248	-0.951565	-0.690408
2	SO-X	-0.027434	-0.068208	-0.020218	-0.021388	-0.035485	-0.021933
3	HC	-0.361319	-0.360174	-0.263776	-0.252612	-0.331117	-0.265605
4	CO	-2.018217	-1.948802	-1.533273	-1.362329	-1.767756	-1.533074
5	PART.	-0.052575	-0.169902	-0.014767	-0.015193	-0.239210	-0.014045
6	HS	-0.002831	-0.002517	-0.000662	-0.000394	-0.002053	-0.000381
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000015	-0.000016	-0.000015	-0.000016	-0.000018	-0.000015
9	BOD	-0.023244	-0.000483	-0.000406	-0.000390	-0.000436	-0.000401
10	COD	-0.066420	-0.000467	-0.000295	-0.000314	-0.000340	-0.000297
11	TSS	-5.345863	-109.888123	-2.381653	-2.329309	-2.799542	-2.091702
12	VSS	-0.022327	-0.000050	-0.000027	-0.000025	-0.000028	-0.000026
13	S-SOL	-0.000046	-0.000046	-0.000046	-0.000046	-0.000046	-0.000046
14	S.WASTE(L)	-0.150721	-0.134771	-0.035257	-0.020841	-0.109167	-0.020330
15	S.WASTE(S)	-5.443105	-6.039785	-7.647923	-4.836088	-7.940464	-4.718923
16	WATER USE	17.797165	7.400815	1.446188	1.382195	1.330309	1.275079

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 11: Type II Resource - Income Multipliers

Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in income)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		CHEM DRUGS	PETRO PROD	CLAY STONE	CEMENT	FOUND FORGE	FAB STL&METL
1	NO-X	-2.800427	-2.028540	-2.074372	-1.505141	-0.970081	-0.606580
2	SO-X	-0.634612	-0.048358	-0.066961	-0.064987	-0.025305	-0.017269
3	HC	-5.132086	-0.967692	-0.427419	-0.390983	-0.305337	-0.251364
4	CO	-30.650925	-2.626707	-1.884696	-1.978025	-1.660089	-1.463258
5	PART.	-0.195586	-0.024272	-0.027127	-0.818933	-0.016622	-0.013284
6	HS	-0.206514	-0.008475	-0.001602	-0.000409	-0.000418	-0.000405
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000024	-0.000023	-0.000017	-0.000016	-0.000015	-0.000015
9	BOD	-0.004934	-0.002176	-0.000452	-0.003125	-0.000415	-0.000398
10	COD	-0.001931	-0.004135	-0.000667	-0.058382	-0.285394	-0.000301
11	TSS	-2.127544	-2.071763	-2.126071	-2.110040	-2.256117	-4.911016
12	VSS	-0.000087	-0.000329	-0.000046	-0.003733	-0.000608	-0.000026
13	S-SOL	-0.000046	-0.000046	-0.000046	-0.000046	-0.000046	-0.000046
14	S.WASTE(L)	-10.975539	-0.442366	-0.084309	-0.021752	-0.022123	-0.021671
15	S.WASTE(S)	-6.426256	-4.516188	-4.983625	-7.985445	-172.297150	-4.357463
16	WATER USE	1.528715	1.425810	1.408586	1.288795	2.943763	1.271918

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 11: Type II Resource - Income Multipliers

Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in income)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: MACH EQUIP	ELEC EQUIP	TRANS EQUIP	OTHER MANUF	MOTOR FRGT	WATER TRANSP
1	NO-X	-0.607554	-0.620704	-0.633808	-1.179778	-6.918342	-0.582783
2	SO-X	-0.023369	-0.030608	-0.018025	-0.039406	-0.452193	-0.018256
3	HC	-0.266944	-0.314295	-0.299404	-0.353353	-0.950121	-0.323024
4	CO	-1.547746	-1.813515	-1.762793	-1.770204	-5.618110	-1.868334
5	PART.	-0.015108	-0.016701	-0.014581	-0.025484	-0.021256	-0.014806
6	HS	-0.000524	-0.002895	-0.000375	-0.002335	-0.000464	-0.000479
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.000026	-0.000026	-0.000015	-0.000017	-0.000016	-0.000015
9	BOD	-0.000410	-0.000454	-0.000422	-0.000447	-0.000464	-0.000455
10	COD	-0.003650	-0.000949	-0.000302	-0.000599	-0.000380	-0.001132
11	TSS	-2.159825	-2.131572	-2.154006	-8.422681	-2.141994	-2.117884
12	VSS	-0.000035	-0.000028	-0.000029	-0.000034	-0.000038	-0.000036
13	S-SOL	-0.000046	-0.000046	-0.000046	-0.000046	-0.000046	-0.000046
14	S.WASTE(L)	-0.028196	-0.154071	-0.020027	-0.124638	-0.025890	-0.025800
15	S.WASTE(S)	-8.037025	-5.128420	-5.931109	-4.600873	-6.701321	-6.015161
16	WATER USE	1.458112	1.277031	1.276528	1.335934	1.323116	1.274784

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 11: Type II Resource - Income Multipliers

Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in income)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		AIR TRANSP	OTHER TRANSP	COMMUN	GAS SER	ELEC SER	WATER SANIT
1	NO-X	-0.598621	-1.919599	-0.774690	-1.627947	-45.621719	-2.205554
2	SO-X	-3.122133	-0.143144	-0.023226	-0.022129	-0.457432	-0.039420
3	HC	-0.310443	-0.813883	-0.253355	-0.714055	-0.909172	-0.329026
4	CO	-1.601970	-1.678402	-1.454844	-1.531344	-1.586329	-1.790047
5	PART.	-0.770643	-0.044752	-0.014789	-0.017271	-0.215117	-0.030357
6	HS	-0.000956	-0.000831	-0.000370	-0.000768	-0.000480	-0.002551
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-0.007993	-0.000025	-0.000024	-0.000022	-0.000016	-0.000015
9	BOD	-0.000534	-0.000438	-0.000398	-0.000421	-0.000414	-0.000478
10	COD	-0.000569	-0.001205	-0.000301	-0.000396	-0.002228	-0.000985
11	TSS	-2.073711	-2.160588	-2.067374	-2.068383	-2.080384	-2.075606
12	VSS	-0.000048	-0.000047	-0.000027	-0.000035	-0.000303	-0.000074
13	S-SOL	-0.000046	-0.000046	-0.000046	-0.000046	-0.000046	-0.000046
14	S.WASTE(L)	-0.050331	-0.039529	-0.019771	-0.033794	-0.024489	-0.142801
15	S.WASTE(S)	-4.427671	-5.219773	-4.343619	-4.415755	-4.508430	-4.710895
16	WATER USE	1.269728	1.407651	1.289006	1.391442	6.362442	1.451539

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 11: Type II Resource - Income Multipliers

Rio Grande Valley of Texas, 1967

(Resource change per $10,000 change in income)

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: COMMERCE	ECONOMIC SECTORS: HOUSE HOLDS
1	NO-X	-1.207079	-0.435732
2	SO-X	-0.034045	-0.014838
3	HC	-0.980630	-0.225264
4	CO	-5.951848	-1.324265
5	PART.	-0.034220	-0.011786
6	HS	-0.000442	-0.000347
7	H-2SO-4	0.0	0.0
8	FL	-0.000021	-0.000014
9	BOD	-0.000766	-0.000386
10	COD	-0.000450	-0.000274
11	TSS	-2.652931	-2.04843
12	VSS	-0.000077	-0.000023
13	S-SOL	-0.000046	-0.000046
14	S.WASTE(L)	-0.023940	-0.018488
15	S.WASTE(S)	-9.869795	-4.178779
16	WATER USE	1.363856	1.251278

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

tons of hydrocarbons, 3.8439 tons of carbon monoxide, etc. and requires 53.411942 acre feet of water (table 11) when households induced effect is included. In contrast the same industry generates .059786 tons of sulphur oxides, .549222 tons of hydrocarbons, 3.355361 tons of carbon monoxide, etc., and requires 69.461533 acre feet of water per dollar of income (table 8) if households are not taken into account.

Tables 12 and 13 contain the "resource-resource" multipliers. They are the ratio of the total effect on resource use of an industry's output to the direct resource use effect of that industry's production. It provides a ranking of each industry in terms of the relation between its influence on the economy's resource use and its own direct resource use.

For example, the dryland cotton industry causes 1.00546 tons of total suspended solids (sediment) to be produced for each level of production large enough to create 1 ton of TSS. On the other hand, each level of ginning output sufficient to produce one ton of nitrogen oxides, causes 441.147 tons to be produced totally in the region. The figures in the tables include both the initial direct unit of resource and the indirect usage caused by the interdependencies.

The astericks represent lack of direct production of the factor at the left of the table. In these instances no relation can be estimated between the industry's resource use and the resulting use of the rest of the economy.

Industries with rather large multipliers represent those industries which are not resource intensive, but which purchase inputs from other resource intensive industries.

Table 13 is conceptually the same as table 12. The difference in the size of the multipliers results from the inclusion of households in the processing sector. Thus in table 13, the induced production due to consumer

Table 12: Type I "Resource - Resource" Multipliers

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: IRR COTTON	IRR GRAINS	OTHER IRR	DRYLAND COTTON	DRYLAND FDGRAIN	OTHER DRYLAND
1	NO-X	**********	**********	**********	**********	**********	**********
2	SO-X	**********	**********	**********	**********	**********	**********
3	HC	**********	**********	**********	**********	**********	**********
4	CO	**********	**********	**********	**********	**********	**********
5	PART.	**********	**********	**********	**********	**********	**********
6	HS	**********	**********	**********	**********	**********	**********
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	**********	**********	**********	**********	**********	**********
9	BOD	**********	**********	**********	**********	**********	**********
10	COD	**********	**********	**********	**********	**********	**********
11	TSS	1.011901	1.001665	10.955750	1.005981	1.023927	1.005111
12	VSS	**********	**********	**********	**********	**********	**********
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	**********	**********	**********	**********	**********	**********
15	S.WASTE(S)	**********	**********	**********	**********	**********	**********
16	WATER USE	1.007208	1.000404	1.013377	**********	**********	**********

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 12: Type I "Resource - Resource" Multipliers

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		LIVESTK	DAIRY POULT	AGRI SUPPLY	GINNING	AGRI SERV	FISH
1	NO-X	**********	**********	**********	441.146973	**********	**********
2	SO-X	**********	**********	**********	**********	**********	**********
3	HC	**********	**********	**********	2.713388	**********	**********
4	CO	**********	**********	**********	2.616217	**********	**********
5	PART.	**********	**********	**********	1.003052	1.008398	**********
6	HS	**********	**********	**********	**********	**********	**********
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	**********	**********	**********	**********	**********	**********
9	BOD	**********	**********	**********	**********	**********	**********
10	COD	**********	**********	**********	**********	**********	**********
11	TSS	3.536957	**********	**********	**********	**********	**********
12	VSS	**********	**********	**********	**********	**********	**********
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	**********	**********	**********	**********	**********	**********
15	S.WASTE(S)	1.238139	1.067431	**********	**********	**********	**********
16	WATER USE	**********	**********	**********	**********	2.304718	**********

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 12: Type I "Resource - Resource" Multipliers

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: PETROL GAS SERV	RES CONSTR	COMM CONSTR	OTHER CONSTR	MEAT PROD	DAIRY MANUF
1	NO-X	1.159769					
2	SO-X	6.389708					
3	HC	1.133697					
4	CO	16.709885					
5	PART.	1.797977					
6	HS	3.183894					
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL						
9	BOD	3.602991					
10	COD	1.848620					
11	TSS	1186.936279				5703.121094	235.985535
12	VSS	1.444138					
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)				1.370224		
15	S.WASTE(S)		2.266934	1.265455	1.189470		
16	WATER USE	1.153473				11.542189	

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 12: Type I "Resource - Resource" Multipliers

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: PREP FOODS	OTHER FOODS	BEVERAGE	TEXT MILL	WOOD PAPER	PUBL PRINTNG
1	NO-X	6.294276	9.644945	**********	**********	6.347263	**********
2	SO-X	65.139420	1.677699	**********	**********	**********	**********
3	HC	10.479577	**********	**********	**********	7.430263	**********
4	CO	5024.417969	**********	**********	**********	**********	**********
5	PART.	7.031444	2.596267	**********	**********	1.032948	**********
6	HS	**********	**********	**********	**********	**********	**********
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	**********	**********	**********	**********	**********	**********
9	BOD	1.005221	**********	**********	**********	**********	**********
10	COD	1.002327	**********	**********	**********	**********	**********
11	TSS	50.589722	**********	**********	**********	**********	**********
12	VSS	1.001536	**********	**********	**********	**********	**********
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	**********	**********	**********	**********	**********	**********
15	S.WASTE(S)	4.024019	1.636164	1.091062	1.144511	1.081886	1.822261
16	WATER USE	23.988068	9.075223	**********	9.414980	**********	**********

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 12: Type I "Resource - Resource" Multipliers

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		CHEM DRUGS	PETRO PROD	CLAY STONE	CEMENT	FOUND FORGE	FAB STL&METL
1	NO-X	3.438779			3.341007		
2	SO-X	1.073587					
3	HC	1.054803			6.469482		
4	CO	1.031076			10.191402		
5	PART.	1.088371			1.030080		
6	HS	1.021770					
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL						
9	BOD	1.028964	1.132084		1.033953		
10	COD	4.832111	1.060939		1.068903	1.000247	
11	TSS	36.616791	63.612350		3.165738	129.544098	1.007001
12	VSS	1.490612	1.059656		1.027114	1.012387	
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	1.021983					
15	S.WASTE(S)	2.096278		2.975041	2.049997	1.002564	
16	WATER USE	3.201919				1.043114	

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 12: Type I "Resource - Resource" Multipliers

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: MACH EQUIP	ELEC EQUIP	TRANS EQUIP	OTHER MANUF	MOTOR FRGT	WATER TRANSP
1	NO-X	**********	**********	**********	**********	1.102285	**********
2	SO-X	**********	**********	**********	**********	1.018637	**********
3	HC	**********	**********	**********	**********	1.225840	**********
4	CO	**********	**********	**********	**********	1.200174	**********
5	PART.	**********	**********	**********	**********	2.694684	**********
6	HS	**********	**********	**********	**********	**********	**********
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	**********	**********	**********	**********	**********	**********
9	BOD	**********	**********	**********	**********	**********	**********
10	COD	**********	**********	**********	**********	**********	**********
11	TSS	**********	**********	**********	3.586185	**********	**********
12	VSS	**********	**********	**********	**********	**********	**********
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	**********	**********	**********	**********	**********	**********
15	S.WASTE(S)	2.405732	2.527422	1.450670	**********	1.571259	3.216873
16	WATER USE	158.552109	**********	**********	**********	**********	**********

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 12: Type I "Resource - Resource" Multipliers

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: AIR TRANSP	OTHER TRANSP	COMMUN	GAS SER	ELEC SER	WATER SANIT
1	NO-X	37.976517	10.979974	**********	**********	1.007691	**********
2	SO-X	1.108379	1.100687	**********	**********	1.012665	**********
3	HC	248.237503	6.494802	**********	**********	1.278690	**********
4	CO	323.727539	2.792540	**********	**********	43.608704	**********
5	PART.	1.109915	1.238738	**********	4.903188	1.014115	**********
6	HS	**********	**********	**********	**********	**********	**********
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	1.107314	**********	**********	**********	**********	**********
9	BOD	**********	8.054722	**********	**********	**********	**********
10	COD	**********	6.058558	**********	**********	1.036929	**********
11	TSS	**********	17514.128906	**********	**********	40.623764	**********
12	VSS	**********	3.738393	**********	**********	1.023838	**********
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	**********	**********	**********	**********	**********	**********
15	S.WASTE(S)	**********	3.155445	**********	**********	**********	**********
16	WATER USE	**********	**********	**********	14.254627	1.007710	**********

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 12: Type I "Resource - Resource" Multipliers

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS COMMERCE
1	NO-X	2.009315
2	SO-X	1.799609
3	HC	1.077788
4	CO	1.067739
5	PART.	1.254337
6	HS	**********
7	H-2SO-4	0.0
8	FL	**********
9	BOD	1.239931
10	COD	441.364502
11	TSS	2713.642344
12	VSS	101.140396
13	S-SOL	0.0
14	S.WASTE(L)	**********
15	S.WASTE(S)	1.084286
16	WATER USE	**********

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 13: Type II "Resource - Resource" Multipliers

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		IRR COTTON	IRR GRAINS	OTHER IRR	DRYLAND COTTON	DRYLAND FDGRAIN	OTHER DRYLAND
1	NO-X	**********	**********	**********	**********	**********	**********
2	SO-X	**********	**********	**********	**********	**********	**********
3	HC	**********	**********	**********	**********	**********	**********
4	CO	**********	**********	**********	**********	**********	**********
5	PART.	**********	**********	**********	**********	**********	**********
6	HS	**********	**********	**********	**********	**********	**********
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	**********	**********	**********	**********	**********	**********
9	BOD	**********	**********	**********	**********	**********	**********
10	COD	**********	**********	**********	**********	**********	**********
11	TSS	1.026129	1.004146	15.962662	1.012326	1.005963	1.030083
12	VSS	**********	**********	**********	**********	**********	**********
13	S-SOL	**********	**********	**********	**********	**********	**********
14	S.WASTE(L)	**********	**********	**********	**********	**********	**********
15	S.WASTE(S)	**********	**********	**********	**********	**********	**********
16	WATER USE	1.031367	1.006091	1.027394	**********	**********	**********

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 13: Type II "Resource - Resource" Multipliers

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		LIVESTK	DAIRY POULT	AGRI SUPPLY	GINNING	AGRI SERV	FISH
1	NO-X	**********	**********	**********	598.531006	**********	**********
2	SO-X	**********	**********	**********	**********	**********	**********
3	HC	**********	**********	**********	6.804381	**********	**********
4	CO	**********	**********	**********	7.426181	**********	**********
5	PART.	**********	**********	**********	1.007107	1.009945	**********
6	HS	**********	**********	**********	**********	**********	**********
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	**********	**********	**********	**********	**********	**********
9	BOD	**********	**********	**********	**********	**********	**********
10	COD	**********	**********	**********	**********	**********	**********
11	TSS	3.649259	**********	**********	**********	**********	**********
12	VSS	**********	**********	**********	**********	**********	**********
13	S-SOL	**********	**********	**********	**********	**********	**********
14	S.WASTE(L)	**********	**********	**********	**********	**********	**********
15	S.WASTE(S)	1.445570	1.114904	**********	**********	**********	**********
16	WATER USE	**********	**********	**********	11.883008	**********	**********

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 13: Type II "Resource - Resource" Multipliers

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: PETROL GAS SERV	RES CONSTR	COMM CONSTR	OTHER CONSTR	MEAT PROD	DAIRY MANUF
1	NO-X	1.472963					
2	SO-X	17.029724					
3	HC	1.518245					
4	CO	141.173782					
5	PART.	5.753608					
6	HS	5.107069					
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL						
9	BOD	40.661301					
10	COD	5.120981					
11	TSS					5911.953125	238.694107
12	VSS	3.699384					
13	S-SOL						
14	S.WASTE(L)				1.552292		
15	S.WASTE(S)		9.465170	4.441684	2.289164		
16	WATER USE	9.351973				67.852188	

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 13: Type II "Resource - Resource" Multipliers

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		PREP FOODS	OTHER FOODS	BEVERAGE	TEXT MILL	WOOD PAPER	PUBL PRINTNG
1	NO-X	12.553797	14.203396	**********	**********	11.708857	**********
2	SO-X	141.877899	2.144147	**********	**********	**********	**********
3	HC	27.830246	**********	**********	**********	23.242249	**********
4	CO	14612.406250	**********	**********	**********	**********	**********
5	PART.	9.063182	2.789787	**********	**********	1.086477	**********
6	HS	**********	**********	**********	**********	**********	**********
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	**********	**********	**********	**********	**********	**********
9	BOD	1.022202	**********	**********	**********	**********	**********
10	COD	1.006480	**********	**********	**********	**********	**********
11	TSS	82.016876	**********	**********	**********	**********	**********
12	VSS	1.002569	**********	**********	**********	**********	**********
13	S-SOL	**********	**********	**********	**********	**********	**********
14	S.WASTE(L)	**********	**********	**********	**********	**********	**********
15	S.WASTE(S)	17.323898	5.310043	2.405304	8.420565	2.283725	15.919807
16	WATER USE	25.802155	10.921790	**********	99.400848	**********	**********

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 13: Type II "Resource - Resource" Multipliers

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: CHEM DRUGS	PETRO PROD	CLAY STONE	CEMENT	FOUND FORGE	FAB STL&METL
1	NO-X	4.072433			4.702292		
2	SO-X	1.099293					
3	HC	1.103230			15.263421		
4	CO	1.077638			30.834991		
5	PART.	1.158164			1.045120		
6	HS	1.023491					
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL						
9	BOD	1.116328	1.376340		1.179705		
10	COD	5.631374	1.136253		1.073943	1.001206	
11	TSS	984.517090	108.409805		108.409805	1407.136719	1.727589
12	VSS	2.031916	1.139472		1.033492	1.052279	
13	S-SOL						
14	S.WASTE(L)	1.023710					
15	S.WASTE(S)	5.993900		18.421341	4.300370	1.027483	
16	WATER USE	17.642975				1.814297	

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 13: Type II "Resource - Resource" Multipliers

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		MACH EQUIP	ELEC EQUIP	TRANS EQUIP	OTHER MANUF	MOTOR FRGT	WATER TRANSP
1	NO-X	**********	**********	**********	**********	1.176373	**********
2	SO-X	**********	**********	**********	**********	1.053195	**********
3	HC	**********	**********	**********	**********	1.606791	**********
4	CO	**********	**********	**********	**********	1.570316	**********
5	PART.	**********	**********	**********	**********	6.048405	**********
6	HS	**********	**********	**********	**********	**********	**********
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	**********	**********	**********	**********	**********	**********
9	BOD	**********	**********	**********	**********	**********	**********
10	COD	**********	**********	**********	**********	**********	**********
11	TSS	**********	**********	**********	4.738631	**********	**********
12	VSS	**********	**********	**********	**********	**********	**********
13	S-SOL	**********	**********	**********	**********	**********	**********
14	S.WASTE(L)	**********	**********	**********	**********	**********	**********
15	S.WASTE(S)	5.011317	13.648911	4.910059	**********	4.174157	10.536995
16	WATER USE	1117.739502	**********	**********	**********	**********	**********

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 13: Type II "Resource - Resource" Multipliers

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		AIR TRANSP	OTHER TRANSP	COMMUN	GAS SER	ELEC SER	WATER SANIT
1	NO-X	139.562637	14.204182			1.017406	
2	SO-X	1.113669	1.227978			1.046613	
3	HC	904.710693	8.980348			1.699858	
4	CO	1867.418945	13.234838			263.967285	
5	PART.	1.127151	1.681611		15.438431	1.072896	
6	HS						
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	1.109288					
9	BOD		68.340195				
10	COD		7.841547			1.182340	
11	TSS					2644.422363	
12	VSS					1.108204	
13	S-SOL						
14	S.WASTE(L)						
15	S.WASTE(S)		15.821974				
16	WATER USE				141.508820	1.254406	

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 13: Type II "Resource - Resource" Multipliers

Rio Grande Valley of Texas, 1967

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS COMMERCE	HOUSE HOLDS
1	NO-X	3.144372**********	
2	SO-X	3.189923**********	
3	HC	1.399207**********	
4	CO	1.373294**********	
5	PART.	1.913307**********	
6	HS	**********	
7	H-2SO-4	0.0	0.0
8	FL	**********	
9	BOD	2.498722	1.972047
10	COD	1127.880371**********	
11	TSS	11908.847656	5801.066406
12	VSS	144.435745**********	
13	S-SOL	**********	1.331674
14	S.WASTE(L)	**********	
15	S.WASTE(S)	1.880456	2.496818
16	WATER USE	**********	1.817717

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

spending, with its demand for additional resources, is added to the corresponding multipliers indicated by table 12.

ENVIRONMENTAL IMPACT OF ECONOMIC GROWTH IN THE RIO GRANDE VALLEY

Economic growth of the Rio Grande Valley has been the subject of several reports recently[1]. The purpose of this report, as previously stated, is to provide a method whereby the environmental effects of economic growth can be estimated. The tables given in the previous section provide the tools to achieve this goal. In the present section, they are combined with estimates of future economic changes in order to calculate the "costs" of that growth in terms of changes in the environment.

Estimates of growth potentials for exports and internal markets were taken from the report by Dr. John W. Adams and are presented in table 14. Self-sufficiency refers to the replacement of imports by production from industries within the region. Export expansion is self-explanatory, and the new industry column refers to the attraction of more firms into an existing industry or firms in an industry not previously present (table 14).

Table 15 was formed by utilizing the direct requirements of table 6 and the projected output for certain firms which were thought to be capable of achieving self-sufficiency. The entries represent the additional quantities of pollutants added directly to the Rio Grande Valley region with the hypothesized growth and the added direct demand on the environment with respect to

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[1] Murrel, Joe C. Jr. et al, op. cit.; John W. Adams, The Economic Impact of Selected New and Expanding Industries on the Economy of the Rio Grande Region of Texas, Department of Agricultural Economics and Rural Sociology, Texas A&M University, Agricultural Experiment Station, Jan. 1973; Conrad F. Fritsch, The Economic Impact on the Lower Rio Grande Region From the Extension of Unemployment Insurance to Texas Agriculture: An Input-Output Analysis, Department of Agricultural Economics and Rural Sociology, Texas A&M University, Agricultural Experiment Station.

water requirement per year. If the prepared foods industry were to make the region self-sufficient with respect to its products, it would increase its own output by 5.74 million dollars (table 14). Without considering secondary effects within the economy, this new production would cause an increased resource use consisting of 16.525 tons of nitrogen oxides, .0459 tons of sulphur oxides, 3.0823 tons of hydrocarbons, etc. (table 15).

TABLE 14: GROWTH POTENTIALS FOR THE RIO GRANDE VALLEY OF TEXAS[1]

	Output in Growth Classes		
Industry	Self-Sufficiency	Export Expansion	New Industry
Livestock	4,068.233		
Dairy Manuf.		6,734.000	
Prepared Foods	5,736.638	11,680.286	
Other Foods	3,701.194	55,874.000	
Textiles	4,419.756		
Chem-Drugs			179,772.000
Petrol. Prod.	22,303.017		
Other Manuf. (Leather)			33,778.000

[1]Figures are in thousands.

The direct impact on the Valley's environment resulting from another group of firms achieving their export potential is shown in table 16. These results were also found using table 6 and the hypothesized increased output. Economic growth achieved by this alternative will, therefore, be accompanied by the listed direct additions to the pollution level and further draw on the area's

Table 15. Direct Environmental Impact of Output Required for Self Sufficiency in Selected Industries, Rio Grande Valley of Texas.

	Environmental[1] Factors	Economic Sectors				
		Livestock	Prep Foods	Oth. Foods	Textile Mill	Petro Prod.
1	NO-X		16.52496	10.88669		
2	SO-X		.04589	3.62310		
3	HC		3.0823			
4	CO		.0327			
5	PART.		1.37737	6.93641		
6	HS					
7	H-250-4					
8	FL					
9	BOD		5.39818			1.09062
10	COD		15.66618			2.50909
11	TSS	6579.65412	15.47443			.25202
12	VSS		5.28689			.19850
13	S-Sol					
14	S. Waste (L)					
15	S. Waste (S)	7266.93815	74.48777	129.54475	151.64492	
16	Water Use		163.44315	77.17582	3.67149	

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 16. Direct Environmental Impact of Export Expansion in Selected Industries, Rio Grande Valley of Texas

	Environmental[1] Factors	Economic Sectors		
		Dairy Manuf.	Prep Foods	Other Foods
1	NO-X		33.64623	164.34778
2	SO-X		.09344	54.69506
3	HC		6.27582	
4	CO		.06658	
5	PART.		2.80444	104.71346
6	HS			
7	H-250-4			
8	FL			
9	BOD		10.99115	
10	COD	155.55675	31.89769	
11	TSS		31.50524	
12	VSS		10.76455	
13	S-Sol			
14	S. Waste (L)			
15	S. Waste (S)		35.0642	1955.63470
16	Water Use		333.39508	1165.06230

[1] See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

water supply. The industry classified as other foods, for example, would add 55.87 million dollars to the region's economy (table 14). In terms of the environment this addition would "cost" 164.35 tons of nitrogen oxides, 54.695 tons of sulphur oxides, 104.713 tons of particles, 1955.63 tons of solid waste, and 1165.062 acre feet water use (table 16).

Table 17 shows the direct impacts from the third growth alternative. The chemical-drug industry already exists to some degree in the Rio Grande Valley. Its production function, including environmental usages, is given by the model. The leather industry (under other manufacturing in the sector groupings) is not yet part of the Valley's economy except as included in undifferentiated imports and exports. The direct environmental impact of these two industries' potential output is given in table 17.

Since the linkages of the leather industry with the rest of the economy are buried in imports and exports, considerably less information can be derived from consideration of growth in it than from the assumed growth in the chemical-drugs industry. An approach to improving this deficiency is presented later.

Although the increased output required to obtain self-sufficiency is sold to firms as well as final demand sectors, the entire output can be treated as an increase in final demand in order to obtain the direct, indirect, and (where appropriate) induced effect. Table 18 uses the output potential along with the type I resource interdependence matrix (table 7) in order to calculate the total effect of this type of growth. These additional resource demands are generated with the output figures in table 14 and are without the influence on households (type I effects). For an increase in production of a little over four million dollars by the livestock industry, the direct and indirect impact on the environment is in excess of 100 tons of nitrogen oxides, 7.0629 tons of sulphur oxides, 5.834 tons of hydrocarbons, etc.

Table 17. Direct Environmental Impact of Attraction of Selected New Industries into the Rio Grande Valley of Texas

	Environmental[1] Factors	Economic Sectors	
		Chem.-Drugs	Other Manufacturing
1	NO-X	6125.51517	
2	SO-X	5142.43199	
3	HC	41438.18307	
4	CO	253363.10638	
5	PART.	1504.31412	
6	HS	1797.37843	
7	H-250-4		
8	FL		
9	BOD	39.37007	
10	COD	3.05612	
11	TSS	19.25358	2597.51500
12	VSS	.37752	
13	S-Sol		
14	S. Waste (L)	9550.387500	
15	S. Waste (S)	955.038750	
16	Water Use	771.83310	

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 18. Total Type I Environmental Impact of Output Required for Self Sufficiency in Selected Industries of the Rio Grande Valley of Texas

	Environmental[1] Factors	Economic Sectors				
		Livestock	Prep Foods	Oth. Foods	Textile Mill	Petro Prod.
1	NO-X	100.95564	104.01385	105.00139	43.70387	1098.12250
2	SO-X	7.06286	2.98994	6.07847	1.72945	23.11039
3	HC	58.34090	32.29899	15.36551	7.22144	511.84978
4	CO	348.00560	164.74018	71.13066	10.05141	897.93954
5	PART.	58.33277	9.68287	18.00816	.89986	8.60896
6	HS	1.01502	.58973	.24724	.01238	5.60475
7	H-250-4					
8	FL	.00041			.00044	.00669
9	BOD	.03865	5.42629	.01110	.00133	1.23336
10	COD	.02563	15.70233	.02184	.01061	2.66075
11	TSS	24979.56289	741.25738	12316.92925	3.44653	18.15466
12	VSS	.00325	5.29492	.00296	.00044	.21188
13	S-Sol					
14	S. Waste (L)	54.31539	31.39146	13.24398	.62098	292.23197
15	S. Waste (S)	8997.48311	300.14319	211.95628	173.55896	232.62270
16	Water Use	90.25334	3927.87776	700.38878	34.56780	120.36938

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 19. Total Type II Environmental Impact of Output Required for Self Sufficiency in Selected Industries of the Rio Grande Valley of Texas

	Environmental[1] Factors	Economic Sectors				
		Livestock	Prep Foods	Oth. Foods	Textile Mill	Petro Prod.
1	NO-X	258.13386	207.45289	154.62811	158.75498	1398.52629
2	SO-X	12.41543	6.51281	7.76844	5.64756	33.33855
3	HC	139.59857	85.77479	41.02144	66.70031	667.15015
4	CO	825.69711	479.11081	221.95431	359.71245	1810.91800
5	PART.	62.58448	12.48063	19.35058	4.01181	16.73395
6	HS	1.14033	.67176	.28684	.10386	5.84339
7	H-250-4					
8	FL	.00520	.00344	.00185	.00398	.01561
9	BOD	.17778	55.18072	.05515	.10298	1.50099
10	COD	.12449	15.76772	.05330	.08309	2.85033
11	TSS	25899.81916	1346.88516	12607.48002	677.06021	1776.99288
12	VSS	.01139	5.30008	.00592	.00663	.22749
13	S-Sol	.01668	.01090	.00518	.01193	.3122
14	S. Waste (L)	60.98444	35.77998	15.34959	5.50304	304.97815
15	S. Waste (S)	10504.86961	1292.15476	687.88800	1276.93425	3113.57254
16	Water Use	541.61769	4224.92088	842.89919	364.95870	983.03001

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

Table 19 presents similar information with the addition of the influence of household consumption. This table was formed using column one of table 14 and the type II resource-output interdependence matrix (table 11). With the induced effect added, the prospect of the livestock industry becoming self-sufficient within the Rio Grande Valley is accompanied by an additional 258.1339 tons of nitrogen oxides, 12.415 tons of sulphur oxides, 139.599 tons of hydrocarbons, etc. (table 19).

Similar estimates of the environmental impact of expanding exports can be found. These estimates, like those in tables 18 and 19, are found by multiplying the amounts in column 2 of table 14 times the appropriate industry column sectors in table 7 and table 11. All such impacts will not be discussed here.

Table 20 shows the indirect environmental impact which would result if the leather goods industry were attracted to the Rio Grande Valley. There is a special aspect of this alternative that makes finding the resource effects a little more complicated.

Firms conforming to the general industrial category of chemical-drugs are already located in this region. Their operation there causes their production function to be generated within the general model. The effect of attracting new and different firms can be found by using the existing production function (including resource use) as an approximation of what it would be after the new firms located. The expected output could then be treated as if it were a change in final demand and environmental impact tables calculated as above.

However, firms which belong to an industry not already located in the region do not have interrelationships with the rest of the economy explicitly stated within the model. The linkages are buried within the export and import

Table 20. Indirect Environmental Impact (Type II) of Attracting the Leather Industry to the Rio Grande Valley of Texas

	Environmental[1] Factors	Economic Sectors				
		Other Const.	Chem-Drugs	Motor Freight	Commerce	H H
1	NO-X	2.0480	101.43605	66.40520	51.30047	784.58909
2	SO-X	.07170	22.98673	4.34034	1.44690	26.71848
3	HC	1.06062	185.89257	9.11966	41.67643	405.61525
4	CO	6.18588	1110.22686	53.92502	252.95158	2384.50300
5	PART.	.11326	7.08441	.20402	1.45432	21.22335
6	HS	.00345	7.48025	.00445	.1877	.62469
7	H-250-4					
8	FL	.00005	.00088	.00014	.00089	.2569
9	BOD	.00169	.17873	.00445	.03257	.69501
10	COD	.00565	.06996	.00365	.01914	.49353
11	TSS	8.90625	96.02175	25.48475	136.99361	4593.69570
12	VSS	.00038	.00314	.00037	.00326	.04192
13	S-Sol	.00015	.00168	.00043	.00193	.08248
14	S. Waste (L)	.52924	397.55194	.24850	1.01743	33.28993
15	S. Waste (S)	29.20624	232.76948	64.32212	419.46299	7524.41052
16	Water Use	4.24720	54.64159	12.69984	57.96348	2253.08078

[1]See Glossary for description of terms. Environmental factors 1 through 15 are expressed in tons. Water use figures are in acre feet.

sectors. In addition, since resource use data was collected for a region without that industry, the environmental factors related to its production process are not known.

Since no data on direct resource-output relationships were available for the study region, the environmental effects estimated for creation of a new leather industry are limited to the indirect effects that would result as existing industries expand output to meet the needs created by this new industry. These indirect effects of the new industry were found by estimating the leather industry's dollar input requirements from other sectors of the valley economy (table 21), treating these requirements as new final demand and multiplying these values by the existing resource-output interdependence matrix. This procedure provides an approximation of the indirect resource requirements generated by the addition of the leather industry to the regional economy. These results are presented in table 20. Total environmental effects of the new industry could be found by estimating its direct environmental effects and adding these to the indirect effects shown in table 20.

TABLE 21: SAMPLE DOLLAR AMOUNTS OF INPUTS FOR THE LEATHER GOODS INDUSTRY

Industry	Sales to Leather Goods (dollars)
Other Constr.	49,200
Chem-Drugs	731,000
Motor Freight	160,000
Commerce	742,000
Households	13,521,500

The results presented in this section concerning development alternatives (self-sufficiency, export expansion and new industry) are examples of applications of the extended input-output model. Such results provide comparative information on the relative economic output and environmental impacts of alternative expansion alternatives. For any specified development alternative, comparisons may be drawn among changes in output, income, employment and selected environmental factors. Hence, the choice criteria for development correlations are broader based than with planning tools that include only comparative economic impact data.

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APPENDIX

Table A1: Total Resource Use in the Rio Grande Valley of Texas

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		IRR COTTON	IRR GRAINS	OTHER IRR	DRYLAND COTTON	DRYLAND FDGRAIN	OTHER DRYLAND
1	NO-X	0.0	0.0	0.0	0.0	0.0	0.0
2	SO-X	0.0	0.0	0.0	0.0	0.0	0.0
3	HC	0.0	0.0	0.0	0.0	0.0	0.0
4	CO	0.0	0.0	0.0	0.0	0.0	0.0
5	PART.	0.0	0.0	0.0	0.0	0.0	0.0
6	HS	0.0	0.0	0.0	0.0	0.0	0.0
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	0.0	0.0	0.0	0.0	0.0	0.0
9	BOD	0.0	0.0	0.0	0.0	0.0	0.0
10	COD	0.0	0.0	0.0	0.0	0.0	0.0
11	TSS	-636920.00	-687750.00	-1935.00	-1112454.00	-4386742.00	-105315.00
12	VSS	0.0	0.0	0.0	0.0	0.0	0.0
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	0.0	0.0	0.0	0.0	0.0	0.0
15	S.WASTE(S)	0.0	0.0	0.0	0.0	0.0	0.0
16	WATER USE	229136.25	18343.00	422091.75	0.0	0.0	0.0

[1]See Glossary for description of terms. Environmental factors 1 through 15 are in tons. Water use figures are expressed in area feet.

Table A1: Total Resource Use in the Rio Grande Valley of Texas

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		LIVESTK	DAIRY POULT	AGRI SUPPLY	GINNING	AGRI SERV	FISH
1	NO-X	0.0	0.0	0.0	-0.90	0.0	0.0
2	SO-X	0.0	0.0	0.0	0.0	0.0	0.0
3	HC	0.0	0.0	0.0	-17.90	0.0	0.0
4	CO	0.0	0.0	0.0	-89.50	0.0	0.0
5	PART.	0.0	0.0	0.0	-944.30	-5277.30	0.0
6	HS	0.0	0.0	0.0	0.0	0.0	0.0
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	0.0	0.0	0.0	0.0	0.0	0.0
9	BOD	0.0	0.0	0.0	0.0	0.0	0.0
10	COD	0.0	0.0	0.0	0.0	0.0	0.0
11	TSS	-100274.00	0.0	0.0	0.0	0.0	0.0
12	VSS	0.0	0.0	0.0	0.0	0.0	0.0
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	0.0	0.0	0.0	0.0	0.0	0.0
15	S.WASTE(S)	-110748.25	-33346.22	0.0	0.0	0.0	0.0
16	WATER USE	0.0	0.0	0.0	0.0	91.00	0.0

[1]See Glossary for description of terms. Environmental factors 1 through 15 are in tons. Water use figures are expressed in area feet.

Table A1: Total Resource Use in the Rio Grande Valley of Texas

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		PETROL GAS SERV	RES CONSTR	COMM CONSTR	OTHER CONSTR	MEAT PROD	DAIRY MANUF
1	NO-X	-69432.88	0.0	0.0	0.0	0.0	0.0
2	SO-X	-69.60	0.0	0.0	0.0	0.0	0.0
3	HC	-29235.00	0.0	0.0	0.0	0.0	0.0
4	CO	-531.00	0.0	0.0	0.0	0.0	0.0
5	PART.	-148.70	0.0	0.0	0.0	0.0	0.0
6	HS	-9.00	0.0	0.0	0.0	0.0	0.0
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	0.0	0.0	0.0	0.0	0.0	0.0
9	BOD	-0.52	0.0	0.0	0.0	0.0	0.0
10	COD	-4.18	0.0	0.0	0.0	0.0	0.0
11	TSS	-0.58	0.0	0.0	0.0	-15.45	-500.17
12	VSS	-0.51	0.0	0.0	0.0	0.0	0.0
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	0.0	0.0	0.0	-1472.67	0.0	0.0
15	S.WASTE(S)	0.0	-2273.55	-4194.32	-55109.09	0.0	0.0
16	WATER USE	7617.00	0.0	0.0	0.0	35.00	0.0

[1]See Glossary for description of terms. Environmental factors 1 through 15 are in tons. Water use figures are expressed in area feet.

Table A1: Total Resource Use in the Rio Grande Valley of Texas

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS: PREP FOODS	OTHER FOODS	BEVERAGE	TEXT MILL	WOOD PAPER	PUBL PRINTNG
1	NO-X	-252.00	-249.40	0.0	0.0	-25.10	0.0
2	SO-X	-0.70	-83.00	0.0	0.0	0.0	0.0
3	HC	-47.00	0.0	0.0	0.0	-4.40	0.0
4	CO	-0.50	0.0	0.0	0.0	0.0	0.0
5	PART.	-21.00	-158.90	0.0	0.0	-68.00	0.0
6	HS	0.0	0.0	0.0	0.0	0.0	0.0
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	0.0	0.0	0.0	0.0	0.0	0.0
9	BOD	-82.32	0.0	0.0	0.0	0.0	0.0
10	COD	-238.90	0.0	0.0	0.0	0.0	0.0
11	TSS	-235.96	0.0	0.0	0.0	0.0	0.0
12	VSS	-80.62	0.0	0.0	0.0	0.0	0.0
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	0.0	0.0	0.0	0.0	0.0	0.0
15	S.WASTE(S)	-1137.43	-2967.70	-1999.02	-371.72	-1073.87	-283.72
16	WATER USE	2497.00	1768.00	0.0	9.00	0.0	0.0

[1]See Glossary for description of terms. Environmental factors 1 through 15 are in tons. Water use figures are expressed in area feet.

Table A1: Total Resource Use in the Rio Grande Valley of Texas

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		CHEM DRUGS	PETRO PROD	CLAY STONE	CEMENT	FOUND FORGE	FAB STL&METL
1	NO-X	-5976.00	0.0	0.0	-146.20	0.0	0.0
2	SO-X	-5016.90	0.0	0.0	0.0	0.0	0.0
3	HC	-40426.70	0.0	0.0	-11.70	0.0	0.0
4	CO	-247178.56	0.0	0.0	-29.30	0.0	0.0
5	PART.	-1467.60	0.0	0.0	-357.90	0.0	0.0
6	HS	-1753.50	0.0	0.0	0.0	0.0	0.0
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	0.0	0.0	0.0	0.0	0.0	0.0
9	BOD	-38.41	-23.87	0.0	-1.21	0.0	0.0
10	COD	-2.98	-54.95	0.0	-24.83	-1603.62	0.0
11	TSS	-18.78	-5.54	0.0	-8.89	-9.02	-1236.12
12	VSS	-0.37	-4.36	0.0	-1.65	-3.25	0.0
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	-93172.75	0.0	0.0	0.0	0.0	0.0
15	S.WASTE(S)	-9317.27	0.0	-22.42	-848.15	-943375.06	0.0
16	WATER USE	753.00	0.0	0.0	0.0	9128.00	0.0

[1]See Glossary for description of terms. Environmental factors 1 through 15 are in tons. Water use figures are expressed in area feet.

Table A1: Total Resource Use in the Rio Grande Valley of Texas

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		MACH EQUIP	ELEC EQUIP	TRANS EQUIP	OTHER MANUF	MOTOR FRGT	WATER TRANSP
1	NO-X	0.0	0.0	0.0	0.0	-7698.00	0.0
2	SO-X	0.0	0.0	0.0	0.0	-562.00	0.0
3	HC	0.0	0.0	0.0	0.0	-774.00	0.0
4	CO	0.0	0.0	0.0	0.0	-4683.00	0.0
5	PART.	0.0	0.0	0.0	0.0	-4.60	0.0
6	HS	0.0	0.0	0.0	0.0	0.0	0.0
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	0.0	0.0	0.0	0.0	0.0	0.0
9	BOD	0.0	0.0	0.0	0.0	0.0	0.0
10	COD	0.0	0.0	0.0	0.0	0.0	0.0
11	TSS	0.0	0.0	0.0	-436.24	0.0	0.0
12	VSS	0.0	0.0	0.0	0.0	0.0	0.0
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	0.0	0.0	0.0	0.0	0.0	0.0
15	S.WASTE(S)	-1229.40	-45.43	-425.40	0.0	-2101.42	-1326.97
16	WATER USE	1.00	0.0	0.0	0.0	0.0	0.0

[1]See Glossary for description of terms. Environmental factors 1 through 15 are in tons. Water use figures are expressed in area feet.

Table A1: Total Resource Use in the Rio Grande Valley of Texas

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS					
		AIR TRANSP	OTHER TRANSP	COMMUN	GAS SER	ELEC SER	WATER SANIT
1	NO-X	-2.50	-422.00	0.0	0.0	-82078.00	0.0
2	SO-X	-1634.00	-364.00	0.0	0.0	-800.00	0.0
3	HC	-0.20	-283.00	0.0	0.0	-979.00	0.0
4	CO	-0.50	-396.00	0.0	0.0	-11.00	0.0
5	PART.	-398.50	-83.10	0.0	-19.00	-367.00	0.0
6	HS	0.0	0.0	0.0	0.0	0.0	0.0
7	H-2SO-4	0.0	0.0	0.0	0.0	0.0	0.0
8	FL	-4.20	0.0	0.0	0.0	0.0	0.0
9	BOD	0.0	-0.02	0.0	0.0	0.0	0.0
10	COD	0.0	-0.48	0.0	0.0	-3.45	0.0
11	TSS	0.0	-0.02	0.0	0.0	-1.44	0.0
12	VSS	0.0	-0.02	0.0	0.0	-0.50	0.0
13	S-SOL	0.0	0.0	0.0	0.0	0.0	0.0
14	S.WASTE(L)	0.0	0.0	0.0	0.0	0.0	0.0
15	S.WASTE(S)	0.0	-1030.17	0.0	0.0	0.0	0.0
16	WATER USE	0.0	0.0	0.0	167.00	9284.00	0.0

[1]See Glossary for description of terms. Environmental factors 1 through 15 are in tons. Water use figures are expressed in area feet.

Table A1: Total Resource Use in the Rio Grande Valley of Texas

	ENVIRONMENTAL[1] FACTORS	ECONOMIC SECTORS COMMERCE	HOUSE HOLDS
1	NO-X	-28847.00	0.0
2	SO-X	-802.00	0.0
3	HC	-52665.00	0.0
4	CO	-325677.00	0.0
5	PART.	-1344.00	0.0
6	HS	0.0	0.0
7	H-2SO-4	0.0	0.0
8	FL	0.0	0.0
9	BOD	-23.05	-45.74
10	COD	-0.03	0.0
11	TSS	-16.74	-82.49
12	VSS	-0.04	0.0
13	S-SOL	0.0	-8.03
14	S.WASTE(L)	0.0	0.0
15	S.WASTE(S)	-394406.25	-390976.63
16	WATER USE	0.0	160811.00

[1]See Glossary for description of terms. Environmental factors 1 through 15 are in tons. Water use figures are expressed in area feet.