United States
Environmental Protection
Agency

Municipal Environmental Research
Laboratory
Cincinnati OH 45268

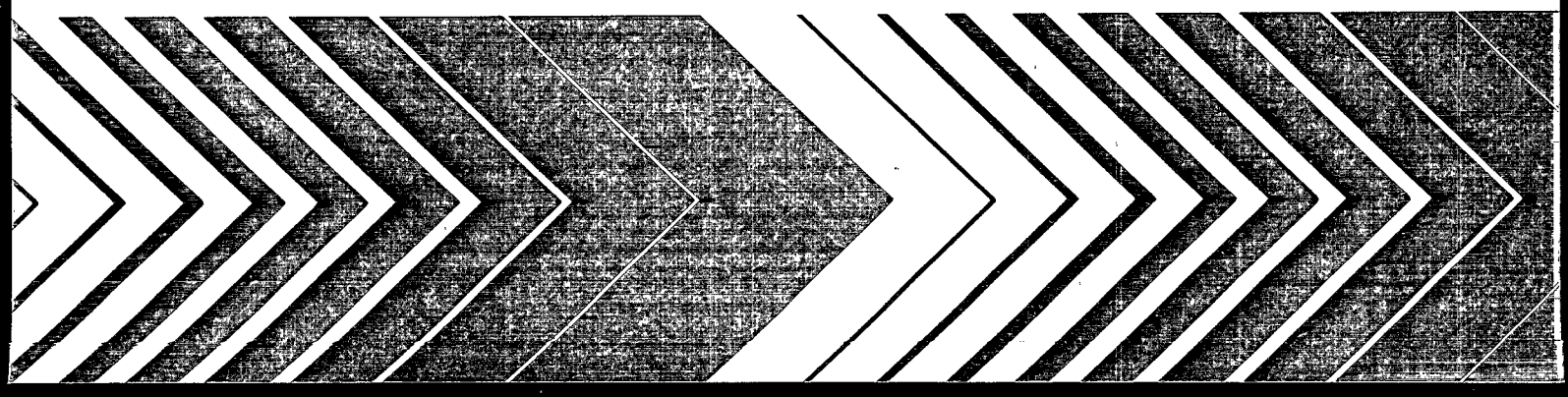
EPA-600/2-79-162d
August 1979

Research and Development

EPA

Estimating Water Treatment Costs

Volume 4
Computer User's Manual for Retrieving and Updating Cost Data



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ESTIMATING WATER TREATMENT COSTS

Volume 4. Computer User's Manual for Retrieving and Updating Cost Data

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FOREWORD

The U.S. Environmental Protection Agency (EPA) was created because of increasing public and government concern about the dangers of pollution to the health and welfare of the American people. Noxious air, foul water, and spoiled land are tragic testimonies to the deterioration of our natural environment. The complexity of that environment and the interplay of its components require a concentrated and integrated attack on the problem.

Research and development is that necessary first step in problem solution, and it involves defining the problem, measuring its impact, and searching for solutions. The Municipal Environmental Research Laboratory develops new and improved technology and systems to prevent, treat, and manage wastewater and solid and hazardous water pollutant discharges from municipal and community sources to preserve and treat public drinking water supplies, and to minimize the adverse economic, social, health, and aesthetic effects of pollution. This publication is one of the products of that research--a most vital communications link between the researcher and the user community.

The cost of water treatment processes that may be used by water supply systems to remove contaminants included in the National Interim Primary Drinking Water Regulations is of interest to the EPA, State and local agencies, and consulting engineers. This volume contains documentation and user information for the WATER program, a FORTRAN computer program that retrieves and updates cost information for the 72 large-system unit processes and the 27 small system processes presented in Volumes 1, 2, and 3 of this report. The WATER program is capable of determining costs for individual processes and complete treatment plants.

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ABSTRACT

This volume is the fourth in a series of four reports on estimating costs for water treatment as a function of system size and treatment efficiency. Volume 4 is a computer users manual and contains a FORTRAN computer program, WATER, that can be used for retrieval and updating of all cost data contained in the Volumes 1, 2 and 3. Volume 1 is the summary volume and discusses the cost estimating approaches utilized to develop the cost curves and the treatment techniques applicable for contaminant removal. It also presents a series of examples demonstrating the use of the cost curves applicable to large water supply systems with treatment capacities between 1 and 200 mgd. Information is included on virus and asbestos removal. Volume 2 presents cost curves for large water systems (1 to 200 mgd), and Volume 3 presents cost curves for small systems (2,500 gpd to 1 mgd).

The WATER program determines costs by retrieving stored coefficients for a least squares polynomial fit of the cost curves presented in Volumes 1, 2, and 3, and by evaluating the polynomial expression for the desired process design parameter. Cost information is presented for construction and operation and maintenance, including energy, maintenance material and labor. The conceptual designs and assumptions used in formulating the cost information are presented in Volumes 1, 2, and 3.

The program will compute costs for individual processes or for a series of processes. Capital costs are determined from construction costs by applying cost factors (input by the user) for engineering, sitework, subsurface considerations, land, and standby power. The program computes general contractor overhead and profit, legal, fiscal, and administrative fees, and interest during construction based on the overall cost of the project.

All construction costs are stored in terms of October 1978 dollars, and are updated by one of two methods, determined by the user. The program computes a weighted composite cost index for each process, using eight individual cost indices for excavation and sitework, manufactured equipment, concrete, steel, labor, pipe and valves, electrical equipment and instrumentation, and housing - or the user may specify updating by use of the Engineering News Record Construction Cost Index. Operation and maintenance costs are determined from unit costs (input by the user) such as dollars per hour for labor and dollars per kilowatt hour for electricity. Maintenance material costs are stored as dollars per year and are updated using the Bureau of Labor Statistics Price Index.

The user need not be an experienced programmer, but a familiarity with programming is recommended. This report was submitted in fulfillment of Contract No. 68-03-2516 by Culp/Wesner/Culp under the sponsorship of the U.S. Environmental Protection Agency. This report covers the period November 1, 1976 to January 1, 1979. It was completed as of July 2, 1979.

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ACKNOWLEDGEMENTS

This report was prepared under the direction of Dr. Robert M. Clark, Municipal Environmental Research Laboratory, Office of Research and Development. The report was prepared by Robert C. Gumerman, Russell L. Culp, Sigurd P. Hansen, Thomas S. Lineck, and Bruce E. Burris of Culp/Wesner/Culp. Ms. Karin J. Wells of Culp/Wesner/Culp was responsible for typing of the final report.

Mr. Ronald M. Dahman of Zurheide-Herrmann, Inc., was responsible for checking all unit costs. Dr. Isadore Nusbaum and Mr. Dean Owens were respective sub-consultants on the reverse osmosis and ion exchange curves.

Special acknowledgement is given to Mr. Keith Carswell, Dr. Robert M. Clark, Mr. Jack De Marco, Dr. Gary Logsdon, Dr. O. Thomas Love, Mr. Benjamin Lykins, Jr., Mr. Thomas J. Sorg, all of the EPA Municipal Environmental Research Laboratory, who reviewed the final report, and Mr. Paul Dorsey, also of the EPA Municipal Environmental Research Laboratory, who reviewed the computer program.

Mrs. Anne Hamilton was the technical editor for all four volumes of this report.

SECTION 1

INTRODUCTION

SCOPE

This report is Volume 4 of a four-volume study that presents construction and operation and maintenance cost curves for 99 unit processes that are especially applicable (either individually or in combination) to the removal of contaminants listed in the National Interim Primary Drinking Water Regulations. This volume is a computer users manual and contains documentation and user information for the WATER program, which is a FORTRAN computer program that retrieves and updates cost information for the 72 large and 27 small water supply systems presented in Volumes 1, 2, and 3 of this report. Costs are also determined for treatment plants, and they are input to the program as trains of individual processes.

BACKGROUND

The WATER program described here can be used as a valuable tool to facilitate retrieval and updating of the cost information presented in Volumes 1, 2, and 3 of this report. Since WATER has been designed to compute costs for entire treatment plants, cost determinations for competing treatment trains or regional variations in operating costs for a particular treatment train can be made quickly and accurately.

The costs generated by this program are broken down into capital costs and operation and maintenance costs. Capital costs include those for construction, engineering, sitework and interface piping, subsurface considerations, standby power, legal, fiscal and administrative services, interest during construction, and land. Operation and maintenance costs include those for electricity, labor, maintenance materials, diesel fuel, natural gas, and chemicals. Most costs are stored as coefficients of third-degree polynomial expressions determined by the method of least squares for the values in the cost tables presented in Volumes 1, 2, and 3. Therefore, the cost generated for a specific point in these tables could vary by as much as 10 to 15 percent from the value generated by the program, depending on the deviation of the values in the table from a smooth curve fit. In general, the differences between the costs generated by the program and the costs obtained through use of the cost curves in Volumes 1, 2, and 3, will be insignificant.

The user need not be an experienced programmer, but a familiarity with programming is recommended.

PURPOSE AND OBJECTIVES

The purpose of this volume is to present complete documentation and user information for the FORTRAN computer program, WATER, which retrieves and updates cost information for the large and small water supply treatment processes presented in Volumes 1, 2, and 3 of this report. The WATER program has been designed to facilitate the estimation of overall treatment plant costs as well as individual process costs.

SECTION 2

INPUT DATA FILES

Three data files are necessary to run this program. Two of these files, COST.DAT and PROCES.DAT, are set up by the user. The third data file, CRV.DAT, is a construction and operation and maintenance data base containing information about each of the water treatment processes considered in this report. This file is an integral part of the program and must be established on the computing system with the main program. Once it is established, the general user should have no need to access the main program, WATER, or the data base, CRV.DAT.

The first of the two data files to be constructed by the user is the COST.DAT file. Table 1 is an example listing of the COST.DAT file. This file basically contains all the cost information necessary to run the program. The variables in this file, called cost factors, must be input in the sequence shown in Table 1. A detailed explanation of the input format is given in the following section on COST.DAT File Construction.

The second file to be constructed by the user is the PROCES.DAT file. Table 2 is an example listing of the PROCES.DAT file. This file contains information about each of the water treatment processes for which the user desires costs. A detailed explanation of the input format is given in a following section entitled, PROCES.DAT File Construction.

Table 1

COST.DAT File Example

```
COSTS PRESENTED ARE CURRENT AS OF OCTOBER 1978
CAPITAL COST FACTORS (% OF CONSTRUCTION COST):
 1 ENGINEERING(%)                      =10.
 2 SITEWORK, INTERFACE PIPING(%)       =5.
 3 SUBSURFACE CONSIDERATIONS(%)        =0.0
 4 STANDBY POWER(%)                    =0.0
 5 INTEREST RATE(%)                    =7.
 6 NUMBER OF YEARS                     =20.0
 7 LAND COST, $/ACRE                   =2000.
UNIT COST FACTORS:
 8 ELECTRICITY, $/KWH                  =.03
 9 LABOR, $/HR                         =10.
10 DIESEL FUEL, $/GAL                  =.45
11 NATURAL GAS, $/CU FT                =.0013
12 BLDNG ENERGY USE,KWH/SQ FT/YR       =102.6
COST INDEXES:
13 EXCAVATION(ENR SKILLED LABOR)       =247.0
14 MANUFACTURED EQUIP (BLS #114)       =221.3
15 CONCRETE (BLS #132)                 =221.1
16 STEEL (BLS #101.3)                  =262.1
17 LABOR (ENR SKILLED LABOR)           =247.0
18 PIPE & VALVES (BLS #114.901)        =236.4
19 ELECTRICAL & INSTR (BLS #117)       =167.5
20 HOUSING (ENR BUILDING COST)         =254.76
21 PRODUCER PRICE INDEX                =199.7
22 ENR CONSTRUCTION, '67 BASE YR       =0.0
OUTPUT(6 FOR LP,5 FOR TELETYPE)        =5
PRINTOUT(DETAILED OR SUMMARY)          =SUMMARY
9,2
7.5,12.5
```

Table 2

PROCES.DAT File Example

```
ACRES=1.5
1,57,IN-PLANT PUMPING
2,5.0,3.5,7.5,3.5
3,75.0,TDH
1,60,PRESSURE ION EXCHANGE-SOFTENING
2,5.0,3.5,5.0,3.5
3,30.6,REGENERATION SALT
1,15,SODIUM HYDROXIDE FEED SYSTEMS
2,5.0,3.5,625.0,438.0
3,200.0,SODIUM HYDROXIDE,15 MG/L
1,1,CL2 FEED-CYLINDER STORAGE
2,5.0,3.5,63.0,44.0
3,300.0,CHLORINE,1.5 MG/L
1,95,CLEARWELL STORAGE-GROUND LEVEL
2,5.0,3.5,500000.0,500000.0
1,93,FINISHED WATER PUMPING FACILITY
2,5.0,3.5,8.0,3.5
3,200.0,TDH
0000000000000000000000000000000000000000
ACRES=0.0
1,11,LIME FEED-NO RECALCINATION
2,1.0,0.7,8.7,6.1
3,65.0,LIME,25 MG/L
```

SECTION 3

COST.DAT FILE CONSTRUCTION

To aid in understanding the format of this data file, the user is referred to Table 1, which must be constructed as shown. Cards 2, 10, and 16 are for user information only and are skipped by the program when reading this file. They must not be omitted, however, or the program will skip actual data. A card-by-card explanation of this file is given in Table 3.

Table 3

Card-by-Card Explanation of COST.DAT File

Card No.	Explanation
1	First 48 characters printed "as is" on the program output. Intended to be used to denote valid data of cost information produced.
2	For user information only. This line is skipped by the program.
3-9	Capital cost factors as shown. Program read skips the first 34 characters then reads floating point number input. These values must start in Column 35 and must contain a decimal point. Percentage values, as indicated, must be percentages, not decimal values. Example: Engineering must be listed as 10.0 for 10 percent, not as 0.10. The program internally divides by 100.
10	For user information only - skipped by program read.
11-15	Unit cost factors as shown. As with lines 3-9, program read skips the first 34 characters. Values must begin in Column 35 and must contain decimal points. Units are as shown in Table 1.
16	For user information only - skipped by program read.

Card No.	Explanation (continued)
17-26	Cost indices as shown. As with lines 3-9 and 11-15, program read skips the first 34 characters. Values must begin in Column 35 and must contain decimal points. These cost indices are used to update the cost data base stored in the CRV.DAT file. The user has the option of using the first eight cost indices listed (Excavation through Housing) to update the construction costs produced by the program, or he can use the ENR Construction Cost Index (line 26) in lieu of the first eight indices. The computer will use the ENR Construction Cost Index if the value input is greater than zero. If the value input for the ENR Construction Cost Index is equal to zero, the computer will use the first eight indices.
27	This card designates the location for program output. On most computer installations, a "5" designates the teletype or remote terminal. The program output is 132 characters wide, so it is suggested that the line printer be used if the teletype does not have the capacity to print 132 characters per line. The value for this variable must be an integer and must begin in Column 35.
28	This card designates a detailed or summary output. See sections 5 (Program Output) and 6 (Examples) for an explanation and sample of these options.
29-30	These cards are optional. The user may wish to run the program while varying only one of the cost factors in the COST.DAT file. Cost factors are numbered 1 through 22 for convenience. For example, cost factor number 9 is labor ($/hr). Thus if the user wants to determine the change in overall operations and maintenance cost based on the regional variation of the cost of electricity across the nation, he first inputs in card 29 the number of the cost factor and the additional number of values to be used for that cost factor. In this case, cards 29 and 30 are as follows for two additional values of cost factor number 9: Card 29: 9,2 Card 30: 7.5,12.5 Card 30 contains the two additional values of labor ($/hr) namely, 7.5 and 12.5. Note that all input values begin in column one for lines 29 and 30, and that they are separated by a comma. Up to 10 additional values may be input. They must be floating point numbers with decimal points, but they can appear in any column as long as they are separated by a comma.

Card No.	Explanation (continued)
29-30 continued	Cards 29 and 30 shown in the listing of the COST.DAT file in Table 1 accomplish the following: The program computes all costs with the cost of labor ($/hr) at 10. Then the program is automatically rerun twice with the cost of labor ($/hr) at 7.5 and 12.5. This produces three complete printouts. If the user wants to run the program only once, without varying any of the 22 cost factors, cards 29 and 30 are omitted, and the designation of DETAILED or SUMMARY printout is the last card of the COST.DAT file.

SECTION 4

PROCES.DAT FILE CONSTRUCTION

The PROCES.DAT file contains design and operating information about each of the processes for which the user may desire costs. Table 4 lists the processes for which costs are available and includes the process parameter range over which cost information is stored in the computer. For example, process 1 CL2 FEED - CYLINDER STORAGE, has cost information stored in the program data file over a range of 10 to 10,000 lb/day of chlorine feed. Also shown in Table 4 are the number of chemicals used in the treatment process, the process type and the number of data cards.

Chemical cost information is input along with process design and operating parameters, as explained later. The number of chemicals used in the process is listed in Table 4, and in most cases, the types of chemicals used will be obvious (for example, chlorine is used in process 1, CL2 FEED - CYLINDER STORAGE). For convenience, however, Table 5 lists the processes that use chemicals and the chemicals used.

The Process Type listed in Table 4 denotes the way in which information is input to the computer, and the number of data cards indicates the number of cards necessary to input information for that process. There are a total of 11 process types. The input data for each type are described later in this section.

Since the computer program is designed to determine individual process costs and plant costs by totaling the process costs, the PROCES.DAT file is assembled into what is here termed loosely as "segments" of data (Figure 1).

THE ACRES= CARD

Each data segment corresponds to a treatment plant and must begin with the ACRES= card. This card denotes the land area, in acres, required for the plant. If land costs are not to be included, the card should read ACRES=0.0, with the "A" in acres beginning in Column 1. For convenience, typical land area requirements are shown in Figures 2 and 3.

PROCESS DATA CARDS

Following the ACRES= card, data cards for the processes in the plant are assembled sequentially. There may be as many processes as desired, in any order, and processes may be input more than once. The set of process data cards preceded by the ACRES= card constitutes a segment of data (Figure 1).

Table 4

Process Cost Curves for Large and Small Water Treatment Systems

	TREATMENT PROCESS - LARGE SYSTEMS	PARAMETER RANGE				NUMBER OF CHEMICALS	PROCESS TYPE	NO. DATA CARDS
1	CL2 FEED-CYLINDER STORAGE	10.0	TO	10000.0	LB/DAY	1	1	3
2	CL2 FEED-ON SITE STORAGE TANK	2000.0	TO	10000.0	LB/DAY	1	1	3
3	CL2 FEED FROM RAIL CAR	2000.0	TO	10000.0	LB/DAY	1	1	3
4	CHLORINE DIOXIDE GENERATING,FEED	10.0	TO	3500.0	LB/DAY	2	1	4
5	OZONE GENERATION SYSTEMS	10.0	TO	3500.0	LB/DAY	0	1	2
6	OZONE CONTACT CHAMBER	460.0	TO	92000.0	CU FT	0	1	2
7	ON-SITE HYPOCHLORITE GENERATION	10.0	TO	10000.0	LB/DAY	1	1	3
8	ALUM FEED-LIQUID STOCK	5.4	TO	5400.0	LB/HR	1	1	3
9	ALUM FEED-DRY STOCK	10.0	TO	5000.0	LB/HR	1	1	3
10	POLYMER FEED SYSTEMS	1.0	TO	200.0	LB/DAY	1	10	3
11	LIME FEED-NO RECALCINATION	10.0	TO	1000.0	LB/HR	1	1	3
12	LIME FEED-WITH RECALCINATION	1000.0	TO	10000.0	LB/HR	1	8	4
13	POTASSIUM PERMANGANATE FEED	1.0	TO	500.0	LB/DAY	1	1	3
14	SULFURIC ACID FEED SYSTEMS	10.0	TO	5000.0	GPD	1	1	3
15	SODIUM HYDROXIDE FEED SYSTEMS	10.0	TO	10000.0	LB/DAY	1	1	3
16	FERROUS SULFATE FEED SYSTEMS	10.7	TO	5350.0	LB/HR	1	1	3
17	FERRIC SULFATE FEED SYSTEMS	13.3	TO	6600.0	LB/HR	1	1	3
18	ANHYDROUS AMMONIA FEED FACILITY	250.0	TO	5000.0	LB/DAY	1	1	3
19	AQUA AMMONIA FEED FACILITY	250.0	TO	5000.0	LB/DAY	1	1	3
20	POWDERED ACTIVATED CARBON FEED	3.5	TO	7000.0	LB/HR	1	1	3
21	RAPID MIX, G=300	100.0	TO	20000.0	CU FT	0	1	2
22	RAPID MIX, G=600	100.0	TO	20000.0	CU FT	0	1	2
23	RAPID MIX, G=900	100.0	TO	20000.0	CU FT	0	1	2
24	FLOCCULATION-HORIZ PADDLE, G=20	1800.0	TO	1000000.0	CU FT	0	1	2
25	FLOCCULATION-HORIZ PADDLE, G=50	1800.0	TO	1000000.0	CU FT	0	1	2
26	FLOCCULATION-HORIZ PADDLE, G=80	1800.0	TO	500000.0	CU FT	0	1	2
27	FLOCCULATION-VERT TURBINE, G=20	1800.0	TO	25000.0	CU FT	0	1	2
28	FLOCCULATION-VERT TURBINE, G=50	1800.0	TO	25000.0	CU FT	0	1	2

Table 4 (Continued)

TREATMENT PROCESS - LARGE SYSTEMS	PARAMETER RANGE				NUMBER OF CHEMICALS	PROCESS TYPE	NO. DATA CARDS
29 FLOCCULATION-VERT TURBINE, G=80	1800.0	TO	25000.0	CU FT	0	1	2
30 CIRCULAR CLARIFIER-LIME SLUDGE	707.0	TO	31400.0	SQ FT	0	3	3
31 CIRC CLARIFIER-FECL3 & ALUM SLDG	707.0	TO	31400.0	SQ FT	0	3	3
32 RECTANGULAR CLARIFIER-LIME SLDG	240.0	TO	4800.0	SQ FT	0	3	3
33 RECT CLARIFIER-FECL3 & ALUM SLG	240.0	TO	4800.0	SQ FT	0	3	3
34 UPFLOW SOLIDS CONTACT CLAR,G=70	255.0	TO	14500.0	SQ FT	0	3	3
35 UPFLOW SOLIDS CONTACT CLAR,G=110	255.0	TO	14500.0	SQ FT	0	3	3
36 UPFLOW SOLIDS CONTACT CLAR,G=150	255.0	TO	14500.0	SQ FT	0	3	3
37 TUBE SETTLING MODULES	280.0	TO	56000.0	SQ FT	0	1	2
38 GRAVITY FILTRATION STRUCTURE	140.0	TO	28000.0	SQ FT	0	1	2
39 FILTRATION MEDIA-RAPID SAND	370.0	TO	74800.0	SQ FT	0	1	2
40 FILTRATION MEDIA-DUAL MEDIA	140.0	TO	29900.0	SQ FT	0	1	2
41 FILTRATION MEDIA-MIXED MEDIA	140.0	TO	29900.0	SQ FT	0	1	2
42 BACKWASH PUMPING FACILITIES	1260.0	TO	23000.0	GPM	0	1	2
O&M:	1537.2	TO	28060.0	SQ FT			
43 HYDRAULIC SURFACE WASH SYSTEMS	140.0	TO	28000.0	SQ FT	0	1	2
44 AIR-WATER BACKWASH FACILITIES	140.0	TO	28000.0	SQ FT	0	1	2
45 WASH WATER SURGE BASINS	10000.0	TO	500000.0	GAL	0	1	2
46 FILTER MOD-RAP SAND TO HIGH RATE	140.0	TO	28000.0	SQ FT	0	1	2
47 CONTINUOUS AUTO. BACKWASH FILTER	360.0	TO	70400.0	SQ FT	0	1	2
48 RECARBONATION BASIN	770.0	TO	35200.0	CU FT	0	3	3
49 RECARBONATION-LIQUID CO2 FEED	380.0	TO	15000.0	LB/DAY	1	1	3
50 RECARB-CO2 FROM SUBMERGED BURNER	500.0	TO	10000.0	LB/DAY	0	3	3
51 RECARBONATION-CO2 FROM STACK GAS	2500.0	TO	50000.0	LB/DAY	0	1	2
52 MULTIPLE HEARTH RECALCINATION	179.0	TO	2930.0	SQ FT	0	3	3
53 CONTACT BASIN-DIRECT FILTRATION	2640.0	TO	52800.0	CU FT	0	3	3
54 PRESSURE DIATOMITE FILTERS	1.0	TO	200.0	MGD	3	2	5
55 VACUUM DIATOMITE FILTERS	1.0	TO	200.0	MGD	3	2	5

Table 4 (Continued)

	TREATMENT PROCESS - LARGE SYSTEMS	PARAMETER RANGE				NUMBER OF CHEMICALS	PROCESS TYPE	NO. DATA CARDS
56	PRESSURE FILTRATION PLANTS	140.0	TO	28000.0	SQ FT	0	1	2
57	IN-PLANT PUMPING	1.0	TO	200.0	MGD	0	5	3
58	WASH WATER STORAGE TANKS	21000.0	TO	900000.0	GAL	0	1	2
59	REVERSE OSMOSIS	1.0	TO	200.0	MGD	3	2	5
60	PRESSURE ION EXCHANGE-SOFTENING	1.1	TO	123.0	MGD	1	1	3
61	GRAVITY ION EXCHANGE-SOFTENING	1.5	TO	150.0	MGD	1	1	3
62	PRESSURE ION EXCHANG-NO3 REMOVAL	1.1	TO	12.3	MGD	1	1	3
63	ACTIV. ALUMINA-FLUORIDE REMOVAL	0.7	TO	135.0	MGD	2	2	4
64	GRAVITY GAC CONTACTORS-CONCRETE	350.0	TO	10600.0	CU FT	0	4	3
	O&M:	140.0	TO	28000.0	SQ FT			
65	GRAVITY GAC CONTACTORS-STEEL	6280.0	TO	14100.0	CU FT	0	4	3
	O&M:	31400.0	TO	628000.0	CU FT			
66	PRESSURE CARBON CONTACTORS	390.0	TO	2260.0	CU FT	0	4	3
	O&M:	157.0	TO	6790.0	SQ FT			
67	CONVERT FILTER TO GAC CONTACTOR	370.0	TO	70000.0	SQ FT	0	1	2
68	GRANULAR ACT CARBON-CONSTR COST	10000.0	TO	10000000.0	LB	0	1	2
69	MAKEUP CARBON COST-O&M ONLY	10000.0	TO	10000000.0	LB/YR	0	1	2
70	CAPPING SAND FILTER W/ANTHRACITE	350.0	TO	70000.0	SQ FT	0	1	2
71	REGIONAL GAC REGEN-TRANS & STOR	1000.0	TO	20000.0	CU FT	0	6	3
	O&M:	30000.0	TO	3000000.0	LB/YR			
72	REGIONAL MULTI HEARTH GAC REGEN	27.0	TO	1510.0	SQ FT	0	12	4
73	MULTIPLE HEARTH GAC REGENERATION	27.0	TO	1510.0	SQ FT	0	3	3
74	INFRARED CARBON REGEN FURNACE	2400.0	TO	60000.0	LB/DAY	0	1	2
75	FLUIDIZED BED GAC REGENERATION	6000.0	TO	24000.0	LB/DAY	0	3	3
76	POWDERED CARB REGEN-FLUIDIZED BD	209.0	TO	33400.0	LB/DAY	0	1	2
77	POWDERED CARB REGEN-ATOMIZED SUS	1000.0	TO	10000.0	LB/DAY	0	1	2
78	CHEM SLUDGE PUMPING-UNTHICKENED	20.0	TO	10000.0	GPM	0	1	2
79	CHEM SLUDGE PUMPING-THICKENED	5.0	TO	1250.0	GPM	0	1	2
80	GRAVITY SLUDGE THICKENER-LIME	314.0	TO	17800.0	SQ FT	0	3	3
81	GRAV SLDG THICKENER-ALUM & FECL3	314.0	TO	17800.0	SQ FT	0	3	3

Table 4 (Continued)

	TREATMENT PROCESS - LARGE SYSTEMS	PARAMETER RANGE				NUMBER OF CHEMICALS	PROCESS TYPE	NO. DATA CARDS
82	VACUUM FILTERS	9.4	TO	1320.0	SQ FT	0	1	2
83	BELT FILTER PRESS	15.0	TO	450.0	GPM	0	1	2
84	FILTER PRESS	4.3	TO	896.0	CU FT	0	1	2
85	DECANTER CENTRIFUGES	10.0	TO	500.0	GPM	0	3	3
86	BASKET CENTRIFUGES	3600.0	TO	720000.0	GPD	0	1	2
87	SAND DRYING BEDS	5000.0	TO	400000.0	SQ FT	0	1	2
88	SLUDGE DEWATERING LAGOONS	40000.0	TO	8000000.0	CU FT	0	1	2
	O&M:	25000.0	TO	5000000.0	CF/YR			
89	SLUDGE DISPOSAL-SANITARY SEWER	20.0	TO	10000.0	GPM	0	11	3
90	LIQUID SLUDGE HAULING	1.3	TO	100.0	MG/YR	0	7	3
91	DEWATERED SLUDGE HAULING	1000.0	TO	300000.0	CY/YR	0	7	3
92	RAW WATER PUMPING FACILITY	1.0	TO	200.0	MGD	0	5	3
93	FINISHED WATER PUMPING FACILITY	1.5	TO	300.0	MGD	0	5	3
94	CLEARWELL STORAGE-BELOW GROUND	10000.0	TO	7500000.0	GAL	0	1	2
95	CLEARWELL STORAGE-GROUND LEVEL	8500.0	TO	9400000.0	GAL	0	1	2
96	DIFFUSED AERATION BASIN	1900.0	TO	380000.0	CU FT	0	1	2
97	AERATION-AERATION TOWERS	680.0	TO	256000.0	CU FT	0	1	2
98	ADMIN,LAB & MAINTENANCE BUILDING	1.0	TO	200.0	MGD	0	1	2
	TREATMENT PROCESS - SMALL SYSTEMS							
99	PACKAGE COMPLETE TREATMENT PLANT	4.0	TO	1400.0	GPM	4	9	7
100	PACKAGE GRAVITY FILTER PLANTS	80.0	TO	1400.0	GPM	4	9	7
101	PACKAGE PRESSURE FILTRATION PLNT	0.7	TO	350.0	GPM	4	9	7
102	FILTER MEDIA-RAPID SAND	4.0	TO	280.0	SQ FT	0	1	2
103	FILTER MEDIA-DUAL MEDIA	4.0	TO	280.0	SQ FT	0	1	2
104	FILTER MEDIA-MIXED MEDIA	4.0	TO	280.0	SQ FT	0	1	2
105	FILTER MEDIA-MIXED,INST W/MF SUP	4.0	TO	280.0	SQ FT	0	1	2
106	PACKAGE PRESS DIATOMITE FILTERS	28000.0	TO	1000000.0	GPD	4	2	6

Table 4 (Continued)

TREATMENT PROCESS - SMALL SYSTEMS	PARAMETER RANGE				NUMBER OF CHEMICALS	PROCESS TYPE	NO. DATA CARDS
107 PACKAGE VACUUM DIATOMITE FILTERS	30.0	TO	720.0	GPM	4	2	6
108 PACKAGE ULTRAFILTRATION PLANTS	2500.0	TO	1000000.0	GPD	3	2	5
109 PACKAGE GRAN ACT CARBON COLUMNS	2500.0	TO	500000.0	GPD	0	1	2
110 POTASSIUM PERMANGANATE FEED SYST	0.1	TO	10.0	LB/DAY	1	1	3
111 POLYMER FEED SYSTEMS	0.1	TO	10.0	LB/DAY	1	10	3
112 POWDERED ACT CARBON FEED SYSTEMS	1.0	TO	10.0	LB/HR	1	1	3
113 DIRECT FEED GAS CHLORINATION	0.1	TO	100.0	LB/DAY	1	1	3
114 SODIUM HYPOCHLORITE SOLUTN FEED	0.1	TO	100.0	LB/DAY	1	1	3
115 OZONE GENERATING AND FEED	0.5	TO	10.0	LB/DAY	0	1	2
116 OZONE CONTACT CHAMBER	850.0	TO	13500.0	GAL	0	1	2
117 CHLORINE DIOXIDE GENERATING/FEED	0.1	TO	50.0	LB/DAY	2	1	4
118 ULTRAVIOLET LIGHT DISINFECTION	10.0	TO	780.0	GPM	0	1	2
119 REVERSE OSMOSIS	2500.0	TO	1000000.0	GPD	3	2	5
120 PRESSURE ION EXCHANGE-SOFTENING	70000.0	TO	860000.0	GPD	1	1	3
121 PRESSURE ION EXCHANG-NO3 REMOVAL	70000.0	TO	830000.0	GPD	1	1	3
122 ACTIVATED ALUMINA FLUORIDE REMOV	12700.0	TO	910000.0	GPD	2	2	4
123 BONE CHAR FLUORIDE REMOVAL	16300.0	TO	800000.0	GPD	2	1	4
124 PACKAGE RAW WATER PUMPING-TDH=50	20.0	TO	700.0	GPM	0	1	2
125 PACKAGE HIGH SERVICE PUMP STATN	30.0	TO	1100.0	GPM	0	1	2
126 STEEL BACKWASH/CLEARWELL TANKS	500.0	TO	30000.0	GAL	0	1	2
127 LIQUID SLUDGE HAULING	68.0	TO	41100.0	GPD	0	7	3
128 DEWATERED SLUDGE HAULING	100.0	TO	50000.0	CY/YR	0	7	3
129 SLUDGE DISPOSAL-SANITARY SEWER	50.0	TO	25000.0	GPD	0	11	3
130 SLUDGE DEWATERING LAGOONS	1500.0	TO	30000.0	CU FT	0	1	2
O&M:	750.0	TO	15000.0	CF/YR			
131 SAND DRYING BEDS	200.0	TO	800.0	SQ FT	0	1	2

Table 5

Processes that Use Chemicals and Chemicals Used

	TREATMENT PROCESS - LARGE SYSTEMS	CHEMICALS USED
1	CL2 FEED-CYLINDER STORAGE	CHLORINE
2	CL2 FEED-ON SITE STORAGE TANK	CHLORINE
3	CL2 FEED FROM RAIL CAR	CHLORINE
4	CHLORINE DIOXIDE GENERATING,FEED	CHLORINE,SALT
7	ON-SITE HYPOCHLORITE GENERATION	SALT
8	ALUM FEED-LIQUID STOCK	ALUM-LIQUID STOCK
9	ALUM FEED-DRY STOCK	ALUM-DRY STOCK
10	POLYMER FEED SYSTEMS	POLYMER
11	LIME FEED-NO RECALCINATION	LIME
12	LIME FEED-WITH RECALCINATION	LIME
13	POTASSIUM PERMANGANATE FEED	POTASSIUM PERMANGANATE
14	SULFURIC ACID FEED SYSTEMS	SULFURIC ACID
15	SODIUM HYDROXIDE FEED SYSTEMS	SODIUM HYDROXIDE
16	FERROUS SULFATE FEED SYSTEMS	FERROUS SULFATE
17	FERRIC SULFATE FEED SYSTEMS	FERRIC SULFATE
18	ANHYDROUS AMMONIA FEED FACILITY	ANHYDROUS AMMONIA
19	AQUA AMMONIA FEED FACILITY	AQUACEOUS AMMONIA
20	POWDERED ACTIVATED CARBON FEED	POWDERED ACTIVATED CARBON
49	RECARBONATION-LIQUID CO2 FEED	LIQUID CARBON DIOXIDE
54	PRESSURE DIATOMITE FILTERS	POLYMER, ALUM, DIATOMACEOUS EARTH
55	VACUUM DIATOMITE FILTERS	POLYMER, ALUM, DIATOMACEOUS EARTH
59	REVERSE OSMOSIS	SULFURIC ACID, HEXAMETAPHOSPHATE, CHLORINE
60	PRESSURE ION EXCHANGE-SOFTENING	SALT
61	GRAVITY ION EXCHANGE-SOFTENING	SALT
62	PRESSURE ION EXCHANG-NO3 REMOVAL	SALT
63	ACTIV. ALUMINA-FLUORIDE REMOVAL	SODIUM HYDROXIDE, SULFURIC ACID
	TREATMENT PROCESS - SMALL SYSTEMS	
99	PACKAGE COMPLETE TREATMENT PLANT	ALUM, POLYMER, SODA ASH, CHLORINE OR HYPOCHLORITE

Table 5 (Continued)

	TREATMENT PROCESS - SMALL SYSTEMS	CHEMICALS USED
100	PACKAGE GRAVITY FILTER PLANTS	ALUM, POLYMER, SODA ASH, CHLORINE OR HYPOCHLORITE
101	PACKAGE PRESSURE FILTRATION PLNT	ALUM, POLYMER, SODA ASH, CHLORINE OR HYPOCHLORITE
106	PACKAGE PRESS DIATOMITE FILTERS	ALUM, POLYMER, CHLORINE, DIATOMACEOUS EARTH
107	PACKAGE VACUUM DIATOMITE FILTERS	ALUM, POLYMER, CHLORINE, DIATOMACEOUS EARTH
108	PACKAGE ULTRAFILTRATION PLANTS	SULFURIC ACID, HEXAMETAPHOSPHATE, CHLORINE
110	POTASSIUM PERMANGANATE FEED SYST	POTASSIUM PERMANGANATE
111	POLYMER FEED SYSTEMS	POLYMER
112	POWDERED ACT CARBON FEED SYSTEMS	POWDERED ACTIVATED CARBON
113	DIRECT FEED GAS CHLORINATION	GASEOUS CHLORINE
114	SODIUM HYPOCHLORITE SOLUTN FEED	SODIUM HYPOCHLORITE
117	CHLORINE DIOXIDE GENERATING/FEED	CHLORINE, SALT
119	REVERSE OSMOSIS	SULFURIC ACID, HEXAMETAPHOSPHATE, CHLORINE
120	PRESSURE ION EXCHANGE-SOFTENING	SALT
121	PRESSURE ION EXCHANG-NO3 REMOVAL	SALT
122	ACTIVATED ALUMINA FLUORIDE REMOV	SODIUM HYDROXIDE, SULFURIC ACID
123	BONE CHAR FLUORIDE REMOVAL	SODIUM HYDROXIDE, CARBONIC ACID

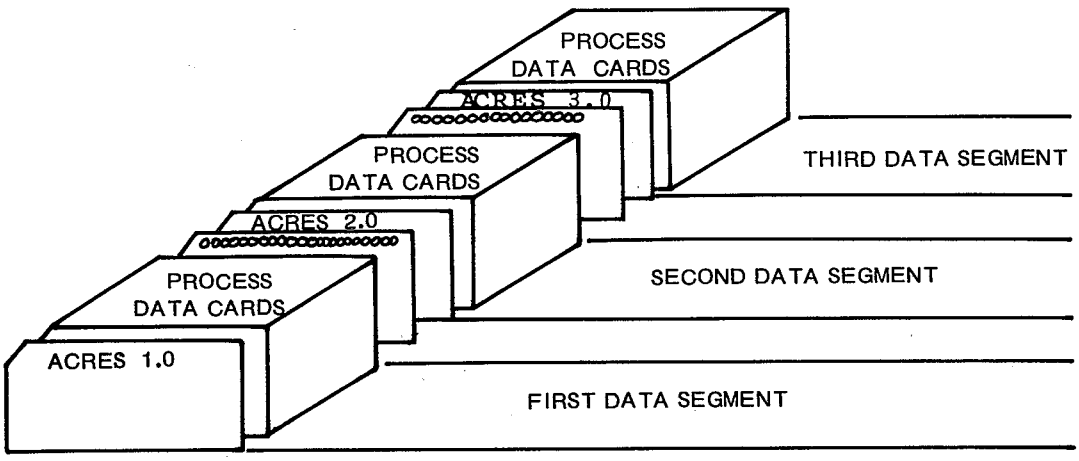

Figure 1. PROCES.DAT data segments.

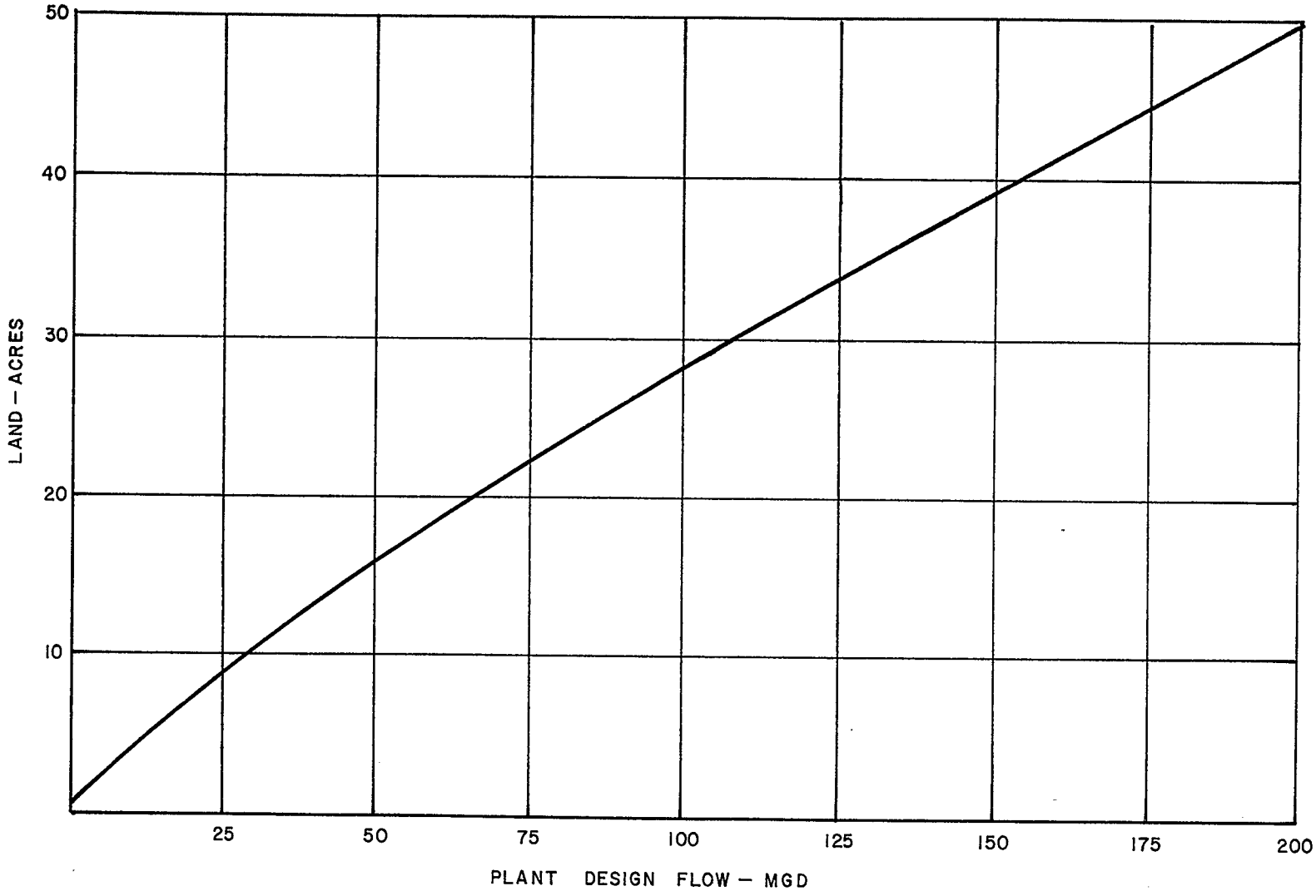

Figure 2. Land Requirements for Conventional Plants (add area for sand drying beds or lagoons).

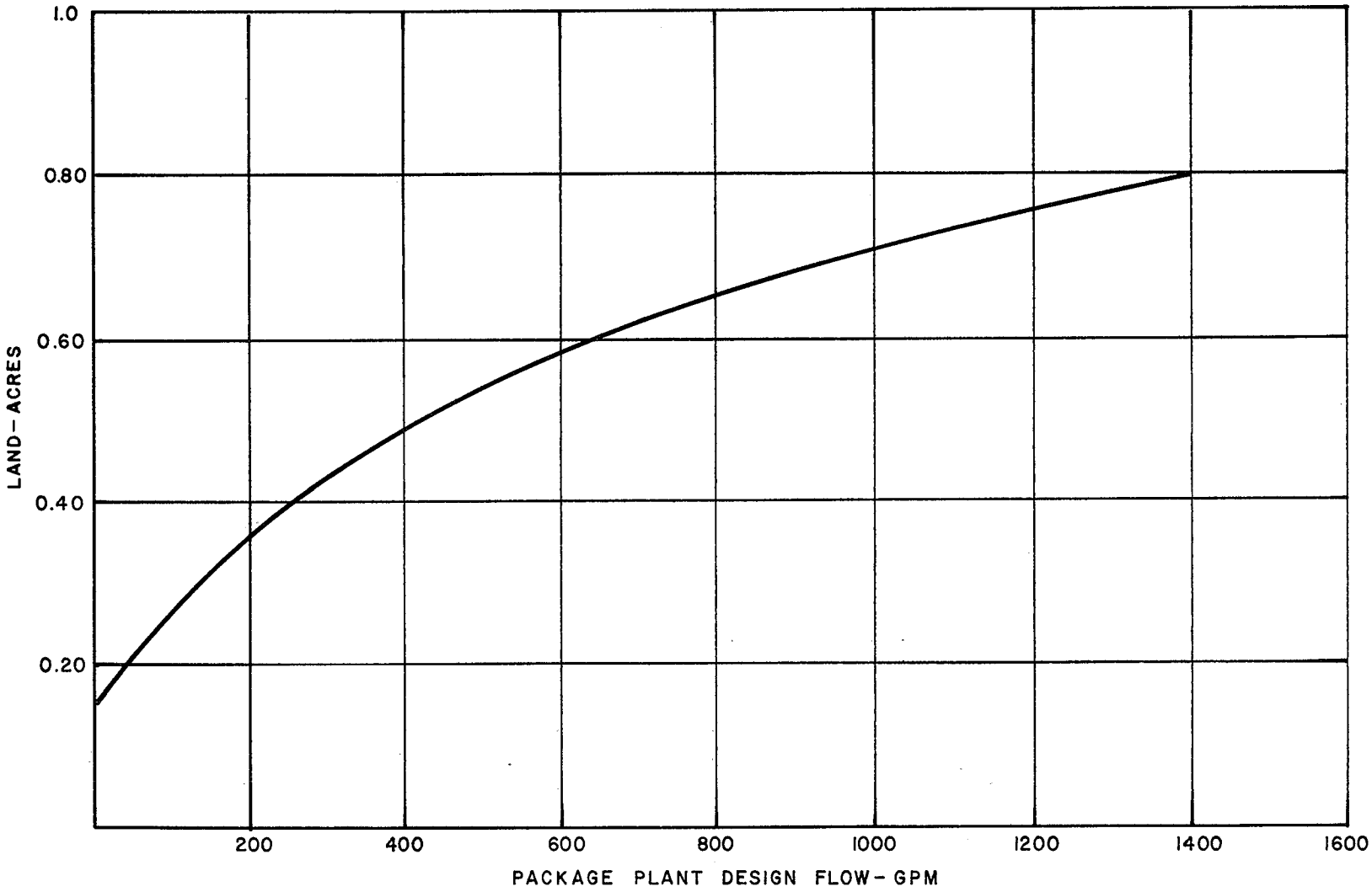

Figure 3. Land Requirements for Package Complete Treatment Plants.

THE ZERO CARD

Segments of data in the PROCES.DAT file must be separated by a card containing a string of at least 15 zeros. (In some systems, a blank card may suffice).

If cost data are desired for only one plant or segment of data, no ZERO card should be included. Inclusion of cost data for two or more plants requires that the PROCES.DAT file be arranged as shown in Figure 1, with ZERO cards between each segment.

The last card in the PROCES.DAT file is the last card of the last segment of data. A Zero card must not be placed at the end of the file. A ZERO card is only placed between segments.

PROCESS TYPES AND DATA INPUT

The various process types require two to seven cards for data input. The First two cards of data for all process types are the same. Data card format and content are explained in the following pages.

Type 1 Process Data Input

Card 1--

The first card of data contains the following information starting in column 1: The card number (the integer 1) followed by a comma in column 2, the process number (integer) from Table 3 followed immediately by a comma, and finally, the process name.

Examples:

Card 1: 1,9,ALUM FEED - DRY STOCK
Card 1: 1,21,RAPID MIX, G=300
Card 1: 1,131,SAND DRYING BEDS

The commas are necessary to separate numbers and must not be omitted. The process name is optional, but, it is a useful identifier for the user when reviewing the PROCES.DAT file later. The comma preceding the process name is not optional

Card 2--

The second card of data contains the following information starting in column 1: The card number (the integer 2) followed by a comma in column 2, the plant design flow in mgd (floating point) followed by a comma, the plant actual flow in mgd (floating point) followed by a comma, the process design parameter (floating point) followed by a comma, and the process operating parameter (floating point)

Examples: Using the same three examples as used above for Card 1, assume the following:

Example 1: Plant Design Flow = 10.0 mgd
Plant Operating Flow = 7.0 mgd
Alum Design Feed = 245 lb/hr
Alum Operating Feed = 170 lb/hr
Card 2: 2,10.0,7.0,245.0,170.0

Example 2: Plant Design Flow = 5.0 mgd
Plant Operating Flow = 4.0 mgd
Design Rapid Mix Volume = 464 cu ft
Operating Rapid Mix Volume = 464 cu ft
Card 2: 2,5.0,4.0,464.0,464.0

Example 3: Plant Design Flow = 0.5 mgd
Plant Actual Flow = 0.25 mgd
Design Sand Drying Bed Area = 500.0 sq ft
Operating Sand Drying Bed Area = 250.0 sq ft
Card 2: 2,0.5,0.25,500.0,250.0

The process design and operating parameters have the units specified in Tables 4 and 6. The process design parameter is used to calculate construction costs, and the operating parameter is used to determine operation and maintenance costs. In some cases, these parameters have different units and/or ranges. In Table 4, for example, process 42 (BACKWASH PUMPING FACILITIES) has the unit gpm for the design parameter and sq ft for the operating parameter. Plant flows are always in mgd. All values are floating point (except the card number) and are separated by a comma. Notice that for some processes such as chemical feed and pumping, the numerical values of the design and operating parameters may be different, since the design parameter indicates capacity, and these processes generally do not operate at capacity. For other processes, such as basins, the design and operating parameters are identical. Operation and maintenance costs for any process operating at less than 100 percent time can be determined by inputing a proportionately lower value for the operating parameter. For example, operation and maintenance costs for a 500 sq ft furnace operating 70 percent of the time are determined by inputing a value of 350 for the operating parameter.

Cards 3 and 4--

The number of cards for a type 1 process is equal to 2 plus the number of chemicals. For example, process number 9, ALUM FEED - DRY STOCK, requires 2 + 1 = 3 cards. Process 21 (RAPID MIX, G=300) requires 2 + 0 = 2 cards.

If a third or fourth card of data is required, it contains the following information: The number of the card (the integer 3 or 4) followed by a comma, the cost of the chemical(s) used in the process in dollars/ton (floating point) followed by a comma, and the name of the chemical used in the process (up to 24 characters). For most processes, the chemical(s) used will be

Table 6

Process Parameter Units

	TREATMENT PROCESS - LARGE SYSTEMS	UNITS
1	CL2 FEED-CYLINDER STORAGE	LB/DAY OF CHLORINE
2	CL2 FEED-ON SITE STORAGE TANK	LB/DAY OF CHLORINE
3	CL2 FEED FROM RAIL CAR	LB/DAY OF CHLORINE
4	CHLORINE DIOXIDE GENERATING,FEED	LB/DAY OF CHLORINE DIOXIDE
5	OZONE GENERATION SYSTEMS	LB/DAY OF OZONE
6	OZONE CONTACT CHAMBER	CU FT OF TOTAL CHAMBER VOLUME
7	ON-SITE HYPOCHLORITE GENERATION	LB/DAY OF EQUIVALENT CHLORINE
8	ALUM FEED-LIQUID STOCK	LB/HR OF ALUM
9	ALUM FEED-DRY STOCK	LB/HR OF ALUM
10	POLYMER FEED SYSTEMS	LB/DAY OF POLYMER
11	LIME FEED-NO RECALCINATION	LB/HR OF LIME
12	LIME FEED-WITH RECALCINATION	LB/HR OF LIME
13	POTASSIUM PERMANGANATE FEED	LB/DAY OF PERMANGANATE
14	SULFURIC ACID FEED SYSTEMS	GPD OF SULFURIC ACID
15	SODIUM HYDROXIDE FEED SYSTEMS	LB/DAY OF SODIUM HYDROXIDE
16	FERROUS SULFATE FEED SYSTEMS	LB/HR OF FERROUS SULFATE
17	FERRIC SULFATE FEED SYSTEMS	LB/HR OF FERRIC SULFATE
18	ANHYDROUS AMMONIA FEED FACILITY	LB/DAY OF AMMONIA
19	AQUA AMMONIA FEED FACILITY	LB/DAY OF AMMONIA
20	POWDERED ACTIVATED CARBON FEED	LB/HR OF POWDERED CARBON
21	RAPID MIX, G=300	CU FT OF TOTAL BASIN VOLUME
22	RAPID MIX, G=600	CU FT OF TOTAL BASIN VOLUME
23	RAPID MIX, G=900	CU FT OF TOTAL BASIN VOLUME
24	FLOCCULATION-HORIZ PADDLE, G=20	CU FT OF TOTAL BASIN VOLUME
25	FLOCCULATION-HORIZ PADDLE, G=50	CU FT OF TOTAL BASIN VOLUME
26	FLOCCULATION-HORIZ PADDLE, G=80	CU FT OF TOTAL BASIN VOLUME
27	FLOCCULATION-VERT TURBINE, G=20	CU FT OF TOTAL BASIN VOLUME
28	FLOCCULATION-VERT TURBINE, G=50	CU FT OF TOTAL BASIN VOLUME

Table 6 (Continued)

	TREATMENT PROCESS - LARGE SYSTEMS	UNITS	
29	FLOCCULATION-VERT TURBINE, G=80	CU FT	OF TOTAL BASIN VOLUME
30	CIRCULAR CLARIFIER-LIME SLUDGE	SQ FT	OF SINGLE CLARIFIER AREA
31	CIRC CLARIFIER-FECL3 & ALUM SLDG	SQ FT	OF SINGLE CLARIFIER AREA
32	RECTANGULAR CLARIFIER-LIME SLDG	SQ FT	OF SINGLE CLARIFIER AREA
33	RECT CLARIFIER-FECL3 & ALUM SLG	SQ FT	OF SINGLE CLARIFIER AREA
34	UPFLOW SOLIDS CONTACT CLAR,G=70	SQ FT	OF SINGLE CLARIFIER AREA
35	UPFLOW SOLIDS CONTACT CLAR,G=110	SQ FT	OF SINGLE CLARIFIER AREA
36	UPFLOW SOLIDS CONTACT CLAR,G=150	SQ FT	OF SINGLE CLARIFIER AREA
37	TUBE SETTLING MODULES	SQ FT	OF TOTAL TUBE MODULE AREA
38	GRAVITY FILTRATION STRUCTURE	SQ FT	OF TOTAL FILTER AREA
39	FILTRATION MEDIA-RAPID SAND	SQ FT	OF TOTAL FILTER AREA
40	FILTRATION MEDIA-DUAL MEDIA	SQ FT	OF TOTAL FILTER AREA
41	FILTRATION MEDIA-MIXED MEDIA	SQ FT	OF TOTAL FILTER AREA
42	BACKWASH PUMPING FACILITIES O&M:	GPM SQ FT	OF BACKWASH PUMPING CAPACITY OF TOTAL FILTER AREA
43	HYDRAULIC SURFACE WASH SYSTEMS	SQ FT	OF TOTAL FILTER AREA
44	AIR-WATER BACKWASH FACILITIES	SQ FT	OF TOTAL FILTER AREA
45	WASH WATER SURGE BASINS	GAL	OF BASIN VOLUME
46	FILTER MOD-RAP SAND TO HIGH RATE	SQ FT	OF TOTAL FILTER AREA
47	CONTINUOUS AUTO. BACKWASH FILTER	SQ FT	OF TOTAL FILTER AREA
48	RECARBONATION BASIN	CU FT	OF SINGLE BASIN VOLUME
49	RECARBONATION-LIQUID CO2 FEED	LB/DAY	OF LIQUID CARBON DIOXIDE
50	RECARB-CO2 FROM SUBMERGED BURNER	LB/DAY	OF CARBON DIOXIDE FROM SINGLE BURNER SET
51	RECARBONATION-CO2 FROM STACK GAS	LB/DAY	OF CARBON DIOXIDE
52	MULTIPLE HEARTH RECALCINATION	SQ FT	OF SINGLE FURNACE EFFECTIVE HEARTH AREA
53	CONTACT BASIN-DIRECT FILTRATION	CU FT	OF SINGLE BASIN AREA
54	PRESSURE DIATOMITE FILTERS	MGD	OF TOTAL FILTER FLOW
55	VACUUM DIATOMITE FILTERS	MGD	OF TOTAL FILTER FLOW

Table 6 (Continued)

	TREATMENT PROCESS - LARGE SYSTEMS	UNITS	
56	PRESSURE FILTRATION PLANTS	SQ FT	OF TOTAL FILTER AREA
57	IN-PLANT PUMPING	MGD	OF TOTAL PLANT FLOW
58	WASH WATER STORAGE TANKS	GAL	OF TOTAL TANK VOLUME
59	REVERSE OSMOSIS	MGD	OF TOTAL FLOW
60	PRESSURE ION EXCHANGE-SOFTENING	MGD	OF TOTAL FLOW
61	GRAVITY ION EXCHANGE-SOFTENING	MGD	OF TOTAL FLOW
62	PRESSURE ION EXCHANG-NO3 REMOVAL	MGD	OF TOTAL FLOW
63	ACTIV. ALUMINA-FLUORIDE REMOVAL	MGD	OF TOTAL FLOW
64	GRAVITY GAC CONTACTORS-CONCRETE	CU FT	OF SINGLE CONTACTOR VOLUME
	O&M:	SQ FT	OF TOTAL CONTACTOR AREA
65	GRAVITY GAC CONTACTORS-STEEL	CU FT	OF SINGLE VOLUME
	O&M:	CU FT	OF TOTAL CONTACTOR VOLUME
66	PRESSURE CARBON CONTACTORS	CU FT	OF SINGLE CONTACTOR VOLUME
	O&M:	SQ FT	OF TOTAL CONTACTOR AREA
67	CONVERT FILTER TO GAC CONTACTOR	SQ FT	OF TOTAL FILTER AREA
68	GRANULAR ACT CARBON-CONSTR COST	LB	OF TOTAL CARBON WEIGHT
69	MAKEUP CARBON COST-O&M ONLY	LB/YR	OF TOTAL CARBON WEIGHT
70	CAPPING SAND FILTER W/ANTHRACITE	SQ FT	OF TOTAL FILTER AREA
71	REGIONAL GAC REGEN-TRANS & STOR	CU FT	OF ON-SITE CARBON STORAGE CAPACITY
	O&M:	LB/YR	OF CARBON REGENERATED
72	REGIONAL MULTI HEARTH GAC REGEN	SQ FT	OF SINGLE FURNACE EFFECTIVE HEARTH AREA
73	MULTIPLE HEARTH GAC REGENERATION	SQ FT	OF SINGLE FURNACE EFFECTIVE HEARTH AREA
74	INFRARED CARBON REGEN FURNACE	LB/DAY	OF TOTAL CARBON WEIGHT
75	FLUIDIZED BED GAC REGENERATION	LB/DAY	OF CARBON FOR SINGLE FURNACE
76	POWDERED CARB REGEN-FLUIDIZED BD	LB/DAY	OF TOTAL CARBON WEIGHT
77	POWDERED CARB REGEN-ATOMIZED SUS	LB/DAY	OF TOTAL CARBON WEIGHT
78	CHEM SLUDGE PUMPING-UNTHICKENED	GPM	OF SLUDGE PUMPING
79	CHEM SLUDGE PUMPING-THICKENED	GPM	OF SLUDGE PUMPING
80	GRAVITY SLUDGE THICKENER-LIME	SQ FT	OF SINGLE BASIN AREA
81	GRAV SLDG THICKENER-ALUM & FECL3	SQ FT	OF SINGLE BASIN AREA

Table 6 (Continued)

TREATMENT PROCESS - LARGE SYSTEMS	UNITS	
82 VACUUM FILTERS	SQ FT	OF TOTAL FILTER AREA
83 BELT FILTER PRESS	GPM	OF TOTAL SLUDGE PUMPING
84 FILTER PRESS	CU FT	OF PRESS SLUDGE CAPACITY
85 DECANTER CENTRIFUGES	GPM	OF SLUDGE PUMPING
86 BASKET CENTRIFUGES	GPD	OF SLUDGE PUMPING
87 SAND DRYING BEDS	SQ FT	OF TOTAL BED AREA
88 SLUDGE DEWATERING LAGOONS	CU FT	OF TOTAL LAGOON VOLUME
O&M:	CF/YR	OF SLUDGE REMOVED
89 SLUDGE DISPOSAL-SANITARY SEWER	GPM	OF SLUDGE
90 LIQUID SLUDGE HAULING	MG/YR	OF SLUDGE
91 DEWATERED SLUDGE HAULING	CY/YR	OF SLUDGE
92 RAW WATER PUMPING FACILITY	MGD	OF TOTAL FLOW
93 FINISHED WATER PUMPING FACILITY	MGD	OF TOTAL FLOW
94 CLEARWELL STORAGE-BELOW GROUND	GAL	OF CLEARWELL VOLUME
95 CLEARWELL STORAGE-GROUND LEVEL	GAL	OF CLEARWELL VOLUME
96 DIFFUSED AERATION BASIN	CU FT	OF BASIN VOLUME
97 AERATION-AERATION TOWERS	CU FT	OF TOWER VOLUME
98 ADMIN,LAB & MAINTENANCE BUILDING	MGD	OF PLANT FLOW
TREATMENT PROCESS - SMALL SYSTEMS		
99 PACKAGE COMPLETE TREATMENT PLANT	GPM	OF TOTAL FLOW
100 PACKAGE GRAVITY FILTER PLANTS	GPM	OF TOTAL FLOW
101 PACKAGE PRESSURE FILTRATION PLNT	GPM	OF TOTAL FLOW
102 FILTER MEDIA-RAPID SAND	SQ FT	OF TOTAL FILTER AREA
103 FILTER MEDIA-DUAL MEDIA	SQ FT	OF TOTAL FILTER AREA
104 FILTER MEDIA-MIXED MEDIA	SQ FT	OF TOTAL FILTER AREA
105 FILTER MEDIA-MIXED,INST W/MF SUP	SQ FT	OF TOTAL FILTER AREA
106 PACKAGE PRESS DIATOMITE FILTERS	GPD	OF TOTAL FILTER FLOW

Table 6 (Continued)

	TREATMENT PROCESS - SMALL SYSTEMS	UNITS	
107	PACKAGE VACUUM DIATOMITE FILTERS	GPM	OF TOTAL FILTER FLOW
108	PACKAGE ULTRAFILTRATION PLANTS	GPD	OF TOTAL FLOW
109	PACKAGE GRAN ACT CARBON COLUMNS	GPD	OF TOTAL FLOW
110	POTASSIUM PERMANGANATE FEED SYST	LB/DAY	OF PERMANGANATE
111	POLYMER FEED SYSTEMS	LB/DAY	OF POLYMER
112	POWDERED ACT CARBON FEED SYSTEMS	LB/HR	OF POWDERED CARBON
113	DIRECT FEED GAS CHLORINATION	LB/DAY	OF CHLORINE
114	SODIUM HYPOCHLORITE SOLUTN FEED	LB/DAY	OF EQUIVALENT CHLORINE
115	OZONE GENERATING AND FEED	LB/DAY	OF OZONE
116	OZONE CONTACT CHAMBER	GAL	OF TOTAL CHAMBER VOLUME
117	CHLORINE DIOXIDE GENERATING/FEED	LB/DAY	OF CHLORINE DIOXIDE
118	ULTRAVIOLET LIGHT DISINFECTION	GPM	OF TOTAL FLOW
119	REVERSE OSMOSIS	GPD	OF FLOW
120	PRESSURE ION EXCHANGE-SOFTENING	GPD	OF FLOW
121	PRESSURE ION EXCHANG-NO3 REMOVAL	GPD	OF FLOW
122	ACTIVATED ALUMINA FLUORIDE REMOV	GPD	OF FLOW
123	BONE CHAR FLUORIDE REMOVAL	GPD	OF FLOW
124	PACKAGE RAW WATER PUMPING-TDH=50	GPM	OF FLOW
125	PACKAGE HIGH SERVICE PUMP STATN	GPM	OF FLOW
126	STEEL BACKWASH/CLEARWELL TANKS	GAL	OF TOTAL TANK VOLUME
127	LIQUID SLUDGE HAULING	GPD	OF SLUDGE
128	DEWATERED SLUDGE HAULING	CY/YR	OF SLUDGE
129	SLUDGE DISPOSAL-SANITARY SEWER	GPD	OF SLUDGE
130	SLUDGE DEWATERING LAGOONS O&M:	CU FT CF/YR	OF TOTAL LAGOON VOLUME OF SLUDGE REMOVED
131	SAND DRYING BEDS	SQ FT	OF TOTAL BED AREA

obvious. For example, process 9 (ALUM FEED - DRY STOCK) uses alum. For convenience, however, the processes that use chemicals and the names of the chemicals are shown in Table 5.

Examples: Alum = $70.00/ton

Card 3: 3,70.00,ALUM

Since the 24 characters immediately following the second comma are copied on the printout, other useful information may be included. For example, we could have written:

Card 3: 3,70.00,ALUM (DOSE = 70 MG/L)

Any characters following the 24th character will be ignored.

Completed Examples--

The following four examples show all cards necessary for data input of the processes shown. All data begin in column one.

```
Card 1:   1,9,ALUM FEED - DRY STOCK
Card 2:   2,10.0,7.0,245.0,170.0
Card 3:   3,70.0,ALUM (DOSE = 70 MG/L)

Card 1:   1,21,RAPID MIX, G=300
Card 2:   2,5.0,4.0,464.0,464.0

Card 1:   1,131,SAND DRYING BEDS
Card 2:   2,0.5,0.25,500.0,500.0

Card 1:   1,4,CHLORINE DIOXIDE GENERATING,FEED
Card 2:   2,2.0,1.75,16.7,14.5
Card 3:   3,300.0,CHLORINE
Card 4:   4,225.0,SODIUM CHLORITE
```

The first three examples were explained above. The last example can be interpreted as follows:

Total number of cards necessary is 2 + number of chemicals = 2 + 2 = 4.

Card 1: Process No. 4, CHLORINE DIOXIDE GENERATING - FEED
Card 2: Design flow = 2.0 mgd, actual flow = 1.75 mgd, process design parameter = 16.7 lb/day, process operating parameter = 14.5 lb/day
Card 3: $300.00/ton for chlorine used in this process
Card 4: $225.00/ton for sodium chlorite used in this process

Type 2 Process Data Input

The total number of data cards required for a type 2 process is 2 + number of chemicals. The first two cards of data are identical in format

and content to a type 1 process. The remaining cards contain chemical cost and chemical feed information. For example, process 59 (REVERSE OSMOSIS) may use up to 3 chemicals: sulfuric acid, sodium hexameta phosphate, and chlorine. This process requires 2 + 3 = 5 cards of data with the following information: The card number (integer) followed by a comma, the cost of the chemical in $/ton (floating point) followed by a comma, the actual (not design) feed rate in lb/day for the chemical (floating point) followed by a comma, and the name of the chemical (not to exceed 24 characters). The chemicals can be input in any order. If one or more of the chemicals is not used, an input of zeros for the chemical cost and the chemical feed rate will cause no information to be printed on the output for that chemical. To illustrate, the 5 data cards for process 59 (REVERSE OSMOSIS) may be constructed as follows:

```
Card 1:    1,59,REVERSE OSMOSIS
Card 2:    2,2.0,1.5,2.0,1.5
Card 3:    3,65.0,250.2,SULFURIC ACID,20 MG/L
Card 4:    4,650.0,62.6,SODIUM HEXA PO3,5 MG/L
Card 5:    5,300.0,25.0,CHLORINE,2 MG/L

Card 1:    1,59,REVERSE OSMOSIS
Card 2:    2,2.0,1.5,2.0,1.5
Card 3:    3,650.0,62.5,SODIUM HEXA PO3,5 MG/L
Card 4:    4,65.0,125.1,SULFURIC ACID,10 MG/L
Card 5:    5,0.0,0.0

Card 1:    1,59,REVERSE OSMOSIS
Card 2:    2,2.0,1.5,2.0,1.5
Card 3:    3,0.0,0.0
Card 4:    4,0.0,0.0
Card 5:    5,0.0,0.0
```

Example 1, above, indicates the following:

Card 3: $65.00/ton cost and 250.2 lb/day feed rate for sulfuric acid at a dose of 20 mg/l

Card 4: $650.00/ton and 62.6 lb/day feed rate for sodium hexameta phosphate at a dose of 5 mg/l

Card 5: $300.00/ton and 25.0 lb/day feed rate for chlorine at 2 mg/l

Example 2, above, indicates the following:

Card 3: $650.00/ton for sodium hexameta phosphate at a 5 mg/l dose
Card 4: $65.00/ton for sulfuric acid at a 10 mg/l dose
Card 5: No other chemicals used

Example 3, above, indicates that no chemicals were used in this process since cards 3 to 5 contained zeros for the chemicals costs and feed rates.

Type 3 Process Data Input

The total number of cards required for a type 3 process is 3 + number of chemicals. The first two lines are identical in form and content to the first two lines of process type 1. Card 3 is very specific and must contain the number of units of the process in question for which costs are desired. For example, process 31 (CIRC CLARIFIER - FECL3 & ALUM SLDG), when input to the computer, calculates costs for a single clarifier. The program then multiplies the calculated costs for a single clarifier by the number of units indicated on card 3.

To illustrate this, consider the following process data input. Total number of data cards = 3 + 0 = 3.

```
Card 1:    1,31,CIRC CLARIFIER - FECL3 & ALUM SLDG
Card 2:    2,1.0,0.9,1667.0,1667.0
Card 3:    3,1,UNIT
```

Card 3 above contains the integer 3 beginning in column 1 followed by a comma, and the number of units (integer) for which costs are desired followed by a comma and the word UNIT or UNITS. The word UNIT(S) is optional, but the comma following the number of units is not. Costs could be obtained for three 1667.0 sq ft clarifiers by either of the following methods (more about this later):

```
Card 1:    1,31,CIRC CLARIFIER - FECL3 & ALUM SLDG
Card 2:    2,3.0,2.7,1667.0,1667.0
Card 3:    3,3,UNIT
```

or,

```
Card 1:    1,31,CIRC CLARIFIER - FECL3 & ALUM SLDG
Card 2:    2,1.0,0.9,1667.0,1667.0
Card 3:    3,1,UNIT
Card 1:    1,31,CIRC CLARIFIER - FECL3 & ALUM SLDG
Card 2:    2,1.0,0.9,1667.0,1667.0
Card 3:    3,1,UNIT
Card 1:    1,31,CIRC CLARIFIER - FECL3 & ALUM SLDG
Card 2:    2,1.0,0.9,1667.0,1667.0
Card 3:    3,1,UNIT
```

The above example shows that the design and operating flows in card 2 of each process represent the total flow for that process only. The first example, gives a total of 2.7 mgd (0.9 mgd/clarifier x 3 clarifiers), and the second example yields a flow of 0.9 mgd for each clarifier.

If the number of chemicals for any type 3 process is greater than 1, the additional cards will contain chemical cost information identical in format and content to the third card of process type 1.

Type 4 Process Data Input

The number of data cards required for type 4 processes (GAC Contactors) is 3 + number of chemicals or 3 + 0 = 3 cards of data. The first two cards of data are identical in format and content to type 1. The third data card is identical in form and content to the third data card of type 3 processes. Note, however, that the design process variable has the units of cu ft per single contactor volume, and the operating process variable has the units of total volume in cu ft or total area in sq ft (see Table 6). For example, consider the following data cards for process 65 (GRAVITY GAC CONTACTORS - STEEL): The design flow is 50.0 mgd, the actual flow is 30.0 mgd, the single contactor volume is 6,300 cu ft, the number of contactors is 22, and the total volume is 138,600 cu ft.

```
Card 1:    1,65,GRAVITY GAC CONTACTORS - STEEL
Card 2:    2,50.0,30.0,6300.0,138600.0
Card 3:    3,22,UNITS
```

There are only 3 type 4 processes. All are granular activated carbon treatment. The operation and maintenance cost curves for each include the costs for backwash pumping for the contactors. The cost for backwash pumping is different for each type of contactor because of the variation in the pumping head. Therefore, when computing costs for a train of processes that includes any of the activated carbon contactors (processes 64, 65 or 66) and backwash pumping for these contactors (process 42), a zero must be input for the operating parameter of the backwash pumping curve. This will avoid duplication of the operation and maintenance costs for backwash pumping.

Type 5 Process Data Input

The number of data cards for type 5 is 3 + number of chemicals or 3 + 0 = 3. Type 5 processes consist of the various types of pumping facilities. Cards 1 and 2 are identical in format and content to cards 1 and 2 of type 1. Card 3 contains the integer 3 followed by a comma, the total dynamic pumping head in feet (floating point) followed by a comma, and the abbreviation TDH.

For example, process 57 (IN PLANT PUMPING) for a 5.0 mgd plant with an actual flow of 3.0 mgd and a total dynamic head of 40 ft becomes:

```
Card 1:    1,57,IN-PLANT PUMPING
Card 2:    2,5.0,3.0,7.5,3.0
Card 3:    3,40.0,TDH
```

In this case, a 7.5 mgd pumping capacity has been installed as shown in Card 2. The abbreviation TDH is optional, but the comma preceding it is not.

Type 6 and 7 Process Data Input

The number of data cards required for types 6 and 7 is 3 + number of chemicals = 3 + 0 = 3. The first two data cards of types 6 and 7 are

identical in format and content to type 1. The third card of data contains the number of one-way miles driven to the regeneration site or the sludge disposal site. Similar to previous processes, Card 3 contains the integer 3 followed by a comma, the number of one-way miles (floating point) followed by a comma, and the word MILES. The word MILES is optional, but the comma preceding it is not.

Examples:

```
Card 1:    1,71,REGIONAL GAC REGEN-TRANS & STOR
Card 2:    2,1.0,0.9,1000.0,30000.0
Card 3:    3,10.0,MILES

Card 1:    1,90,LIQUID SLUDGE HAULING
Card 2:    2,1.0,1.0,1.3,1.3
Card 3:    3,15.0,MILES
```

Type 8 Process Data Input

The number of data cards for type 8 is 3 + number of chemicals = 3 + 1 = 4. The first two data cards are identical in format and content to the first two data cards of type 1. The third data card contains the integer 3 followed by a comma, the amount of makeup lime added to the recalcined lime is percent of lime feed rate (floating point) followed by a comma, and the words MAKEUP LIME %. The words MAKEUP LIME % are optional, but the preceding comma is not. The fourth card of data contains chemical cost information and is similar to the third card of type 1.

Examples for 5% and 10% makeup lime:

```
Card 1:    1,12,LIME FEED - WITH RECALCINATION
Card 2:    2,30.0,25.0,3500.0,2606.0
Card 3:    3,5.0,MAKEUP LIME %
Card 4:    4,40.0,LIME

Card 1:    1,12,LIME FEED - WITH RECALCINATION
Card 2:    2,30.0,25.0,3500.0,2606.0
Card 3:    3,10.0,MAKEUP LIME %
Card 4:    4,40.0,LIME
```

In the above examples, the cost of lime is $40.00/ton, the plant design flow is 30.0 mgd, and the design lime rate is 3500.0 lb/hr. In the fourth data card, the word LIME is not optional. Chemical names following chemical cost information are not optional unless the amount or the cost of that chemical is zero.

Type 9 Process Data Input

The total number of data cards required for type 9 is 3 + number of chemicals = 3 + 4 = 7. This process type includes the package treatment plants, which may use from zero to 4 chemicals, depending on the operators' requirements. The first two data cards are identical in format and content

to the first two data cards of type 1. The third data card contains the integer 3 followed by a comma, the hydraulic loading on the package plant in gpm/sf (floating point) followed by a comma, and the abbreviation gpm/sf. The abbreviation, gpm/sf is optional, but the preceding comma is not. The fourth, fifth, sixth and seventh data cards contain chemical cost and chemical feed information with format and content identical to chemical information cards for type 2 processes. That is, they contain the card number (integer) followed by a comma, the cost of the chemical used is $/ton (floating point) followed by a comma, the chemical feed rate is lb/day (floating point) followed by a comma, and the name of the chemical (up to 24 charaters long). If a chemical name is input exceeding 24 characters, the 25th and succeeding characters will be ignored.

Example:

```
Card 1:    1,99,PACKAGE COMPLETE TREATMENT PLANT
Card 2:    2,0.288,0.252,200.0,175.0
Card 3:    3,2.0,GPM/SF
Card 4:    4,70.0,147.0,ALUM,70 MG/L
Card 5:    5,4000.0,2.0,POLYMER,1 MG/L($2/LB)
Card 6:    5,0.0,0.0
Card 7:    7,0.0,0.0
```

Type 10 Process Data Input

The total number of cards for type 10 is 2 + number of chemicals = 2 + 1 = 3.

The data card input is identical in format and content to type 1 for all cards with one exception. The chemical cost is input in $/lb instead of $/ton.

Example:

```
Card 1:    1,10,POLYMER FEED SYSTEMS
Card 2:    2,1.0,1.0,8.34,8.34
Card 3:    3,2.0, POLYMER,1 MG/1
```

Refer to section on type 1 process data input for a discussion of format and content of data cards.

Type 11 Process Data Input

The total number of data cards for type 11 is 3 + number of chemicals = 3 + 0 = 3. The first two data cards are identical in format and content to the first two data cards of type 1. The third data card for process 11 contains the integer 3 followed by a comma, the sludge concentration in mg/1 (floating point) followed by a comma, and the abbreviation mg/1. The abbreviation mg/1 is optional, but the preceding comma is not.

Example:

```
Card 1:    1,89,SLUDGE DISPOSAL - SANITARY SEWER
Card 2:    2,1.0,1.0,20.0,20.0
Card 3:    3,10000.0,MG/L
```

Type 12 Process Data Input

The total number of cards for type 12 is 4 + number of chemicals = 4 + 0 = 4. The first two data cards are identical in format and content to the first two data cards of type 1. The third data card indicates the number of units and is identical to the third data card of type 3. The fourth data card indicates percent ownership of the regional facility and contains the integer 4 followed by a comma, the percent ownership (floating point) followed by a comma, and the optional words % OWNERSHIP. The comma preceding % OWNERSHIP is not optional.

Example:

```
Card 1:    1,72,REGIONAL MULTI HEARTH GAC REGEN
Card 2:    2,5.0,3.5,800.0,560.0
Card 3:    3,2,UNITS
Card 4:    4,10.0% OWNERSHIP
```

SECTION 5

PROGRAM OUTPUT

DETAILED OR SUMMARY

Program output is controlled by both the COST.DAT file and the PROCES.DAT file. The main option available to the user is determined in line 28 of the COST.DAT file. The two options available are the DETAILED or SUMMARY printout. Sample printouts for each of the options are shown in Examples 1 through 3 in Section 6. Note that if the user chooses the DETAILED printout, he gets all the information contained in the SUMMARY plus a detailed cost breakdown for each process.

REPETITIVE OUTPUT

Program output is also controlled, in part, by the way in which the COST.DAT and PROCES.DAT files are constructed. In Section 3, COST.DAT File Construction, it was shown that two additional cards of data could be added (cards 29 and 30) to the file to cause the program to be rerun. Card 29 designates which cost factor is to be changed during the rerun, and card 30 contains the values to be used during the rerun. In other words, if cards 29 and 30 were added to the COST.DAT file with the following information,

```
Card 29:  8,2
Card 30:  0.02,0.04
```

the program would be rerun twice using the existing PROCES.DAT file and the new values, 0.02 and 0.04, of cost factor number 8, ELECTRICITY, $/kwh. This has the same effect as running the program three times. This is, three complete program output listings will be generated: One complete output computing costs with the original cost of electricity, one complete output computing costs with electricity at $0.02/kwh, and one complete output computing costs with electricity at $0.04/kwh.

In Section 4, PROCES.DAT File Construction, it was shown that data were input or assembled as segments, with a segment representing costs for one treatment plant. A complete program output includes computed costs listed separately for each data segment, with a listing of the COST.DAT file following the output for the final data segment. Therefore, if the PROCES.DAT file were constructed with five data segments and the COST.DAT file contained cards of 29 and 30, as shown above, the printout generated by the program would consist of:

1st data segment cost information
2nd data segment cost information
3rd data segment cost information
4th data segment cost information
5th data segment cost information
Listing of COST.DAT values used

1st data segment cost information

.
.
.

5th data segment cost information
Listing of COST.DAT values used (as above except electricity = $0.02/kwh)

1st data segment cost information

.
.
.

5th data segment cost information
Listing of COST.DAT values used (as above except electricity = $0.04/kwh)

Examples of the above program outputs are shown in Section 6, Examples.

COST EXTRAPOLATION FOR OUT-OF-RANGE INPUTS

Table 4 lists the processes for which costs are available and the design and operating parameter ranges over which these costs are valid. If the user attempts to obtain costs for process parameters outside the valid range, the program will extrapolate the stored costs and notify the user of this condition on the printout. The extrapolation is accomplished by evaluating the following equation for y after first computing the constants C_1 and C_2 from stored cost data:

$$\ln y = C_1 + C_2 \ln x$$

Where x is the input process parameter (out of range) and y is the extrapolated cost at x.

When plotted on log-log paper, this results in a linear extrapolation of the cost curve. See Section 6, EXAMPLES, for a sample printout of extrapolated costs.

SECTION 6

EXAMPLES

The following examples have been constructed to demonstrate the options of input and output available. Each example is arranged with a table of the plant and process assumptions followed by copies of the actual COST.DAT and PROCES.DAT files and the program output.

EXAMPLE 1

Example 1 contains one segment of data with five treatment processes in the PROCES.DAT file. The COST.DAT file contains the DETAILED printout option and the use of the ENR Construction Cost Index. The COST.DAT and PROCES.DAT files are shown along with the printout generated by these inputs.

EXAMPLE 2

Example 2 contains two segments of data with 17 and 4 treatment processes, respectively, in the PROCES.DAT file. The COST.DAT file contains the SUMMARY printout option and does not use the ENR Construction Cost Index. The COST.DAT and PROCES.DAT files are shown along with the printouts generated by these inputs.

EXAMPLE 3

Example 3 contains two segments of data with 6 and 1 treatment processes, respectively, in the PROCES.DAT file. The COST.DAT file contains the SUMMARY printout option and does not use the ENR Construction Cost Index. The COST.DAT file also contains lines 29 and 30, which causes additional printouts varying the cost of labor to include $7.50/hr and $12.50/hr. The COST.DAT and PROCES.DAT files are shown along with the printouts generated by these inputs.

COST.DAT File

Example 1

```
COSTS PRESENTED ARE CURRENT AS OF OCTOBER 1978
CAPITAL COST FACTORS (% OF CONSTRUCTION COST):
 1 ENGINEERING(%)                      =10.
 2 SITEWORK, INTERFACE PIPING(%)       =5.
 3 SUBSURFACE CONSIDERATIONS(%)        =0.0
 4 STANDBY POWER(%)                    =0.0
 5 INTEREST RATE(%)                    =7.
 6 NUMBER OF YEARS                     =20.0
 7 LAND COST, $/ACRE                   =2000.
UNIT COST FACTORS:
 8 ELECTRICITY, $/KWH                  =.03
 9 LABOR, $/HR                         =10.
10 DIESEL FUEL, $/GAL                  =.45
11 NATURAL GAS, $/CU FT                =.0013
12 BLDNG ENERGY USE,KWH/SQ FT/YR       =102.6
COST INDEXES:
13 EXCAVATION(ENR SKILLED LABOR)       =247.0
14 MANUFACTURED EQUIP (BLS #114)       =221.3
15 CONCRETE (BLS #132)                 =221.1
16 STEEL (BLS #101.3)                  =262.1
17 LABOR (ENR SKILLED LABOR)           =247.0
18 PIPE & VALVES (BLS #114.901)        =236.4
19 ELECTRICAL & INSTR (BLS #117)       =167.5
20 HOUSING (ENR BUILDING COST)         =254.76
21 PRODUCER PRICE INDEX                =199.7
22 ENR CONSTRUCTION, '67 BASE YR       =265.38
OUTPUT(6 FOR LP,5 FOR TELETYPE)        =5
PRINTOUT(DETAILED OR SUMMARY)          =DETAILED
```

PROCES.DAT File

Example 1

```
ACRES=0.25
1,124,PACKAGE RAW WATER PUMPING-TDH=50
2,0.101,0.072,105.0,50.0
1,99,PACKAGE COMPLETE TREATMENT PLANT
2,0.101,0.072,70.0,50.0
3,5.0,GPM/SF
4,70.0,12.0,ALUM, 20 MG/L
5,4000.,0.15,POLYMER($2/LB),0.25 MG/L
6,300.0,1.8,CHLORINE, 3 MG/L
7,0.0,0.0,
1,126,STEEL BACKWASH/CLEARWELL TANKS
2,0.101,0.072,15000.0,15000.0
1,125,PACKAGE HIGH SERVICE PUMP STATN
2,0.101,0.072,105.0,50.0
1,131,SAND DRYING BEDS
2,0.101,0.072,500.0,500.0
```

***** COST ESTIMATE FOR PACKAGE RAW WATER PUMPING-TDH=50

	DESIGN	OPERATING
PROCESS FLOW	0.101 MGD	0.072 MGD
PROCESS PARAMETER	105.00 GPM	50.00 GPM

CAPITAL COST

	DOLLARS
CONSTRUCTION	15653.
OTHER RELATED COSTS	5691.
PROCESS CAPITAL COST	21344.

O&M COST

	CTS/1000 GAL TREATED	DOLLARS/YR
ELECTRICAL ENERGY @ $ 0.030/KWH	0.662	174.
MAINTENANCE MATERIAL	0.237	62.
LABOR @ $10.000/HR	2.043	537.
DIESEL FUEL @ $ 0.450/GAL	0.000	0.
NATURAL GAS @ $ .0013/CU FT	0.000	0.
CHEMICALS	0.000	0.
PROCESS O&M COST	2.943	773.

COST SUMMARY

O&M	2.943	773.
DEBT @ 20.0 YRS AND 7.0 %	7.666	2015.
PROCESS TOTAL COST	10.609	2788.

***** COST ESTIMATE FOR PACKAGE COMPLETE TREATMENT PLANT

	DESIGN	OPERATING
PROCESS FLOW	0.101 MGD	0.072 MGD
PROCESS PARAMETER	70.00 GPM	50.00 GPM

CAPITAL COST

	DOLLARS
CONSTRUCTION	87293.
OTHER RELATED COSTS	31736.
PROCESS CAPITAL COST	119029.

O&M COST

	CTS/1000 GAL TREATED	DOLLARS/YR
ELECTRICAL ENERGY @ $ 0.030/KWH	6.637	1744.
MAINTENANCE MATERIAL	2.426	638.
LABOR @ $10.000/HR	64.883	17051.
DIESEL FUEL @ $ 0.450/GAL	0.000	0.
NATURAL GAS @ $ .0013/CU FT	0.000	0.
CHEMICALS	1.375	361.
PROCESS O&M COST	75.321	19794.

COST SUMMARY

O&M	75.321	19794.
DEBT @ 20.0 YRS AND 7.0 %	42.753	11235.
PROCESS TOTAL COST	118.074	31030.

***** COST ESTIMATE FOR STEEL BACKWASH/CLEARWELL TANKS

	DESIGN	OPERATING
PROCESS FLOW	0.101 MGD	0.072 MGD
PROCESS PARAMETER	15000.00 GAL	15000.00 GAL

CAPITAL COST	DOLLARS
CONSTRUCTION	14896.
OTHER RELATED COSTS	5415.
PROCESS CAPITAL COST	20311.

O&M COST	CTS/1000 GAL TREATED	DOLLARS/YR
ELECTRICAL ENERGY @ $ 0.030/KWH	0.000	0.
MAINTENANCE MATERIAL	0.000	0.
LABOR @ $10.000/HR	0.000	0.
DIESEL FUEL @ $ 0.450/GAL	0.000	0.
NATURAL GAS @ $ .0013/CU FT	0.000	0.
CHEMICALS	0.000	0.
PROCESS O&M COST	0.000	0.

COST SUMMARY		
O&M	0.000	0.
DEBT @ 20.0 YRS AND 7.0 %	7.295	1917.
PROCESS TOTAL COST	7.295	1917.

***** COST ESTIMATE FOR PACKAGE HIGH SERVICE PUMP STATN

	DESIGN	OPERATING
PROCESS FLOW	0.101 MGD	0.072 MGD
PROCESS PARAMETER	105.00 GPM	50.00 GPM

CAPITAL COST	DOLLARS
CONSTRUCTION	11866.
OTHER RELATED COSTS	4314.
PROCESS CAPITAL COST	16181.

O&M COST	CTS/1000 GAL TREATED	DOLLARS/YR
ELECTRICAL ENERGY @ $ 0.030/KWH	0.819	215.
MAINTENANCE MATERIAL	0.118	31.
LABOR @ $10.000/HR	3.973	1044.
DIESEL FUEL @ $ 0.450/GAL	0.000	0.
NATURAL GAS @ $ .0013/CU FT	0.000	0.
CHEMICALS	0.000	0.
PROCESS O&M COST	4.910	1290.

COST SUMMARY		
O&M	4.910	1290.
DEBT @ 20.0 YRS AND 7.0 %	5.812	1527.
PROCESS TOTAL COST	10.722	2818.

***** COST ESTIMATE FOR SAND DRYING BEDS

	DESIGN	OPERATING
PROCESS FLOW	0.101 MGD	0.072 MGD
PROCESS PARAMETER	500.00 SQ FT	500.00 SQ FT

CAPITAL COST	DOLLARS
CONSTRUCTION	3763.
OTHER RELATED COSTS	1368.
PROCESS CAPITAL COST	5130.

O&M COST	CTS/1000 GAL TREATED	DOLLARS/YR
ELECTRICAL ENERGY @ $ 0.030/KWH	0.000	0.
MAINTENANCE MATERIAL	0.076	20.
LABOR @ $10.000/HR	9.701	2549.
DIESEL FUEL @ $ 0.450/GAL	0.068	18.
NATURAL GAS @ $ .0013/CU FT	0.000	0.
CHEMICALS	0.000	0.
PROCESS O&M COST	9.845	2587.

COST SUMMARY

O&M	9.845	2587.
DEBT @ 20.0 YRS AND 7.0 %	1.843	484.
PROCESS TOTAL COST	11.688	3072.

***** TOTAL COST ESTIMATE FOR WATER TREATMENT PLANT

CAPITAL COST	DOLLARS
CONSTRUCTION	133471.
SITEWORK,INTERFACE PIPING,ROADS @ 5.0 %	6674.
TOTAL CONSTRUCTION COST	140145.
GEN CONTRACTOR OVERHEAD & PROFIT @ 12.0 %	16817.
SUBTOTAL	156962.
ENGINEERING @ 10.0 %	15696.
SUBTOTAL	172659.
LAND, 0.25 ACRES @ $ 2000/ACRE	500.
LEGAL,FISCAL, & ADMINISTRATIVE	6057.
INTEREST DURING CONSTRUCTION	2780.
TOTAL CAPITAL COST	181995.

O&M COST	CTS/1000 GAL TREATED	DOLLARS/YR
ELECTRICAL ENERGY @ $ 0.030/KWH	8.118	2133.
MAINTENANCE MATERIAL	2.858	751.
LABOR @ $10.000/HR	80.601	21182.
DIESEL FUEL @ $ 0.450/GAL	0.068	18.
NATURAL GAS @ $ .0013/CU FT	0.000	0.
CHEMICALS	1.375	361.
TOTAL O&M COST	93.020	24446.

COST SUMMARY		
O&M	93.020	24446.
DEBT @ 20.0 YRS AND 7.0 %	65.369	17179.
TOTAL COST	158.389	41625.

COST SUMMARY FOR 5 WATER TREATMENT PROCESSES

	PROCESS	FLOW-MGD DESIGN	FLOW-MGD ACTUAL	PROCESS PARAMETER DESIGN	PROCESS PARAMETER OPERATING	COSTS-DOLLARS CONSTR	COSTS-DOLLARS CAPITAL	COSTS-CTS/1000 GAL O&M	COSTS-CTS/1000 GAL DEBT	COSTS-CTS/1000 GAL TOTAL
1	PACKAGE RAW WATER PUMPING-TDH=50	0.101	0.072	105.0 GPM	50.0 GPM	15653.	21344.	2.943	7.666	10.609
2	PACKAGE COMPLETE TREATMENT PLANT	0.101	0.072	70.0 GPM	50.0 GPM	87293.	119029.	75.321	42.753	118.074
	LOADING RATE = 5.0 GPM/SQ FT									
	$ 70.00/TON FOR ALUM, 20 MG/L									
	$4000.00/TON FOR POLYMER($2/LB),0.25 MG/L									
	$ 300.00/TON FOR CHLORINE, 3 MG/L									
3	STEEL BACKWASH/CLEARWELL TANKS	0.101	0.072	15000.0 GAL	15000.0 GAL	14896.	20311.	0.000	7.295	7.295
4	PACKAGE HIGH SERVICE PUMP STATN	0.101	0.072	105.0 GPM	50.0 GPM	11866.	16181.	4.910	5.812	10.722
5	SAND DRYING BEDS	0.101	0.072	500.0 SQ FT	500.0 SQ FT	3763.	5130.	9.845	1.843	11.688
					TOTAL	133471.	181995.	93.020	65.369	158.389

SITEWORK,SUBSURFACE,STNBY POWER	6674.
GEN CON OH & P, 12.0%	16817.
ENGINEERING	15696.
LAND, 0.25 ACRES	500.
LEGAL,FISCAL,ADMIN	6057.
INT DURING CONSTR	2780.
TOTAL CAPITAL	181995.

TOTAL O&M:	KWH	MATERIALS,$	LABOR,HR	DIESEL,GAL	NAT GAS,CU FT	CHEMICALS,$
	71113.	751.	2118.	40.	0.	361.
PROCESS O&M						
1	5803.	62.	54.	0.	0.	0.
2	58137.	638.	1705.	0.	0.	361.
3	0.	0.	0.	0.	0.	0.
4	7174.	31.	104.	0.	0.	0.
5	0.	20.	255.	40.	0.	0.

COSTS PRESENTED ARE CURRENT AS OF OCTOBER 1978

CAPITAL COST FACTORS

ENGINEERING(%)	= 10.00
SITEWORK,INTERFACE PIPING(%)	= 5.00
SUBSURFACE CONSIDERATIONS(%)	= 0.00
STANDBY POWER(%)	= 0.00
INTEREST RATE(%)	= 7.00
NUMBER OF YEARS	= 20.00
LAND AREA, ACRES	= 0.25
LAND COST, $/ACRE	= 2000.00

UNIT COST FACTORS

ELECTRICITY, $/KWH	= 0.03
LABOR, $/HR	= 10.00
DIESEL FUEL, $/GAL	= 0.450
NATURAL GAS, $/CU FT	= .0013
BLDNG ENERGY USE,KWH/SQ FT/YR	= 102.6

COST INDEXES

EXCAVATION (ENR SKILLED LABOR)	= 247.0
MANUFACTURED EQUIP (BLS #114)	= 221.3
CONCRETE (BLS #132)	= 221.1
STEEL (BLS #101.3)	= 262.1
LABOR(ENR SKILLED LABOR)	= 247.0
PIPES & VALVES (BLS #114.901)	= 236.4
ELECTRICAL & INSTR (BLS #117)	= 167.5
HOUSING (ENR BUILDING COST)	= 254.8
PRODUCER PRICE INDEX	= 199.7

ENR CONSTRUCTION COST INDEX, 1967 BASE YR (USED IN LIEU OF ABOVE INDEXES) = 265.4

EXIT

COST.DAT File

Example 2

```
COSTS PRESENTED ARE CURRENT AS OF OCTOBER 1978
CAPITAL COST FACTORS (% OF CONSTRUCTION COST):
 1 ENGINEERING(%)                        =10.
 2 SITEWORK, INTERFACE PIPING(%)         =5.
 3 SUBSURFACE CONSIDERATIONS(%)          =0.0
 4 STANDBY POWER(%)                      =0.0
 5 INTEREST RATE(%)                      =7.
 6 NUMBER OF YEARS                       =20.0
 7 LAND COST, $/ACRE                     =2000.
UNIT COST FACTORS:
 8 ELECTRICITY, $/KWH                    =.03
 9 LABOR, $/HR                           =10.
10 DIESEL FUEL, $/GAL                    =.45
11 NATURAL GAS, $/CU FT                  =.0013
12 BLDNG ENERGY USE,KWH/SQ FT/YR         =102.6
COST INDEXES:
13 EXCAVATION(ENR SKILLED LABOR)         =247.0
14 MANUFACTURED EQUIP (BLS #114)         =221.3
15 CONCRETE (BLS #132)                   =221.1
16 STEEL (BLS #101.3)                    =262.1
17 LABOR (ENR SKILLED LABOR)             =247.0
18 PIPE & VALVES (BLS #114.901)          =236.4
19 ELECTRICAL & INSTR (BLS #117)         =167.5
20 HOUSING (ENR BUILDING COST)           =254.76
21 PRODUCER PRICE INDEX                  =199.7
22 ENR CONSTRUCTION, '67 BASE YR         =0.0
OUTPUT(6 FOR LP,5 FOR TELETYPE)          =5
PRINTOUT(DETAILED OR SUMMARY)            =SUMMARY
```

PROCESS.DAT File

Example 2

```
ACRES=13.0
1,8,ALUM FEED-LIQUID STOCK
2,40.0,28.0,556.0,350.0
3,70,ALUM,40 MG/L
1,15,SODIUM HYDROXIDE FEED SYSTEMS
2,40.0,28.0,5000.0,3300.0
3,200.0,SODIUM HYDROXIDE,15 MG/L
1,10,POLYMER FEED SYSTEMS
2,40.0,28.0,67.0,45.0
3,2.0,POLYMER,0.25 MG/L
1,22,RAPID MIX, G=600
2,40.0,28.0,2785.0,2785.0
1,25,FLOCCULATION-HORIZ PADDLE,G=50
2,40.0,28.0,13000.0,13000.0
1,33,RECT CLARIFIER-FECL3 & ALUM SLG
2,40.0,28.0,4444.0,4444.0
3,9,UNITS
1,38,GRAVITY FILTRATION STRUCTURE
2,40.0,28.0,5560.0,5560.0
1,41,FILTRATION MEDIA-MIXED MEDIA
2,40.0,28.0,5560.0,5560.0
1,43,HYDRAULIC SURFACE WASH
2,40.0,28.0,5560.0,5560.0
1,42,BACKWASH PUMPING FACILITIES
2,40.0,28.0,10010.0,5560.0
1,45,WASH WATER SURGE BASINS
2,40.0,28.0,200000.0,200000.0
1,1,CL2 FEED-CYLINDER STORAGE
2,40.0,28.0,670.0,450.0
3,300.0,CHLORINE,2MG/L
1,94,CLEARWELL STORAGE-BELOW GROUND
2,40.0,28.0,2500000.0,2500000.0
1,93,FINISHED WATER PUMPING FACILITY
2,40.0,28.0,55.0,28.0
3,250.0,TDH
1,81,GRAV SLDG THICKENER,ALUM & FECL3
2,40.0,28.0,850.0,850.0
3,1,UNIT
1,86,BASKET CENTRIFUGES
2,40.0,28.0,115000.0,70000.0
1,91,DEWATERED SLUDGE HAULING
2,40.0,28.0,20000.0,12000.0
3,20.0,MILES
0000000000000000000000000000000000000000
ACRES=1.5
1,59,REVERSE OSMOSIS
2,5.0,3.5,5.0,3.5
3,65.0,1042.5,SULFURIC ACID,25 MG/L
4,650.0,208.5,SODIUM HEXA PO3,5 MG/L
5,300.0,29.2,CHLORINE,1 MG/L
1,94,CLEARWELL STORAGE-BELOW GROUND
2,5.0,3.5,300000.0,300000.0
1,1,CL2 FEED-CYLINDER STORAGE
2,5.0,3.5,63.0,44.0
3,300.0,CHLORINE,1.5 MG/L
1,93,FINISHED WATER PUMPING FACILITY
2,5.0,3.5,8.0,3.5
3,200.0,TDH
```

COST SUMMARY FOR 17 WATER TREATMENT PROCESSES

	PROCESS	FLOW-MGD DESIGN	FLOW-MGD ACTUAL	PROCESS PARAMETER DESIGN	PROCESS PARAMETER OPERATING	COSTS-DOLLARS CONSTR	COSTS-DOLLARS CAPITAL	COSTS-CTS/1000 GAL O&M	COSTS-CTS/1000 GAL DEBT	COSTS-CTS/1000 GAL TOTAL
1	ALUM FEED-LIQUID STOCK $ 70.00/TON FOR ALUM,40 MG/L	40.000	28.000	556.0 LB/HR	350.0 LB/HR	71438.	98070.	1.071	0.091	1.161
2	SODIUM HYDROXIDE FEED SYSTEMS $ 200.00/TON FOR SODIUM HYDROXIDE,15 MG/L	40.000	28.000	5000.0 LB/DAY	3300.0 LB/DAY	47300.	64933.	1.209	0.060	1.269
3	POLYMER FEED SYSTEMS $ 2.00/LB FOR POLYMER,0.25 MG/L	40.000	28.000	67.0 LB/DAY	45.0 LB/DAY	22403.	30755.	0.352	0.028	0.381
4	RAPID MIX, G=600	40.000	28.000	2785.0 CU FT	2785.0 CU FT	44214.	60697.	0.133	0.056	0.189
5	FLOCCULATION-HORIZ PADDLE, G=50	40.000	28.000	13000.0 CU FT	13000.0 CU FT	81432.	111790.	0.029	0.103	0.132
6	RECT CLARIFIER-FECL3 & ALUM SLG NUMBER OF UNITS = 9	40.000	28.000	4444.0 SQ FT	4444.0 SQ FT	2247326.	3085128.	0.544	2.849	3.394
7	GRAVITY FILTRATION STRUCTURE	40.000	28.000	5560.0 SQ FT	5560.0 SQ FT	1747729.	2399281.	0.843	2.216	3.059
8	FILTRATION MEDIA-MIXED MEDIA	40.000	28.000	5560.0 SQ FT	5560.0 SQ FT	148195.	203441.	0.000	0.188	0.188
9	HYDRAULIC SURFACE WASH SYSTEMS	40.000	28.000	5560.0 SQ FT	5560.0 SQ FT	160854.	220820.	0.057	0.204	0.261
10	BACKWASH PUMPING FACILITIES	40.000	28.000	10010.0 GPM	5560.0 SQ FT	122534.	168214.	0.099	0.155	0.254
11	WASH WATER SURGE BASINS	40.000	28.000	200000.0 GAL	200000.0 GAL	357600.	490913.	0.000	0.453	0.453
12	CL2 FEED-CYLINDER STORAGE $ 300.00/TON FOR CHLORINE,2MG/L	40.000	28.000	670.0 LB/DAY	450.0 LB/DAY	68978.	94693.	0.362	0.087	0.450
13	CLEARWELL STORAGE-BELOW GROUND	40.000	28.000	2500000.0 GAL	2500000.0 GAL	912033.	1252038.	0.000	1.156	1.156
14	FINISHED WATER PUMPING FACILITY TDH = 250.0 FEET	40.000	28.000	55.0 MGD	28.0 MGD	415025.	569747.	1.526	0.526	2.052
15	GRAV SLDG THICKENER-ALUM & FECL3 NUMBER OF UNITS = 1	40.000	28.000	850.0 SQ FT	850.0 SQ FT	73524.	100934.	0.018	0.093	0.111
16	BASKET CENTRIFUGES	40.000	28.000	115000.0 GPD	70000.0 GPD	334806.	459621.	0.981	0.425	1.406
17	DEWATERED SLUDGE HAULING ONE WAY MILES = 20.0	40.000	28.000	20000.0 CY/YR	12000.0 CY/YR	81507.	111893.	0.162	0.103	0.265
					TOTAL	6936898.	9522972.	7.386	8.796	16.182

SITEWORK,SUBSURFACE,STNBY POWER	346845.
GEN CON OH & P, 10.0%	728374.
ENGINEERING	801212.
LAND, 13.00 ACRES	26000.
LEGAL,FISCAL,ADMIN	63570.
INT DURING CONSTR	620073.
TOTAL CAPITAL	9522972.

TOTAL O&M:	KWH	MATERIALS,$	LABOR,HR	DIESEL,GAL	NAT GAS,CU FT	CHEMICALS,$
	6927859.	42554.	21708.	4816.	0.	285248.
PROCESS O&M						
1	46258.	96.	65.	0.	0.	107310.
2	46864.	253.	150.	0.	0.	120450.
3	26276.	303.	207.	0.	0.	32850.
4	284176.	58.	499.	0.	0.	0.
5	15394.	843.	164.	0.	0.	0.
6	70561.	10053.	4344.	0.	0.	0.
7	978196.	12173.	4464.	0.	0.	0.
8	0.	0.	0.	0.	0.	0.
9	76960.	399.	310.	0.	0.	0.
10	132836.	3172.	294.	0.	0.	0.

PROCESS O&M	KWH	MATERIALS,$	LABOR,HR	DIESEL,GAL	NAT GAS,CU FT	CHEMICALS,$
11	0.	0.	0.	0.	0.	0.
12	79799.	2519.	747.	0.	0.	24637.
13	0.	0.	0.	0.	0.	0.
14	4689639.	4203.	1107.	0.	0.	0.
15	4138.	229.	145.	0.	0.	0.
16	476762.	2998.	8300.	0.	0.	0.
17	0.	5254.	914.	4816.	0.	0.

COSTS PRESENTED ARE CURRENT AS OF OCTOBER 1978

CAPITAL COST FACTORS

ENGINEERING(%)	=	10.00
SITEWORK,INTERFACE PIPING(%)	=	5.00
SUBSURFACE CONSIDERATIONS(%)	=	0.00
STANDBY POWER(%)	=	0.00
INTEREST RATE(%)	=	7.00
NUMBER OF YEARS	=	20.00
LAND AREA, ACRES	=	13.00
LAND COST, $/ACRE	=	2000.00

UNIT COST FACTORS

ELECTRICITY, $/KWH	=	0.03
LABOR, $/HR	=	10.00
DIESEL FUEL, $/GAL	=	0.450
NATURAL GAS, $/CU FT	=	.0013
BLDNG ENERGY USE,KWH/SQ FT/YR	=	102.6

COST INDEXES

EXCAVATION (ENR SKILLED LABOR)	=	247.0
MANUFACTURED EQUIP (BLS #114)	=	221.3
CONCRETE (BLS #132)	=	221.1
STEEL (BLS #101.3)	=	262.1
LABOR(ENR SKILLED LABOR)	=	247.0
PIPES & VALVES (BLS #114.901)	=	236.4
ELECTRICAL & INSTR (BLS #117)	=	167.5
HOUSING (ENR BUILDING COST)	=	254.8
PRODUCER PRICE INDEX	=	199.7

COST SUMMARY FOR 4 WATER TREATMENT PROCESSES

PROCESS	FLOW-MGD DESIGN	FLOW-MGD ACTUAL	PROCESS PARAMETER DESIGN	PROCESS PARAMETER OPERATING	COSTS-DOLLARS CONSTR	COSTS-DOLLARS CAPITAL	COSTS-CTS/1000 GAL O&M	COSTS-CTS/1000 GAL DEBT	COSTS-CTS/1000 GAL TOTAL
1 REVERSE OSMOSIS	5.000	3.500	5.0 MGD	3.5 MGD	2869035.	3893610.	44.717	28.769	73.486
$ 65.00/TON FOR SULFURIC ACID,25 MG/L									
$ 650.00/TON FOR SODIUM HEXA PO3,5 MG/L									
$ 300.00/TON FOR CHLORINE,1 MG/L									
2 CLEARWELL STORAGE-BELOW GROUND	5.000	3.500	300000.0 GAL	300000.0 GAL	155098.	210485.	0.000	1.555	1.555
3 CL2 FEED-CYLINDER STORAGE	5.000	3.500	63.0 LB/DAY	44.0 LB/DAY	17884.	24271.	0.695	0.179	0.874
$ 300.00/TON FOR CHLORINE,1.5 MG/L									
4 FINISHED WATER PUMPING FACILITY	5.000	3.500	8.0 MGD	3.5 MGD	85729.	116344.	1.850	0.860	2.710
TDH = 200.0 FEET									
TOTAL					3127746.	4244710.	47.262	31.364	78.626

SITEWORK,SUBSURFACE,STNBY POWER	156387.
GEN CON OH & P, 10.0%	328413.
ENGINEERING	361255.
LAND, 1.50 ACRES	3000.
LEGAL,FISCAL,ADMIN	37287.
INT DURING CONSTR	230623.
TOTAL CAPITAL	4244710.

	KWH	MATERIALS,$	LABOR,HR	DIESEL,GAL	NAT GAS,CU FT	CHEMICALS,$
TOTAL O&M:	8915745.	263812.	3138.	0.	0.	41108.
PROCESS O&M						
1	8328984.	261476.	2121.	0.	0.	38699.
2	0.	0.	0.	0.	0.	0.
3	15851.	1634.	436.	0.	0.	2409.
4	570910.	702.	581.	0.	0.	0.

COSTS PRESENTED ARE CURRENT AS OF OCTOBER 1978

CAPITAL COST FACTORS

ENGINEERING(%)	= 10.00
SITEWORK,INTERFACE PIPING(%)	= 5.00
SUBSURFACE CONSIDERATIONS(%)	= 0.00
STANDBY POWER(%)	= 0.00
INTEREST RATE(%)	= 7.00
NUMBER OF YEARS	= 20.00
LAND AREA, ACRES	= 1.50
LAND COST, $/ACRE	= 2000.00

UNIT COST FACTORS

ELECTRICITY, $/KWH	= 0.03
LABOR, $/HR	= 10.00
DIESEL FUEL, $/GAL	= 0.450
NATURAL GAS, $/CU FT	= .0013
BLDNG ENERGY USE,KWH/SQ FT/YR	= 102.6

COST INDEXES

EXCAVATION (ENR SKILLED LABOR)	= 247.0
MANUFACTURED EQUIP (BLS #114)	= 221.3
CONCRETE (BLS #132)	= 221.1
STEEL (BLS #101.3)	= 262.1
LABOR(ENR SKILLED LABOR)	= 247.0
PIPES & VALVES (BLS #114.901)	= 236.4
ELECTRICAL & INSTR (BLS #117)	= 167.5
HOUSING (ENR BUILDING COST)	= 254.8
PRODUCER PRICE INDEX	= 199.7

EXIT

COST.DAT File

Example 3

```
COSTS PRESENTED ARE CURRENT AS OF OCTOBER 1978
CAPITAL COST FACTORS (% OF CONSTRUCTION COST):
 1 ENGINEERING(%)                      =10.
 2 SITEWORK, INTERFACE PIPING(%)       =5.
 3 SUBSURFACE CONSIDERATIONS(%)        =0.0
 4 STANDBY POWER(%)                    =0.0
 5 INTEREST RATE(%)                    =7.
 6 NUMBER OF YEARS                     =20.0
 7 LAND COST, $/ACRE                   =2000.
UNIT COST FACTORS:
 8 ELECTRICITY, $/KWH                  =.03
 9 LABOR, $/HR                         =10.
10 DIESEL FUEL, $/GAL                  =.45
11 NATURAL GAS, $/CU FT                =.0013
12 BLDNG ENERGY USE,KWH/SQ FT/YR       =102.6
COST INDEXES:
13 EXCAVATION(ENR SKILLED LABOR)       =247.0
14 MANUFACTURED EQUIP (BLS #114)       =221.3
15 CONCRETE (BLS #132)                 =221.1
16 STEEL (BLS #101.3)                  =262.1
17 LABOR (ENR SKILLED LABOR)           =247.0
18 PIPE & VALVES (BLS #114.901)        =236.4
19 ELECTRICAL & INSTR (BLS #117)       =167.5
20 HOUSING (ENR BUILDING COST)         =254.76
21 PRODUCER PRICE INDEX                =199.7
22 ENR CONSTRUCTION, '67 BASE YR       =0.0
OUTPUT(6 FOR LP,5 FOR TELETYPE)        =5
PRINTOUT(DETAILED OR SUMMARY)          =SUMMARY
9,2
7.5,12.5
```

PROCES.DAT File

Example 3

```
ACRES=1.5
1,57,IN-PLANT PUMPING
2,5.0,3.5,7.5,3.5
3,75.0,TDH
1,60,PRESSURE ION EXCHANGE-SOFTENING
2,5.0,3.5,5.0,3.5
3,30.6,REGENERATION SALT
1,15,SODIUM HYDROXIDE FEED SYSTEMS
2,5.0,3.5,625.0,438.0
3,200.0,SODIUM HYDROXIDE,15 MG/L
1,1,CL2 FEED-CYLINDER STORAGE
2,5.0,3.5,63.0,44.0
3,300.0,CHLORINE,1.5 MG/L
1,95,CLEARWELL STORAGE-GROUND LEVEL
2,5.0,3.5,500000.0,500000.0
1,93,FINISHED WATER PUMPING FACILITY
2,5.0,3.5,8.0,3.5
3,200.0,TDH
0000000000000000000000000000000000000000
ACRES=0.0
1,11,LIME FEED-NO RECALCINATION
2,1.0,0.7,8.7,6.1
3,65.0,LIME,25 MG/L
```

COST SUMMARY FOR 6 WATER TREATMENT PROCESSES

PROCESS	FLOW-MGD DESIGN	FLOW-MGD ACTUAL	PROCESS PARAMETER DESIGN	PROCESS PARAMETER OPERATING	COSTS-DOLLARS CONSTR	COSTS-DOLLARS CAPITAL	COSTS-CTS/1000 GAL O&M	COSTS-CTS/1000 GAL DEBT	COSTS-CTS/1000 GAL TOTAL
1 IN-PLANT PUMPING TDH = 75.0 FEET	5.000	3.500	7.5 MGD	3.5 MGD	62492.	86482.	1.750	0.639	2.389
2 PRESSURE ION EXCHANGE-SOFTENING $ 30.60/TON FOR REGENERATION SALT	5.000	3.500	5.0 MGD	3.5 MGD	485646.	672081.	11.111	4.966	16.077
3 SODIUM HYDROXIDE FEED SYSTEMS $ 200.00/TON FOR SODIUM HYDROXIDE,15 MG/L	5.000	3.500	625.0 LB/DAY	438.0 LB/DAY	19182.	26546.	1.393	0.196	1.589
4 CL2 FEED-CYLINDER STORAGE $ 300.00/TON FOR CHLORINE,1.5 MG/L	5.000	3.500	63.0 LB/DAY	44.0 LB/DAY	17884.	24749.	0.695	0.183	0.878
5 CLEARWELL STORAGE-GROUND LEVEL	5.000	3.500	500000.0 GAL	500000.0 GAL	128065.	177228.	0.000	1.310	1.310
6 FINISHED WATER PUMPING FACILITY TDH = 200.0 FEET	5.000	3.500	8.0 MGD	3.5 MGD	85729.	118640.	1.850	0.877	2.727
				TOTAL	798998.	1105726.	16.799	8.170	24.969

SITEWORK,SUBSURFACE,STNBY POWER	39950.
GEN CON OH & P, 12.0%	100674.
ENGINEERING	93962.
LAND, 1.50 ACRES	3000.
LEGAL,FISCAL,ADMIN	17677.
INT DURING CONSTR	51464.
TOTAL CAPITAL	1105726.

TOTAL O&M:	KWH	MATERIALS,$	LABOR,HR	DIESEL,GAL	NAT GAS,CU FT	CHEMICALS,$
	1303682.	18562.	4276.	0.	0.	114170.
PROCESS O&M						
1	527256.	680.	586.	0.	0.	0.
2	176604.	15393.	2548.	0.	0.	95774.
3	13061.	152.	126.	0.	0.	15987.
4	15851.	1634.	436.	0.	0.	2409.
5	0.	0.	0.	0.	0.	0.
6	570910.	702.	581.	0.	0.	0.

COSTS PRESENTED ARE CURRENT AS OF OCTOBER 1978

CAPITAL COST FACTORS

ENGINEERING(%)	= 10.00
SITEWORK,INTERFACE PIPING(%)	= 5.00
SUBSURFACE CONSIDERATIONS(%)	= 0.00
STANDBY POWER(%)	= 0.00
INTEREST RATE(%)	= 7.00
NUMBER OF YEARS	= 20.00
LAND AREA, ACRES	= 1.50
LAND COST, $/ACRE	= 2000.00

UNIT COST FACTORS

ELECTRICITY, $/KWH	= 0.03
LABOR, $/HR	= 10.00
DIESEL FUEL, $/GAL	= 0.450
NATURAL GAS, $/CU FT	= .0013
BLDNG ENERGY USE,KWH/SQ FT/YR	= 102.6

COST INDEXES

EXCAVATION (ENR SKILLED LABOR)	= 247.0
MANUFACTURED EQUIP (BLS #114)	= 221.3
CONCRETE (BLS #132)	= 221.1
STEEL (BLS #101.3)	= 262.1
LABOR(ENR SKILLED LABOR)	= 247.0
PIPES & VALVES (BLS #114.901)	= 236.4
ELECTRICAL & INSTR (BLS #117)	= 167.5
HOUSING (ENR BUILDING COST)	= 254.8
PRODUCER PRICE INDEX	= 199.7

COST SUMMARY FOR 1 WATER TREATMENT PROCESS

PROCESS	FLOW-MGD DESIGN	FLOW-MGD ACTUAL	PROCESS PARAMETER DESIGN	PROCESS PARAMETER OPERATING	COSTS-DOLLARS CONSTR	COSTS-DOLLARS CAPITAL	COSTS-CTS/1000 GAL O&M	COSTS-CTS/1000 GAL DEBT	COSTS-CTS/1000 GAL TOTAL
1 LIME FEED-NO RECALCINATION $ 65.00/TON FOR LIME,25 MG/L	1.000	0.700	8.7 LB/HR	6.1 LB/HR	57002.	77513.	3.371	2.864	6.234
				TOTAL	57002.	77513.	3.371	2.864	6.234

SITEWORK,SUBSURFACE,STNBY POWER	2850.
GEN CON OH & P, 12.0%	7182.
ENGINEERING	6703.
LAND, 0.00 ACRES	0.
LEGAL,FISCAL,ADMIN	3022.
INT DURING CONSTR	752.
TOTAL CAPITAL	77513.

TOTAL O&M:	KWH	MATERIALS,$	LABOR,HR	DIESEL,GAL	NAT GAS,CU FT	CHEMICALS,$
	25617.	710.	540.	0.	0.	1737.

COSTS FOR THE FOLLOWING PROCESSES HAVE BEEN EXTRAPOLATED. VALID RANGES FOR INPUT DATA ARE:

PROCESS	DESIGN RANGE	YOUR INPUT	OPERATING RANGE	YOUR INPUT
1 LIME FEED-NO RECALCINATION	10.0 TO 1000.0 LB/HR	8.7	10.0 TO 1000.0 LB/HR	6.1

COSTS PRESENTED ARE CURRENT AS OF OCTOBER 1978

CAPITAL COST FACTORS

ENGINEERING(%)	= 10.00
SITEWORK,INTERFACE PIPING(%)	= 5.00
SUBSURFACE CONSIDERATIONS(%)	= 0.00
STANDBY POWER(%)	= 0.00
INTEREST RATE(%)	= 7.00
NUMBER OF YEARS	= 20.00
LAND AREA, ACRES	= 0.00
LAND COST, $/ACRE	= 2000.00

UNIT COST FACTORS

ELECTRICITY, $/KWH	= 0.03
LABOR, $/HR	= 10.00
DIESEL FUEL, $/GAL	= 0.450
NATURAL GAS, $/CU FT	= .0013
BLDNG ENERGY USE,KWH/SQ FT/YR	= 102.6

COST INDEXES

EXCAVATION (ENR SKILLED LABOR)	= 247.0
MANUFACTURED EQUIP (BLS #114)	= 221.3
CONCRETE (BLS #132)	= 221.1
STEEL (BLS #101.3)	= 262.1
LABOR(ENR SKILLED LABOR)	= 247.0
PIPES & VALVES (BLS #114.901)	= 236.4
ELECTRICAL & INSTR (BLS #117)	= 167.5
HOUSING (ENR BUILDING COST)	= 254.8
PRODUCER PRICE INDEX	= 199.7

COST SUMMARY FOR 6 WATER TREATMENT PROCESSES

PROCESS	FLOW-MGD DESIGN	FLOW-MGD ACTUAL	PROCESS PARAMETER DESIGN	PROCESS PARAMETER OPERATING	COSTS-DOLLARS CONSTR	COSTS-DOLLARS CAPITAL	COSTS-CTS/1000 GAL O&M	COSTS-CTS/1000 GAL DEBT	COSTS-CTS/1000 GAL TOTAL
1 IN-PLANT PUMPING TDH = 75.0 FEET	5.000	3.500	7.5 MGD	3.5 MGD	62492.	86482.	1.635	0.639	2.274
2 PRESSURE ION EXCHANGE-SOFTENING $ 30.60/TON FOR REGENERATION SALT	5.000	3.500	5.0 MGD	3.5 MGD	485646.	672081.	10.612	4.966	15.578
3 SODIUM HYDROXIDE FEED SYSTEMS $ 200.00/TON FOR SODIUM HYDROXIDE,15 MG/L	5.000	3.500	625.0 LB/DAY	438.0 LB/DAY	19182.	26546.	1.368	0.196	1.564
4 CL2 FEED-CYLINDER STORAGE $ 300.00/TON FOR CHLORINE,1.5 MG/L	5.000	3.500	63.0 LB/DAY	44.0 LB/DAY	17884.	24749.	0.610	0.183	0.792
5 CLEARWELL STORAGE-GROUND LEVEL	5.000	3.500	500000.0 GAL	500000.0 GAL	128065.	177228.	0.000	1.310	1.310
6 FINISHED WATER PUMPING FACILITY TDH = 200.0 FEET	5.000	3.500	8.0 MGD	3.5 MGD	85729.	118640.	1.736	0.877	2.613
				TOTAL	798998.	1105726.	15.962	8.170	24.132

SITEWORK,SUBSURFACE,STNBY POWER	39950.
GEN CON OH & P, 12.0%	100674.
ENGINEERING	93962.
LAND, 1.50 ACRES	3000.
LEGAL,FISCAL,ADMIN	17677.
INT DURING CONSTR	51464.
TOTAL CAPITAL	1105726.

TOTAL O&M:	KWH 1303682.	MATERIALS,$ 18562.	LABOR,HR 4276.	DIESEL,GAL 0.	NAT GAS,CU FT 0.	CHEMICALS,$ 114170.
PROCESS O&M						
1	527256.	680.	586.	0.	0.	0.
2	176604.	15393.	2548.	0.	0.	95774.
3	13061.	152.	126.	0.	0.	15987.
4	15851.	1634.	436.	0.	0.	2409.
5	0.	0.	0.	0.	0.	0.
6	570910.	702.	581.	0.	0.	0.

COSTS PRESENTED ARE CURRENT AS OF OCTOBER 1978

CAPITAL COST FACTORS

ENGINEERING(%)	= 10.00
SITEWORK,INTERFACE PIPING(%)	= 5.00
SUBSURFACE CONSIDERATIONS(%)	= 0.00
STANDBY POWER(%)	= 0.00
INTEREST RATE(%)	= 7.00
NUMBER OF YEARS	= 20.00
LAND AREA, ACRES	= 1.50
LAND COST, $/ACRE	= 2000.00

UNIT COST FACTORS

ELECTRICITY, $/KWH	= 0.03
LABOR, $/HR	= 7.50
DIESEL FUEL, $/GAL	= 0.450
NATURAL GAS, $/CU FT	= .0013
BLDNG ENERGY USE,KWH/SQ FT/YR	= 102.6

COST INDEXES

EXCAVATION (ENR SKILLED LABOR)	= 247.0
MANUFACTURED EQUIP (BLS #114)	= 221.3
CONCRETE (BLS #132)	= 221.1
STEEL (BLS #101.3)	= 262.1
LABOR(ENR SKILLED LABOR)	= 247.0
PIPES & VALVES (BLS #114.901)	= 236.4
ELECTRICAL & INSTR (BLS #117)	= 167.5
HOUSING (ENR BUILDING COST)	= 254.8
PRODUCER PRICE INDEX	= 199.7

COST SUMMARY FOR 1 WATER TREATMENT PROCESS

PROCESS	FLOW-MGD DESIGN	FLOW-MGD ACTUAL	PROCESS PARAMETER DESIGN	PROCESS PARAMETER OPERATING	COSTS-DOLLARS CONSTR	COSTS-DOLLARS CAPITAL	COSTS-CTS/1000 GAL O&M	COSTS-CTS/1000 GAL DEBT	COSTS-CTS/1000 GAL TOTAL
1 LIME FEED-NO RECALCINATION $ 65.00/TON FOR LIME,25 MG/L	1.000	0.700	8.7 LB/HR	6.1 LB/HR	57002.	77513.	2.843	2.864	5.706
TOTAL					57002.	77513.	2.843	2.864	5.706

SITEWORK,SUBSURFACE,STNBY POWER	2850.
GEN CON OH & P, 12.0%	7182.
ENGINEERING	6703.
LAND, 0.00 ACRES	0.
LEGAL,FISCAL,ADMIN	3022.
INT DURING CONSTR	752.
TOTAL CAPITAL	77513.

TOTAL O&M:	KWH	MATERIALS,$	LABOR,HR	DIESEL,GAL	NAT GAS,CU FT	CHEMICALS,$
	25617.	710.	540.	0.	0.	1737.

COSTS FOR THE FOLLOWING PROCESSES HAVE BEEN EXTRAPOLATED. VALID RANGES FOR INPUT DATA ARE:

PROCESS	DESIGN RANGE	YOUR INPUT	OPERATING RANGE	YOUR INPUT
1 LIME FEED-NO RECALCINATION	10.0 TO 1000.0 LB/HR	8.7	10.0 TO 1000.0 LB/HR	6.1

COSTS PRESENTED ARE CURRENT AS OF OCTOBER 1978

CAPITAL COST FACTORS

ENGINEERING(%)	= 10.00
SITEWORK,INTERFACE PIPING(%)	= 5.00
SUBSURFACE CONSIDERATIONS(%)	= 0.00
STANDBY POWER(%)	= 0.00
INTEREST RATE(%)	= 7.00
NUMBER OF YEARS	= 20.00
LAND AREA, ACRES	= 0.00
LAND COST, $/ACRE	= 2000.00

UNIT COST FACTORS

ELECTRICITY, $/KWH	= 0.03
LABOR, $/HR	= 7.50
DIESEL FUEL, $/GAL	= 0.450
NATURAL GAS, $/CU FT	= .0013
BLDNG ENERGY USE,KWH/SQ FT/YR	= 102.6

COST INDEXES

EXCAVATION (ENR SKILLED LABOR)	= 247.0
MANUFACTURED EQUIP (BLS #114)	= 221.3
CONCRETE (BLS #132)	= 221.1
STEEL (BLS #101.3)	= 262.1
LABOR(ENR SKILLED LABOR)	= 247.0
PIPES & VALVES (BLS #114.901)	= 236.4
ELECTRICAL & INSTR (BLS #117)	= 167.5
HOUSING (ENR BUILDING COST)	= 254.8
PRODUCER PRICE INDEX	= 199.7

COST SUMMARY FOR 6 WATER TREATMENT PROCESSES

	PROCESS	FLOW-MGD DESIGN	FLOW-MGD ACTUAL	PROCESS PARAMETER DESIGN	PROCESS PARAMETER OPERATING	COSTS-DOLLARS CONSTR	COSTS-DOLLARS CAPITAL	COSTS-CTS/1000 GAL O&M	COSTS-CTS/1000 GAL DEBT	COSTS-CTS/1000 GAL TOTAL
1	IN-PLANT PUMPING TDH = 75.0 FEET	5.000	3.500	7.5 MGD	3.5 MGD	62492.	86482.	1.865	0.639	2.504
2	PRESSURE ION EXCHANGE-SOFTENING $ 30.60/TON FOR REGENERATION SALT	5.000	3.500	5.0 MGD	3.5 MGD	485646.	672081.	11.610	4.966	16.575
3	SODIUM HYDROXIDE FEED SYSTEMS $ 200.00/TON FOR SODIUM HYDROXIDE,15 MG/L	5.000	3.500	625.0 LB/DAY	438.0 LB/DAY	19182.	26546.	1.418	0.196	1.614
4	CL2 FEED-CYLINDER STORAGE $ 300.00/TON FOR CHLORINE,1.5 MG/L	5.000	3.500	63.0 LB/DAY	44.0 LB/DAY	17884.	24749.	0.780	0.183	0.963
5	CLEARWELL STORAGE-GROUND LEVEL	5.000	3.500	500000.0 GAL	500000.0 GAL	128065.	177228.	0.000	1.310	1.310
6	FINISHED WATER PUMPING FACILITY TDH = 200.0 FEET	5.000	3.500	8.0 MGD	3.5 MGD	85729.	118640.	1.964	0.877	2.840
					TOTAL	798998.	1105726.	17.636	8.170	25.806

SITEWORK,SUBSURFACE,STNBY POWER	39950.
GEN CON OH & P, 12.0%	100674.
ENGINEERING	93962.
LAND, 1.50 ACRES	3000.
LEGAL,FISCAL,ADMIN	17677.
INT DURING CONSTR	51464.
TOTAL CAPITAL	1105726.

TOTAL O&M:	KWH	MATERIALS,$	LABOR,HR	DIESEL,GAL	NAT GAS,CU FT	CHEMICALS,$
	1303682.	18562.	4276.	0.	0.	114170.
PROCESS O&M						
1	527256.	680.	586.	0.	0.	0.
2	176604.	15393.	2548.	0.	0.	95774.
3	13061.	152.	126.	0.	0.	15987.
4	15851.	1634.	436.	0.	0.	2409.
5	0.	0.	0.	0.	0.	0.
6	570910.	702.	581.	0.	0.	0.

COSTS PRESENTED ARE CURRENT AS OF OCTOBER 1978

CAPITAL COST FACTORS

ENGINEERING(%)	= 10.00
SITEWORK,INTERFACE PIPING(%)	= 5.00
SUBSURFACE CONSIDERATIONS(%)	= 0.00
STANDBY POWER(%)	= 0.00
INTEREST RATE(%)	= 7.00
NUMBER OF YEARS	= 20.00
LAND AREA, ACRES	= 1.50
LAND COST, $/ACRE	= 2000.00

UNIT COST FACTORS

ELECTRICITY, $/KWH	= 0.03
LABOR, $/HR	= 12.50
DIESEL FUEL, $/GAL	= 0.450
NATURAL GAS, $/CU FT	= .0013
BLDNG ENERGY USE,KWH/SQ FT/YR	= 102.6

COST INDEXES

EXCAVATION (ENR SKILLED LABOR)	= 247.0
MANUFACTURED EQUIP (BLS #114)	= 221.3
CONCRETE (BLS #132)	= 221.1
STEEL (BLS #101.3)	= 262.1
LABOR(ENR SKILLED LABOR)	= 247.0
PIPES & VALVES (BLS #114.901)	= 236.4
ELECTRICAL & INSTR (BLS #117)	= 167.5
HOUSING (ENR BUILDING COST)	= 254.8
PRODUCER PRICE INDEX	= 199.7

COST SUMMARY FOR 1 WATER TREATMENT PROCESS

PROCESS	FLOW-MGD DESIGN	FLOW-MGD ACTUAL	PROCESS PARAMETER DESIGN	PROCESS PARAMETER OPERATING	COSTS-DOLLARS CONSTR	COSTS-DOLLARS CAPITAL	COSTS-CTS/1000 GAL O&M	COSTS-CTS/1000 GAL DEBT	COSTS-CTS/1000 GAL TOTAL
1 LIME FEED-NO RECALCINATION	1.000	0.700	8.7 LB/HR	6.1 LB/HR	57002.	77513.	3.899	2.864	6.762
$ 65.00/TON FOR LIME,25 MG/L									
				TOTAL	57002.	77513.	3.899	2.864	6.762

SITEWORK,SUBSURFACE,STNBY POWER	2850.
GEN CON OH & P, 12.0%	7182.
ENGINEERING	6703.
LAND, 0.00 ACRES	0.
LEGAL,FISCAL,ADMIN	3022.
INT DURING CONSTR	752.
TOTAL CAPITAL	77513.

TOTAL O&M:	KWH	MATERIALS,$	LABOR,HR	DIESEL,GAL	NAT GAS,CU FT	CHEMICALS,$
	25617.	710.	540.	0.	0.	1737.

COSTS FOR THE FOLLOWING PROCESSES HAVE BEEN EXTRAPOLATED. VALID RANGES FOR INPUT DATA ARE:

PROCESS	DESIGN RANGE	YOUR INPUT	OPERATING RANGE	YOUR INPUT
1 LIME FEED-NO RECALCINATION	10.0 TO 1000.0 LB/HR	8.7	10.0 TO 1000.0 LB/HR	6.1

COSTS PRESENTED ARE CURRENT AS OF OCTOBER 1978

CAPITAL COST FACTORS

ENGINEERING(%)	= 10.00
SITEWORK,INTERFACE PIPING(%)	= 5.00
SUBSURFACE CONSIDERATIONS(%)	= 0.00
STANDBY POWER(%)	= 0.00
INTEREST RATE(%)	= 7.00
NUMBER OF YEARS	= 20.00
LAND AREA, ACRES	= 0.00
LAND COST, $/ACRE	= 2000.00

UNIT COST FACTORS

ELECTRICITY, $/KWH	= 0.03
LABOR, $/HR	= 12.50
DIESEL FUEL, $/GAL	= 0.450
NATURAL GAS, $/CU FT	= .0013
BLDNG ENERGY USE,KWH/SQ FT/YR	= 102.6

COST INDEXES

EXCAVATION (ENR SKILLED LABOR)	= 247.0
MANUFACTURED EQUIP (BLS #114)	= 221.3
CONCRETE (BLS #132)	= 221.1
STEEL (BLS #101.3)	= 262.1
LABOR(ENR SKILLED LABOR)	= 247.0
PIPES & VALVES (BLS #114.901)	= 236.4
ELECTRICAL & INSTR (BLS #117)	= 167.5
HOUSING (ENR BUILDING COST)	= 254.8
PRODUCER PRICE INDEX	= 199.7

EXIT

-

SECTION 7

TROUBLE SHOOTING GUIDE

The WATER program is designed to check the PROCES.DAT file before computing process costs to assure that all necessary data cards are present. If an error exists in this file, the program will print the type of error and the line number in which the error occurred. The program also checks the length of the COST.DAT file to assure that it contains either 28 or 30 cards. The following self-explanatory error messages are contained in the program:

1. FORTRAN read error in card ___ of the PROCES.DAT file. This card should contain the word "ACRES=" followed by a floating point number of 15 digits or less.

2. Error - card with "ACRES=" is missing or misspelled. Check card ___ of the PROCES.DAT file.

3. FORTRAN read error in card ___ of the PROCES.DAT file. This card should contain the integer 1 followed by a comma, the process number, and name.

4. Error - this should be the first data card of a process and should begin with the integer 1 in column 1. Check card ___ of the PROCES.DAT file.

5. Error in card ___ of the PROCES.DAT file. ___ is an invalid process number. Processes are numbered 1 through 28 in Table ___ of the program manual.

6. Error in card ___ of the PROCES.DAT file. Card number ___ was expected for process ___, which requires ___ cards of data.

7. Error - not enough data in the COST.DAT file; this file should have either 28 or 30 cards.

In addition to the error messages, the program also notifies the user when his input data exceed the valid range of the stored cost data. In this case, the computer extrapolates the stored data. See example 3 in Section 6 for a sample listing of this situation.

Errors may arise that will not cause an error message or program interruption if the required commas between the input data values are forgotten. In this case, erroneous input values will result. If this happens, check the PROCES.DAT file for required commas.

SECTION 8

WATER PROGRAM LISTING

The WATER program is written specifically for the DEC PDP-1170 IAS computing system. Because this FORTRAN program may not be compatible with all systems, it may be necessary to modify the opening and closing of data files. Also, FORMAT statements do not contain the Holerith or H-conversion; instead they transmit alphanumeric data by enclosing it directly in quotation marks.

```
      INTEGER O,REPEAT,REDO                                                    1
      REAL M,L,MAINT,LABOR,LFAFEE                                              2
      LOGICAL DLIMIT,OLIMIT                                                    3
      DIMENSION TDH(10),TMILE1(10),GPMSF1(10),AMAKUP(10),                      4
     : AMGL(10),VAR(22),VARVAL(10),IRANGE(150),NP(150),APCENT(10)              5
      DIMENSION NCHEM(75),CMNAM(75,3),CMCST(75),CMAMT(75),ITYPE(150)           6
      DIMENSION SAVE1(10)                                                      7
      DOUBLE PRECISION OUTPUT,PROCES,DETAILED,DXU,OXU,CMNAM,CHECK1,CHECK       8
      DIMENSION CONSTR(150),ELECTR(150),MAINT(150),LABOR(150),                 9
     : DIESEL(150),GAS(150),CHEM(150),QD(150),QA(150),DPV(150),               10
     : OPV(150),PROCAP(150),CTSTOM(150),CTSDEB(150),CTSTL(150),               11
     : NUMUN(150),DXU(150),OXU(150)                                           12
      DIMENSION C(4),E(4),M(4),L(4),D(4),G(4),F(8),B(4)                        13
      DIMENSION PROCES(150,4),CTS(150)                                         14
      COMMON NUMUN,N/A/TOP,BOTTOM,C,B,CI/B/OTOP,OBOT,E,M,L,D,G,CR9             15
      COMMON/C/ENGR,SITE,SUBSUR,STNBY,RATE,YEARS,CLAND,ELEC,                   16
     : HOURLY,FUEL,GASCST,ENFT,CI1,CI2,CI3,CI4,CI5,CI6,CI7,CI8,CI9,           17
     : CI10                                                                   18
      EQUIVALENCE (ENGR,VAR(1))                                                19
      DATA IVV,DETAILED,CHECK1/0,'DETAILED','ACRES='/                          20
      OPEN(UNIT=1,NAME='COST.DAT',TYPE='OLD')                                  21
      READ(1,100,END=240) ENGR,SITE,SUBSUR,STNBY,RATE,YEARS,CLAND              22
      READ(1,101,END=240) ELEC,HOURLY,FUEL,GASCST,ENFT                         23
      READ(1,102,END=240) CI1,CI2,CI3,CI4,CI5,CI6,CI7,CI8,CI9,CI10             24
      READ(1,103,END=240) O,OUTPUT                                             25
      READ(1,105,END=450) IVN,IVV                                              26
      IF(IVN.LE.0.OR.IVN.GT.22) GOTO 620                                       27
      READ(1,106,END=240) (VARVAL(I1),I1=1,IVV)                                28
  450 IVV=IVV+1                                                                29
      CLOSE(UNIT=1)                                                            30
      DO 610 REDO=1,IVV                                                        31
      IF(REDO.GT.1) VAR(IVN)=VARVAL(REDO-1)                                    32
      CR1=CI1/247.0                                                            33
      CR2=CI2/221.3                                                            34
      CR3=CI3/221.1                                                            35
      CR4=CI4/262.1                                                            36
      CR5=CI5/247.0                                                            37
      CR6=CI6/236.4                                                            38
      CR7=CI7/167.5                                                            39
      CR8=CI8/254.76                                                           40
      CR9=CI9/199.7                                                            41
      CR10=CI10/265.38                                                         42
      OPEN(UNIT=2,NAME='PROCES.DAT',TYPE='OLD')                                43
      NCASE=0                                                                  44
      ILINE=0                                                                  45
  198 ILINE=ILINE+1                                                            46
      READ(2,151,END=251,ERR=210) CHECK,ACRES                                  47
      IF(CHECK.NE.CHECK1) GOTO 215                                             48
  199 ILINE=ILINE+1                                                            49
      READ(2,152,END=250,ERR=220) NCHCK,NP(1)                                  50
      IF(NCHCK.EQ.0.AND.ILINE.GT.3) GOTO 245                                   51
      IF(NCHCK.NE.1) GOTO 225                                                  52
      IF(NP(1).LE.0.OR.NP(1).GT.131) GOTO 230                                  53
      IZ=1+(NP(1)-1)*5                                                         54
      OPEN(UNIT=3,NAME='CRV.DAT',TYPE='OLD',ACCESS='DIRECT',                   55
     : FORM='FORMATTED',ASSOCIATEVARIABLE=IZN)                                 56
      READ(3'IZ,153) (PROCES(1,I1),I1=1,4),NCHEM(1),ITYPE(1)                   57
      CLOSE(UNIT=3)                                                            58
      GOTO(200,200,201,201,201,201,201,201,201,200,201,202)ITYPE(1)            59
  200 NCARD=2+NCHEM(1)                                                         60
      GOTO 203                                                                 61
  201 NCARD=3+NCHEM(1)                                                         62
      GOTO 203                                                                 63
  202 NCARD=4+NCHEM(1)                                                         64
  203 DO 205 I1=2,NCARD                                                        65
      ILINE=ILINE+1                                                            66
      READ(2,154,END=235,ERR=235) NCHCK                                        67
      IF(NCHCK.NE.I1) GOTO 235                                                 68
  205 CONTINUE                                                                 69
      GOTO 199                                                                 70
  210 WRITE(O,370) ILINE                                                       71
      GOTO 1000                                                                72
  215 WRITE(O,371) ILINE                                                       73
      GOTO 1000                                                                74
  220 WRITE(O,372) ILINE                                                       75
      GOTO 1000                                                                76
  225 WRITE(O,373) ILINE                                                       77
      GOTO 1000                                                                78
  230 WRITE(O,374) ILINE,NP(1)                                                 79
      GOTO 1000                                                                80
```

```
235 WRITE(0,375) ILINE,I1,NP(1),(PROCES(1,I2),I2=1,4),NCARD                81
    GOTO 1000                                                              82
240 WRITE(0,376)                                                           83
    GOTO 1000                                                              84
245 NCASE=NCASE+1                                                          85
    GOTO 198                                                               86
250 NCASE=NCASE+1                                                          87
251 CLOSE(UNIT=2)                                                          88
    OPEN(UNIT=2,NAME='PROCES.DAT',TYPE='OLD')                              89
    DO 600 REPEAT=1,NCASE                                                  90
    ICHEM2=0                                                               91
    ITDH=0                                                                 92
    IMILES=0                                                               93
    IMAKUP=0                                                               94
    IGPM=0                                                                 95
    IMGL=0                                                                 96
    IPCENT=0                                                               97
    N=0                                                                    98
    IPAGE=0                                                                99
    TCOST=0.0                                                             100
    TCTSE=0.0                                                             101
    TCTSM=0.0                                                             102
    TCTSL=0.0                                                             103
    TCTSD=0.0                                                             104
    TCTSG=0.0                                                             105
    TCTSC=0.0                                                             106
    TE=0.0                                                                107
    TM=0.0                                                                108
    TL=0.0                                                                109
    TD=0.0                                                                110
    TG=0.0                                                                111
    TC=0.0                                                                112
    SUM1=0.0                                                              113
    SUM2=0.0                                                              114
    SUM3=0.0                                                              115
    SUM4=0.0                                                              116
    SUM5=0.0                                                              117
    READ(2,127) ACRES                                                     118
500 READ(2,110,END=531) NP(N+1)                                           119
    IF(NP(N+1).LE.0) GOTO 531                                             120
    N=N+1                                                                 121
    READ(2,115) QD(N),QA(N),DPV(N),OPV(N)                                 122
    IZ= 1 + (NP(N)-1)*5                                                   123
    OPEN(UNIT=3,NAME='CRV.DAT',TYPE='OLD',ACCESS='DIRECT',                124
   : FORM='FORMATTED',ASSOCIATEVARIABLE=IZN)                              125
    READ(3'IZ,120)(PROCES(N,I1),I1=1,4),DXU(N),OXU(N),BOTTOM,TOP,         126
   : PROP,IRATIO,IEXP,NCHEM(N),ITYPE(N)                                   127
    READ(3'IZ+1 ,121) C,E                                                 128
    READ(3'IZ+2  ,121) M,L                                                129
    READ(3'IZ+3  ,121) D,G                                                130
    READ(3'IZ+4  ,122) B,F                                                131
    CLOSE(UNIT=3)                                                         132
    IF(ITYPE(N).EQ.4.OR.ITYPE(N).EQ.6) GOTO 501                           133
    OBOT=BOTTOM*PROP                                                      134
    OTOP=TOP*PROP                                                         135
    GOTO 502                                                              136
501 OBOT=PROP                                                             137
    OTOP=IRATIO*(10.0**IEXP)                                              138
502 DLIMIT=DPV(N).LT.BOTTOM.OR.DPV(N).GT.TOP                              139
    OLIMIT=OPV(N).LT.OBOT.OR.OPV(N).GT.OTOP                               140
    RATIO=IRATIO*(10.0**IEXP)                                             141
    CI=F(1)*CR1 + F(2)*CR2 + F(3)*CR3 + F(4)*CR4 + F(5)*CR5 +             142
   :   F(6)*CR6 + F(7)*CR7 + F(8)*CR8                                     143
    IF(CI.LT.0.01) CI=CR9                                                 144
    IF(CR10.GT.0.0) CI=CR10                                               145
    CHEM(N)=0.0                                                           146
    NUMUN(N)=1                                                            147
    IRANGE(N)=0                                                           148
    W1=DPV(N)**2                                                          149
    W2=DPV(N)**3                                                          150
    W3=OPV(N)**2                                                          151
    W4=OPV(N)**3                                                          152
    CTS(N)=QA(N)*3650.                                                    153
    GOTO(505,505,504,525,505,505,505,505,550,505,505,504)ITYPE(N)         154
504 READ(2,110) NUMUN(N)                                                  155
```

```
  505 CONSTR(N)=(C(1)+C(2)*DPV(N)+C(3)*W1+C(4)*W2)*NUMUN(N)*CI                156
      BLDEN    =(B(1)+B(2)*DPV(N)+B(3)*W1+B(4)*W2)*ELEC*ENFT/102.6            157
      ELECTR(N)=(E(1)+E(2)*OPV(N)+E(3)*W3+E(4)*W4)*NUMUN(N)*ELEC              158
      MAINT(N) =(M(1)+M(2)*OPV(N)+M(3)*W3+M(4)*W4)*NUMUN(N)*CR9               159
      LABOR(N) =(L(1)+L(2)*OPV(N)+L(3)*W3+L(4)*W4)*NUMUN(N)*HOURLY            160
      DIESEL(N)=(D(1)+D(2)*OPV(N)+D(3)*W3+D(4)*W4)*NUMUN(N)*FUEL              161
      GAS(N)   =(G(1)+G(2)*OPV(N)+G(3)*W3+G(4)*W4)*NUMUN(N)*GASCST            162
      IF(DLIMIT) CALL DRANGE(CONSTR(N),BLDEN,DPV(N))                          163
      IF(OLIMIT) CALL ORANGE(ELECTR(N),MAINT(N),LABOR(N),DIESEL(N),           164
     : GAS(N),OPV(N))                                                         165
      IF(DLIMIT.OR.OLIMIT) IRANGE(N)=1                                        166
      ELECTR(N)=ELECTR(N)+BLDEN                                               167
      GOTO(510,520,510,510,530,535,540,545,510,510,554,557)ITYPE(N)           168
C                  **TYPE 1**                                                 169
  510 IF(NCHEM(N).EQ.0) GOTO 526                                              170
      ICHEM1=ICHEM2+1                                                         171
      ICHEM2=ICHEM2+NCHEM(N)                                                  172
      DO 515 I1=ICHEM1,ICHEM2                                                 173
      READ(2,111) CMCST(I1),(CMNAM(I1,I2),I2=1,3)                             174
      CMAMT(I1)=OPV(N)*RATIO*365./2000.                                       175
      CHEM(N)=CHEM(N)+CMCST(I1)*CMAMT(I1)                                     176
C               **TYPE 10**                                                   177
      IF(ITYPE(N).EQ.10) CHEM(N)=CHEM(N)*2000.0                               178
  515 CONTINUE                                                                179
      GOTO 526                                                                180
C             **TYPE 2**                                                    181
  520 ICHEM1=ICHEM2+1                                                         182
      ICHEM2=ICHEM2+NCHEM(N)                                                  183
      DO 522 I1=ICHEM1,ICHEM2                                                 184
      READ(2,113) CMCST(I1),CMAMT(I1),(CMNAM(I1,I2),I2=1,3)                   185
      CMAMT(I1)=CMAMT(I1)*365./2000.                                          186
  522 CHEM(N)=CHEM(N)+CMCST(I1)*CMAMT(I1)                                     187
      GOTO 526                                                                188
C             **TYPE 4**                                                    189
  525 READ(2,110) NUMUN(N)                                                    190
      CONSTR(N)=(C(1)+C(2)*DPV(N)+C(3)*W1+C(4)*W2)*NUMUN(N)*CI                191
      BLDEN=(B(1)+B(2)*OPV(N)+B(3)*W3+B(4)*W4)*ELEC*ENFT/102.6                192
      IF(DLIMIT) CALL DRANGE(CONSTR(N),W1,DPV(N))                             193
      ELECTR(N)=(E(1)+E(2)*OPV(N)+E(3)*W3+E(4)*W4)*ELEC                       194
      MAINT(N)=(M(1)+M(2)*OPV(N)+M(3)*W3+M(4)*W4)*CR9                         195
      LABOR(N)=(L(1)+L(2)*OPV(N)+L(3)*W3+L(4)*W4)*HOURLY                      196
      IF(OLIMIT) GOTO 527                                                     197
      GOTO 528                                                                198
  527 ISAVE=NUMUN(N)                                                          199
      NUMUN(N)=1                                                              200
      CALL ORANGE(ELECTR(N),MAINT(N),LABOR(N),DIESEL(N),                      201
     : GAS(N),OPV(N))                                                         202
      NUMUN(N)=ISAVE                                                          203
      TOP=OTOP                                                                204
      BOTTOM=OBOT                                                             205
      CALL DRANGE(W1,BLDEN,OPV(N))                                            206
  528 IF(DLIMIT.OR.OLIMIT) IRANGE(N)=1                                        207
      ELECTR(N)=ELECTR(N)+BLDEN                                               208
      DIESEL(N)=0.0                                                           209
      GAS(N)=0.0                                                              210
      CHEM(N)=0.0                                                             211
      GOTO 526                                                                212
C             **TYPE 5**                                                    213
  530 ITDH=ITDH+1                                                             214
      READ(2,123) TDH(ITDH)                                                   215
      BLDEN=BLDEN*102.6/ELEC/ENFT*CI                                          216
      ELECTR(N)=ELECTR(N)*TDH(ITDH)/D(1)                                      217
      DIESEL(N)=0.0                                                           218
      DENOM=D(1)-D(2)                                                         219
      SLOPE=(CONSTR(N)-BLDEN)/DENOM                                           220
      BEE=(D(1)*BLDEN-D(2)*CONSTR(N))/DENOM                                   221
      CONSTR(N)=SLOPE*TDH(ITDH) + BEE                                         222
      BLDEN=0.0                                                               223
      GOTO 526                                                                224
C             **TYPE 6**                                                    225
  535 IMILES=IMILES+1                                                         226
      READ(2,123) TMILE1(IMILES)                                              227
      TMILES=TMILE1(IMILES)                                                   228
      MAINT(N)=MAINT(N)*TMILES                                                229
      IF(TMILES.LE.25.0) LABOR(N)=LABOR(N)*(0.4133*TMILES+5.867)              230
      IF(TMILES.GT.25.0) LABOR(N)=LABOR(N)*(14.71+TMILES/17.0)                231
      DIESEL(N)=DIESEL(N)*TMILES                                              232
      CHEM(N)=0.0                                                             233
      GOTO 526                                                                234
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C              **TYPE 7**                                                        235
  540 IMILES=IMILES+1                                                           236
      READ(2,123) TMILE1(IMILES)                                                237
      TMILES=TMILE1(IMILES)                                                     238
      ELECTR(N)=ELECTR(N)/ELEC*CI                                               239
      SLOPE=(ELECTR(N)-CONSTR(N))/35.0                                          240
      BEE=(40.0*CONSTR(N)-5.0*ELECTR(N))/35.0                                   241
      CONSTR(N)=SLOPE*TMILES + BEE                                              242
      IF(TMILES.LE.20) LABOR(N)=LABOR(N)*(0.667+0.0667*TMILES)                  243
      IF(TMILES.GT.20) LABOR(N)=LABOR(N)*(1.0+0.05*TMILES)                      244
      MAINT(N)=MAINT(N)*TMILES/5.0                                              245
      GAS(N)=0.0                                                                246
      DIESEL(N)=DIESEL(N)*TMILES/5.0                                            247
      ELECTR(N)=0.0                                                             248
      BLDEN=0.0                                                                 249
      CHEM(N)=0.0                                                               250
      GOTO 526                                                                  251
C               **TYPE 8**                                                      252
  545 IMAKUP=IMAKUP+1                                                           253
      READ(2,123) AMAKUP(IMAKUP)                                                254
      ICHEM2=ICHEM2+1                                                           255
      READ(2,111) CMCST(ICHEM2),(CMNAM(ICHEM2,I1),I1=1,3)                       256
      CMAMT(ICHEM2)=OPV(N)*RATIO*365./2000.*AMAKUP(IMAKUP)/100.                 257
      CHEM(N)=CMCST(ICHEM2)*CMAMT(ICHEM2)                                       258
      GOTO 526                                                                  259
C                **TYPE 9**                                                     260
  550 IGPM=IGPM+1                                                               261
      READ(2,123) GPMSF1(IGPM)                                                  262
      GPMSF=GPMSF1(IGPM)                                                        263
      IF(GPMSF.EQ.0.0) GPMSF=2.0                                                264
      W1=DPV(N)/GPMSF                                                           265
      W2=W1**2                                                                  266
      W3=W1**3                                                                  267
      BOTTOM=BOTTOM/2.0                                                         268
      TOP=TOP/5.0                                                               269
      DLIMIT=W1.LT.BOTTOM.OR.W1.GT.TOP                                          270
      CONSTR(N)=(C(1)+C(2)*W1+C(3)*W2+C(4)*W3)*CI                               271
      BLDEN=(B(1)+B(2)*W1+B(3)*W2+B(4)*W3)*ELEC*ENFT/102.6                      272
      IF(DLIMIT) CALL DRANGE(CONSTR(N),BLDEN,W1)                                273
      W1=OPV(N)/GPMSF                                                           274
      W2=W1**2                                                                  275
      W3=W1**3                                                                  276
      ELECTR(N)=(E(1)+E(2)*W1+E(3)*W2+E(4)*W3)*ELEC                             277
      MAINT(N)=(M(1)+M(2)*W1+M(3)*W2+M(4)*W3)*CR9                               278
      LABOR(N)=(L(1)+L(2)*W1+L(3)*W2+L(4)*W3)*HOURLY                            279
      OLIMIT=W1.LT.BOTTOM.OR.W1.GT.TOP                                          280
      IF(OLIMIT) CALL ORANGE(ELECTR(N),MAINT(N),LABOR(N),DIESEL(N),             281
     : GAS(N),W1)                                                               282
      IF(DLIMIT.OR.OLIMIT) IRANGE(N)=1                                          283
      ELECTR(N)=ELECTR(N)*GPMSF/2.0+BLDEN                                       284
      DIESEL(N)=0.0                                                             285
      GAS(N)=0.0                                                                286
      ICHEM1=ICHEM2+1                                                           287
      ICHEM2=ICHEM2+NCHEM(N)                                                    288
      DO 548 I1=ICHEM1,ICHEM2                                                   289
      READ(2,113) CMCST(I1),CMAMT(I1),(CMNAM(I1,I2),I2=1,3)                     290
      CMAMT(I1)=CMAMT(I1)*365./2000.                                            291
  548 CHEM(N)=CHEM(N)+CMCST(I1)*CMAMT(I1)                                       292
      GOTO 526                                                                  293
C              **TYPE 11**                                                      294
  554 IMGL=IMGL+1                                                               295
      READ(2,123) AMGL(IMGL)                                                    296
      SAVE1(IMGL)=CONSTR(N)*AMGL(IMGL)/D(1)                                     297
      CONSTR(N)=0.0                                                             298
      DIESEL(N)=0.0                                                             299
      GOTO 526                                                                  300
C              **TYPE 12**                                                      301
  557 IPCENT=IPCENT+1                                                           302
      READ(2,123) APCENT(IPCENT)                                                303
      CONSTR(N)=CONSTR(N)*APCENT(IPCENT)/100.                                   304
      ELECTR(N)=ELECTR(N)*APCENT(IPCENT)/100.                                   305
      MAINT(N) =MAINT(N) *APCENT(IPCENT)/100.                                   306
      LABOR(N) =LABOR(N) *APCENT(IPCENT)/100.                                   307
      DIESEL(N)=DIESEL(N)*APCENT(IPCENT)/100.                                   308
      GAS(N)   =GAS(N)   *APCENT(IPCENT)/100.                                   309
      CHEM(N)=0.0                                                               310
      GOTO 526                                                                  311
  526 TCOST=TCOST+CONSTR(N)                                                     312
      GOTO 500                                                                  313
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531 CSTSIT=SITE*TCOST/100.                                                    314
    CSTSUB=SUBSUR*TCOST/100.                                                  315
    CSTSTN=STNBY*TCOST/100.                                                   316
    SUBTL1=TCOST + CSTSIT + CSTSUB + CSTSTN                                   317
    OHP=12.                                                                   318
    IF(SUBTL1.GE.2.5E6.AND.SUBTL1.LT.10.E6) OHP=10.                           319
    IF(SUBTL1.GE.10.E6.AND.SUBTL1.LT.25.E6) OHP=9.                            320
    IF(SUBTL1.GE.25.E6) OHP=8.5                                               321
    CSTOHP=OHP*SUBTL1/100.                                                    322
    SUBTL2=CSTOHP + SUBTL1                                                    323
    CSTENG=ENGR*SUBTL2/100.                                                   324
    SUBTL3=CSTENG + SUBTL2                                                    325
    CSTLND=ACRES*CLAND                                                        326
    IF(SUBTL3.GT.1.E6) GOTO 551                                               327
    IF(SUBTL3.LE.0.0) GOTO 552                                                328
    LFAFEE=60.0+.0447*SUBTL3-6.406E-8*SUBTL3**2+3.673E-14*SUBTL3**3           329
    BR=SUBTL3/1.E4                                                            330
    CSTINT=(1.75+.252*BR-2.105E-3*BR**2+9.013E-6*BR**3)/                      331
   : 24.*RATE*SUBTL3/100.                                                     332
    GOTO 555                                                                  333
551 LFAFEE=125570.+6.823E-4*SUBTL3-115564.*EXP(-6.015E-8*SUBTL3)              334
    BR=SUBTL3/1.E6                                                            335
    CSTINT=(16.03+1.02*BR-1.188E-2*BR**2+3.7E-5*BR**3)/                       336
   :       24.*RATE*SUBTL3/100.                                               337
    GOTO 555                                                                  338
552 LFAFEE=0.0                                                                339
    CSTINT=0.0                                                                340
555 TCAP=SUBTL3 + CSTLND + LFAFEE + CSTINT                                    341
    W1=(1.+RATE/100.)                                                         342
    DEBT=TCAP*RATE/100.*W1**YEARS/(W1**YEARS-1.)                              343
    IMGL=0                                                                    344
    DO 570 I=1,N                                                              345
    IF(TCOST.LE.0.0) GOTO 556                                                 346
    GOTO 558                                                                  347
556 W2=0.0                                                                    348
    GOTO 559                                                                  349
558 W2=CONSTR(I)/TCOST                                                        350
559 PRDEBT=DEBT*W2                                                            351
    OTHER=(TCAP-TCOST)*W2                                                     352
    PROCAP(I)=CONSTR(I) + OTHER                                               353
    CTSELE=ELECTR(I)/CTS(I)                                                   354
    CTSMAI=MAINT(I)/CTS(I)                                                    355
    CTSLAB=LABOR(I)/CTS(I)                                                    356
    CTSDIE=DIESEL(I)/CTS(I)                                                   357
    CTSGAS=GAS(I)/CTS(I)                                                      358
    CTSCHE=CHEM(I)/CTS(I)                                                     359
    CTSDEB(I)=PRDEBT/CTS(I)                                                   360
    CTSTOM(I)=CTSELE+CTSMAI+CTSLAB+CTSDIE+CTSGAS+CTSCHE                       361
    IF(ITYPE(I).EQ.11) IMGL=IMGL+1                                            362
    IF(ITYPE(I).EQ.11) CTSTOM(I)=SAVE1(IMGL)/CTS(I)                           363
    CTSTL(I)=CTSDEB(I) + CTSTOM(I)                                            364
    TOM=ELECTR(I)+MAINT(I)+LABOR(I)+DIESEL(I)+GAS(I)+CHEM(I)                  365
    IF(ITYPE(I).EQ.11) TOM=SAVE1(IMGL)                                        366
    TOTAL=TOM + PRDEBT                                                        367
    TCTSE=TCTSE + CTSELE                                                      368
    TCTSM=TCTSM + CTSMAI                                                      369
    TCTSL=TCTSL + CTSLAB                                                      370
    TCTSD=TCTSD + CTSDIE                                                      371
    TCTSG=TCTSG + CTSGAS                                                      372
    TCTSC=TCTSC + CTSCHE                                                      373
    TE=TE + ELECTR(I)                                                         374
    TM=TM + MAINT(I)                                                          375
    TL=TL + LABOR(I)                                                          376
    TD=TD + DIESEL(I)                                                         377
    TG=TG + GAS(I)                                                            378
    TC=TC + CHEM(I)                                                           379
    SUM1=SUM1 + CTSDEB(I)                                                     380
    SUM2=SUM2 + CTSTOM(I)                                                     381
    SUM3=SUM3 + CTSTL(I)                                                      382
    SUM4=SUM4 + TOM                                                           383
    SUM5=SUM5 + TOTAL                                                         384
    IF(OUTPUT.NE.DETAILED) GOTO 570                                           385
    IF(IPAGE.EQ.0) WRITE (O,300)                                              386
    IF(IPAGE.EQ.0) IPAGE=2                                                    387
    IF(NUMUN(I).GT.1) GOTO 560                                                388
    WRITE(O,301) (PROCES(I,I1),I1=1,4),QD(I),QA(I),DPV(I),DXU(I),             389
   : OPV(I),OXU(I)                                                            390
    WRITE(O,302) CONSTR(I),OTHER,PROCAP(I)                                    391
    GOTO 565                                                                  392
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560 IF(NUMUN(N).EQ.0) GOTO 561                                          393
    QD(I)=QD(I)/NUMUN(I)                                                394
    QA(I)=QA(I)/NUMUN(I)                                                395
561 WRITE(0,303) (PROCES(I,I1),I1=1,4),NUMUN(I),QD(I),QA(I),DPV(I),     396
   : DXU(I),OPV(I),OXU(I)                                               397
    QD(I)=QD(I)*NUMUN(I)                                                398
    QA(I)=QA(I)*NUMUN(I)                                                399
    WRITE(0,304) NUMUN(I),CONSTR(I),OTHER,PROCAP(I),NUMUN(I)            400
565 WRITE(0,305) ELEC,CTSELE,ELECTR(I),CTSMAI,MAINT(I),HOURLY,          401
   : CTSLAB,LABOR(I),FUEL,CTSDIE,DIESEL(I)                              402
    WRITE(0,306) GASCST,CTSGAS,GAS(I),CTSCHE,CHEM(I),CTSTOM(I),TOM      403
    WRITE(0,307) CTSTOM(I),TOM,YEARS,RATE,CTSDEB(I),PRDEBT,             404
   : CTSTL(I),TOTAL                                                     405
    IPAGE=IPAGE-1                                                       406
570 CONTINUE                                                            407
    IF(OUTPUT.NE.DETAILED) GOTO 571                                     408
    WRITE(0,300)                                                        409
    WRITE(0,308) TCOST,SITE,CSTSIT                                      410
    IF(SUBSUR.GT.0.) WRITE(0,309) SUBSUR,CSTSUB                         411
    IF(STNBY.GT.0.) WRITE(0,310) STNBY,CSTSTN                           412
    WRITE(0,311) SUBTL1,OHP,CSTOHP,SUBTL2,ENGR,CSTENG,SUBTL3            413
    ICLAND=CLAND                                                        414
    IF(ACRES.GT.0.) WRITE(0,312) ACRES,ICLAND,CSTLND                    415
    WRITE(0,313) LFAFEE,CSTINT,TCAP                                     416
    WRITE(0,314) ELEC,TCTSE,TE,TCTSM,TM,HOURLY,TCTSL,TL,FUEL,TCTSD,TD   417
    WRITE(0,315) GASCST,TCTSG,TG,TCTSC,TC,SUM2,SUM4                     418
    WRITE(0,316) SUM2,SUM4,YEARS,RATE,SUM1,DEBT,SUM3,SUM5               419
571 ICHEM2=0                                                            420
    ITDH=0                                                              421
    IMILES=0                                                            422
    IMAKUP=0                                                            423
    IGPM=0                                                              424
    IMGL=0                                                              425
    IPCENT=0                                                            426
    I3=0                                                                427
    WRITE(0,300)                                                        428
    I3=I3+8                                                             429
    IF(N.GT.1) GOTO 575                                                 430
    WRITE(0,317)                                                        431
    GOTO 578                                                            432
575 WRITE(0,318) N                                                      433
578 WRITE(0,319)                                                        434
    DO 590 I=1,N                                                        435
    IF(I3-45) 583,580,581                                               436
580 IF(N-I) 581,583,581                                                 437
581 IF(I3-63.LT.0.AND.N-I-1.GT.0) GOTO 583                              438
582 I3=0                                                                439
    WRITE(0,300)                                                        440
    WRITE(0,318) N                                                      441
    WRITE(0,319)                                                        442
    I3=I3+8                                                             443
583 WRITE(0,320) I,(PROCES(I,I1),I1=1,4),QD(I),QA(I),DPV(I),DXU(I),     444
   : OPV(I),OXU(I),CONSTR(I),PROCAP(I),CTSTOM(I),CTSDEB(I),CTSTL(I)     445
    I3=I3+1                                                             446
    GOTO(735,735,700,705,710,715,715,720,725,735,730,732)ITYPE(I)       447
700 WRITE(0,331) NUMUN(I)                                               448
    I3=I3+1                                                             449
    GOTO 735                                                            450
705 W3=DPV(I)*NUMUN(I)*7.48/QD(I)/694.44                                451
    WRITE(0,332) W3                                                     452
    W3=DPV(I)*NUMUN(I)                                                  453
    WRITE(0,341) W3,NUMUN(I)                                            454
    I3=I3+3                                                             455
    GOTO 735                                                            456
710 ITDH=ITDH+1                                                         457
    WRITE(0,333) TDH(ITDH)                                              458
    I3=I3+1                                                             459
    GOTO 735                                                            460
715 IMILES=IMILES+1                                                     461
    WRITE(0,334) TMILE1(IMILES)                                         462
    I3=I3+1                                                             463
    GOTO 735                                                            464
720 IMAKUP=IMAKUP+1                                                     465
    WRITE(0,335) AMAKUP(IMAKUP)                                         466
    I3=I3+1                                                             467
    GOTO 735                                                            468
725 IGPM=IGPM+1                                                         469
    WRITE(0,336) GPMSF1(IGPM)                                           470
    I3=I3+1                                                             471
    GOTO 735                                                            472
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730 IMGL=IMGL+1                                                          473
    WRITE(O,337) AMGL(IMGL)                                              474
    I3=I3+1                                                              475
    GOTO 735                                                             476
732 IPCENT=IPCENT+1                                                      477
    WRITE(O,331) NUMUN(I)                                                478
    WRITE(O,339) APCENT(IPCENT)                                          479
    I3=I3+2                                                              480
    GOTO 735                                                             481
735 IF(NCHEM(I).EQ.0) GOTO 590                                           482
    ICHEM1=ICHEM2+1                                                      483
    ICHEM2=ICHEM2+NCHEM(I)                                               484
    DO 585 I2=ICHEM1,ICHEM2                                              485
    IF(ITYPE(I).EQ.10) GOTO 584                                          486
    IF(CMAMT(I2).LE.0.0) GOTO 585                                        487
    WRITE(O,321) CMCST(I2),(CMNAM(I2,I4),I4=1,3)                         488
    I3=I3+1                                                              489
    GOTO 585                                                             490
584 WRITE(O,328) CMCST(I2),(CMNAM(I2,I4),I4=1,3)                         491
    I3=I3+1                                                              492
585 CONTINUE                                                             493
590 CONTINUE                                                             494
    WRITE(O,322) TCOST,TCAP,SUM2,SUM1,SUM3                               495
    I3=I3+4                                                              496
    SUM6=CSTSIT+CSTSUB+CSTSTN                                            497
    WRITE(O,329) SUM6,OHP,CSTOHP,CSTENG,ACRES,CSTLND,LFAFEE,             498
   : CSTINT,TCAP                                                         499
    I3=I3+11                                                             500
    TE=TE/ELEC                                                           501
    TL=TL/HOURLY                                                         502
    TD=TD/FUEL                                                           503
    TG=TG/GASCST                                                         504
    WRITE(O,330) TE,TM,TL,TD,TG,TC                                       505
    I3=I3+3                                                              506
    IF(N-1.EQ.0) GOTO 7778                                               507
    IF(I3-60.GT.0) WRITE(O,300)                                          508
    WRITE(O,351)                                                         509
    I3=I3+2                                                              510
    DO 7777 I=1,N                                                        511
    IF(I3-63.LT.0) GOTO 7776                                             512
    WRITE(O,300)                                                         513
    WRITE(O,354)                                                         514
    I3=3                                                                 515
7776 TMP1=ELECTR(I)/ELEC                                                 516
    TMP2=LABOR(I)/HOURLY                                                 517
    TMP3=DIESEL(I)/FUEL                                                  518
    TMP4=GAS(I)/GASCST                                                   519
    WRITE(O,350) I,TMP1,MAINT(I),TMP2,TMP3,TMP4,CHEM(I)                  520
7777 I3=I3+1                                                             521
7778 I8=0                                                                522
    DO 592 I=1,N                                                         523
 592 I8=I8+IRANGE(I)                                                     524
    IF(I8.EQ.0) GOTO 593                                                 525
    IF(58-I3-I8.LT.0) WRITE(O,300)                                       526
    IF(58-I3-I8.LT.0) I3=0                                               527
    I8=0                                                                 528
 593 DO 596 I=1,N                                                        529
    IF(IRANGE(I).EQ.0) GOTO 596                                          530
    IF(I8.GT.0) GOTO 594                                                 531
    IF(I3-63.EQ.0) WRITE(O,300)                                          532
    IF(I3-63.EQ.0) I3=0                                                  533
    WRITE(O,352)                                                         534
    I8=I8+1                                                              535
    I3=I3+4                                                              536
 594 IZ=1+(NP(I)-1)*5                                                    537
    OPEN(UNIT=3,NAME='CRV.DAT',TYPE='OLD',ACCESS='DIRECT',               538
   : FORM='FORMATTED',ASSOCIATEVARIABLE=IZN)                             539
    READ(3'IZ,125) BOTTOM,TOP,PROP,IRATIO,IEXP                           540
    CLOSE(UNIT=3)                                                        541
    IF(ITYPE(I).EQ.4.OR.ITYPE(I).EQ.6) GOTO 597                          542
    OBOT=BOTTOM*PROP                                                     543
    OTOP=TOP*PROP                                                        544
    GOTO 595                                                             545
 597 OBOT=PROP                                                           546
    OTOP=IRATIO*(10.0**IEXP)                                             547
 595 WRITE(O,353) I,(PROCES(I,I1),I1=1,4),BOTTOM,TOP,DXU(I),DPV(I),      548
   : OBOT,OTOP,DXU(I),DPV(I)                                             549
    I3=I3+1                                                              550
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596 CONTINUE                                                          551
    OPEN(UNIT=1,NAME='COST.DAT',TYPE='OLD')                           552
    IF(I3.GT.47) WRITE(O,300)                                         553
    READ(1,104) B,F                                                   554
    WRITE(O,323) B,F                                                  555
    WRITE(O,324) ENGR,ELEC,CI1,SITE,HOURLY,CI2                        556
    WRITE(O,325) SUBSUR,FUEL,CI3,STNBY,GASCST,CI4,RATE,ENFT,CI5       557
    WRITE(O,326) YEARS,CI6,ACRES,CI7,CLAND,CI8,CI9                    558
    IF(CI10.GT.0.01) WRITE (O,327) CI10                               559
    CLOSE(UNIT=1)                                                     560
600 CONTINUE                                                          561
    CLOSE(UNIT=2)                                                     562
610 CONTINUE                                                          563
    GOTO 1000                                                         564
620 WRITE(O,338) IVN                                                  565
1000 STOP                                                             566
100 FORMAT(//6(34X,F9.2/),34X,F9.2)                                   567
101 FORMAT(/4(34X,F9.2/),34X,F9.2)                                    568
102 FORMAT(/9(34X,F9.2/),34X,F9.2)                                    569
103 FORMAT(34X,I1/34X,A8)                                             570
104 FORMAT(4A4,8A4)                                                   571
105 FORMAT(I,I1)                                                      572
106 FORMAT(10F)                                                       573
110 FORMAT(2X,I)                                                      574
111 FORMAT(2X,F,3A8)                                                  575
113 FORMAT(2X,2F,3A8)                                                 576
114 FORMAT(2X,I,F)                                                    577
115 FORMAT(2X,4F)                                                     578
120 FORMAT(4A8,2A6,3E9.2,I4,I2,I1,I2)                                 579
121 FORMAT(4E10.2,4E10.2)                                             580
122 FORMAT(4E10.2,8F5.3)                                              581
123 FORMAT(2X,F)                                                      582
125 FORMAT(44X,3E9.2,I4,I2)                                           583
127 FORMAT(6X,F)                                                      584
151 FORMAT(A6,F)                                                      585
152 FORMAT(2I)                                                        586
153 FORMAT(4A8,45X,I1,I2)                                             587
154 FORMAT(I)                                                         588
300 FORMAT(1H1)                                                       589
301 FORMAT(//' ***** COST ESTIMATE FOR '4A8//T48,'DESIGN'T66,         590
   : 'OPERATING'/T12,'PROCESS FLOW'T41,F10.3,' MGD'T61,F10.3,         591
   : ' MGD'/T12,'PROCESS PARAMETER'T41,F10.2,1X,A6,T61,F10.2,1X,A6/)  592
302 FORMAT(T8,'CAPITAL COST'T55,'DOLLARS'//                           593
   : T12,'CONSTRUCTION'T52,F11.0/T12,'OTHER RELATED COSTS'T52,F11.0/  594
   : T53,'-----------'/T30,'PROCESS CAPITAL COST'T52,F11.0//          595
   : T8,'O&M COST'T49,'CTS/1000 GAL TREATED'T81,'DOLLARS/YR'/)        596
303 FORMAT(//' ***** COST ESTIMATE FOR',1X,4A8,' ('I3,' UNITS)'//     597
   : T47,'DESIGN'T63,'OPERATING'/                                     598
   : T12,'PROCESS FLOW (PER UNIT)'T41,F11.3,' MGD',T61,F11.3,' MGD'/  599
   : T12,'PROCESS PARAMETER (PER UNIT)'T41,F11.2,1X,A6,T61,F11.2,     600
   : 1X,A6/)                                                          601
304 FORMAT(T8,'CAPITAL COST (TOTAL FOR'I3,' UNITS)'T55,'DOLLARS'//    602
   : T12,'CONSTRUCTION'T52,F11.0/T12,'OTHER RELATED COSTS'T52,F11.0/  603
   : T53,'-----------'/T30,'PROCESS CAPITAL COST'T52,F11.0//          604
   : T8,'O&M COST (TOTAL FOR'I3,' UNITS)'T49,'CTS/1000 GAL TREATED'   605
   : T81,'DOLLARS/YR'/)                                               606
305 FORMAT(T12,'ELECTRICAL ENERGY @ $'F6.3,'/KWH'T53,F10.3,T79,       607
   : F11.0/T12,'MAINTENANCE MATERIAL'T53,F10.3,T79,F11.0/             608
   : T12,'LABOR @ $'F6.3,'/HR'T53,F10.3,T79,F11.0/                    609
   : T12,'DIESEL FUEL @ $'F6.3,'/GAL'T53,F10.3,T79,F11.0)             610
306 FORMAT(T12,'NATURAL GAS @ $'F6.4,'/CU FT'T53,F10.3,T79,F11.0/      611
   : T12,'CHEMICALS'T53,F10.3,T79,F11.0/                              612
   :   T53,'-----------'T80,'-----------'/T34,                        613
   : 'PROCESS O&M COST'F13.3,T79,F11.0/)                              614
307 FORMAT(T8,'COST SUMMARY'//                                        615
   : T12,'O&M'T52,F11.3,T79,F11.0/T12,'DEBT @'                        616
   : F5.1,' YRS AND'F5.1,' %'T52,F11.3,T79 ,F11.0/                    617
   :  T53,'-----------'T80,'-----------'/                             618
   :  T32,'PROCESS TOTAL COST'T52,F11.3,T79 ,F11.0)                   619
308 FORMAT(//' ***** TOTAL COST ESTIMATE FOR WATER TREATMENT PLANT'    620
   : ///T8,'CAPITAL COST'T55,'DOLLARS'//                              621
   : T12,'CONSTRUCTION'T52,F11.0/                                     622
   : T12,'SITEWORK,INTERFACE PIPING,ROADS @'F5.1,' %'T52,F11.0)       623
309 FORMAT(T12,'SUBSURFACE CONSIDERATIONS @'F5.1,' %'T52,F11.0)       624
310 FORMAT(T12,'STANDBY POWER @'F5.1,' %'T52,F11.0)                   625
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311 FORMAT(T53,'-----------'/T27,'TOTAL CONSTRUCTION COST'T52,F11.0//
   : T12,'GEN CONTRACTOR OVERHEAD & PROFIT @'F5.1,' %'T55,F8.0/
   : T53,'-----------'/T42,'SUBTOTAL'T52,F11.0//
   : T12,'ENGINEERING @'F5.1,' %'T52,F11.0/T53,'-----------'/
   : T42,'SUBTOTAL'T52,F11.0/)
312 FORMAT(T12,'LAND,'F7.2,' ACRES @ $'I6,'/ACRE'T52,F11.0)
313 FORMAT(T12,'LEGAL,FISCAL, & ADMINISTRATIVE'T52,F11.0/
   : T12,'INTEREST DURING CONSTRUCTION'T52,F11.0/
   : T53,'-----------'/T32,'TOTAL CAPITAL COST'T52,F11.0//)
314 FORMAT(T8,'O&M COST'T49,'CTS/1000 GAL TREATED'
   : T81,'DOLLARS/YR'//
   : T12,'ELECTRICAL ENERGY @ $'F6.3,'/KWH'T53,F10.3,T79,F11.0/
   : T12,'MAINTENANCE MATERIAL'T53,F10.3,T79,F11.0/
   : T12,'LABOR @ $'F6.3,'/HR'T53,F10.3,T79,F11.0/
   : T12,'DIESEL FUEL @ $'F6.3,'/GAL'T53,F10.3,T79,F11.0)
315 FORMAT(T12,'NATURAL GAS @ $'F6.4,'/CU FT'T53,F10.3,T79,F11.0/
   : T12,'CHEMICALS'T53,F10.3,T79,F11.0/
   : T53,'-----------'T80,'-----------'/T36,
   : 'TOTAL O&M COST'F13.3,T79,F11.0//)
316 FORMAT(T8,'COST SUMMARY'//
   : T12,'O&M'T52,F11.3,T79,F11.0/T12,'DEBT @'
   : F5.1,' YRS AND'F5.1,' %'T52,F11.3,T79,F11.0/
   : T53,'-----------'T80,'-----------'/
   : T40,'TOTAL COST'T52,F11.3,T79,F11.0)
317 FORMAT(//T44,'COST SUMMARY FOR 1 WATER TREATMENT PROCESS'//)
318 FORMAT(//T44,'COST SUMMARY FOR'I4,' WATER TREATMENT PROCESSES'//)
319 FORMAT(T17,'PROCESS'T42,'FLOW-MGD'T64,'PROCESS PARAMETER'
   : T94,'COSTS-DOLLARS'T114,'COSTS-CTS/1000 GAL'/
   : T40,'DESIGN ACTUAL'T61,'DESIGN'T76,'OPERATING'T92,'CONSTR'
   :,'    CAPITAL'T113,'O&M     DEBT   TOTAL'/)
320 FORMAT(1X,I2,1X,4A8,2F8.3,F11.1,1X,A6,F10.1,1X,A6,F10.0,F11.0,
   : 3F8.3)
321 FORMAT(T7,'$',F7.2,'/TON FOR ',3A8)
322 FORMAT(T87,'-----------------------------------------------'//
   : T82,'TOTAL'T88,F10.0,F11.0,3F8.3)
323 FORMAT(///1X,4A4,8A4/)
324 FORMAT(T11,'CAPITAL COST FACTORS'T58,'UNIT'
   :,' COST FACTORS'T105,'COST INDEXES'//T5,'ENGINEERING(%)'T34,'='
   : F8.2,T47,'ELECTRICITY, $/KWH'T80,'='F6.2,T91,'EXCAVATION'
   :,' (ENR SKILLED LABOR)='F7.1/T5,'SITEWORK,INTERFACE PIPING(%) ='
   : F8.2,T47,'LABOR, $/HR'T80,'='F6.2,T91,'MANUFACTURED EQUIP'
   :,' (BLS $114) ='F7.1)
325 FORMAT(T5,'SUBSURFACE CONSIDERATIONS(%) ='F8.2,T47,'DIESEL'
   :,' FUEL, $/GAL'T80,'='F6.3,T91,'CONCRETE (BLS $132)'T121,'='F7.1/
   : T5,'STANDBY POWER(%)'T34,'='F8.2,T47,'NATURAL GAS, $/CU FT'T80,
   : '='F6.4,T91,'STEEL (BLS $101.3)'T121,'='F7.1/T5,'INTEREST'
   :,' RATE(%)'T34,'='F8.2,T47,'BLDNG ENERGY USE,KWH/SQ FT/YR'T80,
   : '='F6.1,T91,'LABOR(ENR SKILLED LABOR)'T121,'='F7.1)
326 FORMAT(T5,'NUMBER OF YEARS'T34,'='F8.2,T91,'PIPES & VALVES'
   :,' (BLS $114.901) ='F7.1/T5,'LAND AREA, ACRES'T34,'='F8.2,T91,
   : 'ELECTRICAL & INSTR (BLS $117) ='F7.1/T5,'LAND COST, $/ACRE'
   : T34,'='F8.2,T91,'HOUSING (ENR BUILDING COST)'T121,'='F7.1/
   : T91,'PRODUCER PRICE INDEX'T121,'='F7.1)
327 FORMAT(T47,'ENR CONSTRUCTION COST INDEX, 1967 BASE YR (USED IN'
   : ' LIEU OF ABOVE INDEXES)'T121,'='F7.1)
328 FORMAT(T7,'$',F7.2,'/LB FOR ',3A8)
329 FORMAT(//T56,'SITEWORK,SUBSURFACE,STNBY POWER',T88,F10.0/T66,
   : 'GEN CON OH & P,',F5.1,'%',T88,F10.0/T76,'ENGINEERING',T88,F10.0/
   : T69,'LAND,',F7.2,' ACRES',T88,F10.0/
   : T69,'LEGAL,FISCAL,ADMIN',T88,F10.0/T70,'INT DURING CONSTR',
   : T88,F10.0/T87,'-----------'/T74,'TOTAL CAPITAL',T88,F10.0)
330 FORMAT(//' TOTAL O&M:',T21,'KWH',8X,'MATERIALS,$',9X,'LABOR,HR',
   : 9X,'DIESEL,GAL',9X,'NAT GAS,CU FT',9X,'CHEMICALS,$'/
   : T16,F11.0,5X,F10.0,8X,F9.0,9X,F10.0,9X,F13.0,10X,F10.0)
331 FORMAT(T7,'NUMBER OF UNITS =',I3)
332 FORMAT(T7,'EMPTY BED CONTACT TIME AT DESIGN FLOW =',F5.1,' MIN')
333 FORMAT(T7,'TDH =',F6.1,' FEET')
334 FORMAT(T7,'ONE WAY MILES =',F6.1)
335 FORMAT(T7,'MAKEUP LIME =',F6.1,' %')
336 FORMAT(T7,'LOADING RATE =',F5.1,' GPM/SQ FT')
337 FORMAT(T7,'SLUDGE CONCENTRATION =',F8.0,' MG/L')
338 FORMAT(' PROGRAM EXIT.  CHECK THE "COST.DAT" FILE',I6,' IS NOT'
   : ' A VALID COST FACTOR NUMBER.')
339 FORMAT(T7,'COSTS CALCULATED FOR',F7.2,' % OWNERSHIP OF REGIONAL'
   : ' FACILITY')
341 FORMAT(T7,'TOTAL VOL.='F8.0,' CU FT ('I4,' CONTACTORS)')
350 FORMAT(I8,T16,F11.0,5X,F10.0,8X,F9.0,9X,
   : F10.0,9X,F13.0,10X,F10.0)
351 FORMAT(/' PROCESS O&M')
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352 FORMAT(/' COSTS FOR THE FOLLOWING PROCESSES HAVE BEEN'                    705
   : ' EXTRAPOLATED.  VALID RANGES FOR INPUT DATA ARE:'//                    706
   : T17,'PROCESS',T43,'DESIGN RANGE',T69,'YOUR INPUT',T86,                  707
   : 'OPERATING RANGE',T114,'YOUR INPUT')                                    708
353 FORMAT(1X,I2,1X,4A8,F9.1,' TO',F11.1,1X,A6,F11.1,F13.1,' TO',            709
   : F11.1,1X,A6,F11.1)                                                      710
354 FORMAT(//' PROCESS O&M',T21,'KWH',8X,'MATERIALS,$',9X,'LABOR,HR',        711
   : 9X,'DIESEL,GAL',9X,'NAT GAS,CU FT',9X,'CHEMICALS,$')                    712
370 FORMAT(' FORTRAN READ ERROR IN CARD',I5,' OF THE PROCES.DAT FILE.'       713
   : ' THIS CARD SHOULD CONTAIN THE WORD "ACRES" FOLLOWED BY'/               714
   : ' A FLOATING POINT NUMBER OF 15 DIGITS OR LESS')                        715
371 FORMAT(' ERROR-CARD WITH "ACRES=" MISSING OR MISSPELLED.'/               716
   : ' CHECK CARD',I5,' OF THE PROCES.DAT FILE.')                            717
372 FORMAT(' FORTRAN READ ERROR IN CARD',I5,' OF THE PROCES.DAT'             718
   : ' FILE'/' THIS CARD SHOULD CONTAIN THE INTEGER "1" '                    719
   : 'FOLLOWED BY'/' A COMMA, THE PROCESS NUMBER AND THE PROCESS'            720
   : ' NAME')                                                                721
373 FORMAT(' ERROR-THIS SHOULD BE THE FIRST DATA CARD'/' OF A'               722
   : ' PROCESS AND SHOULD BEGIN WITH THE INTEGER "1" IN COLUMN 1'/           723
   : ' CHECK CARD',I5,' OF THE PROCES.DAT FILE')                             724
374 FORMAT(' ERROR IN CARD',I5,' OF THE PROCES,DAT FILE'/1X,I5,              725
   : ' IS AN INVALID PROCESS NUMBER.  PROCESSES'/' ARE NUMBERED'             726
   : ' 0 THRU 129 IN TABLE 2 OF THE PROGRAM MANUAL')                         727
375 FORMAT(' ERROR IN CARD',I5,' OF THE PROCES.DAT FILE'/' CARD'             728
   : ' NO.',I3,' WAS EXPECTED FOR PROCESS',I4,1X,4A8,', WHICH'               729
   : ' REQUIRES',I3,' CARDS OF DATA.')                                       730
376 FORMAT(' ERROR-NOT ENOUGH DATA IN THE COST.DAT FILE.'/                   731
   : ' THIS FILE SHOULD HAVE EITHER 28 OR 30 CARDS')                         732
    END                                                                      733
    SUBROUTINE DRANGE(Y1,Y2,X)                                               734
    DIMENSION C(4),B(4),NUMUN(150),VAR(22)                                   735
    COMMON NUMUN,N/A/TOP,BOTTOM,C,B,CI                                       736
    COMMON/C/ENGR,SITE,SUBSUR,STNBY,RATE,YEARS,CLAND,ELEC,                   737
   : HOURLY,FUEL,GASCST,ENFT,CI1,CI2,CI3,CI4,CI5,CI6,CI7,CI8,CI9,            738
   : CI10                                                                    739
    EQUIVALENCE (ENGR,VAR(1))                                                740
    IF(X.LE.0.0) GOTO 98                                                     741
    GOTO 99                                                                  742
 98 Y1=0.0                                                                   743
    Y2=0.0                                                                   744
    GOTO 130                                                                 745
 99 IF(X-TOP.GT.0.0) GOTO 100                                                746
    X1=BOTTOM                                                                747
    X2=2.*BOTTOM                                                             748
    GOTO 110                                                                 749
100 X1=TOP                                                                   750
    X2=(TOP+BOTTOM)/2.0                                                      751
110 C1=(C(1)+C(2)*X1+C(3)*X1**2+C(4)*X1**3)                                  752
    C2=(C(1)+C(2)*X2+C(3)*X2**2+C(4)*X2**3)                                  753
    B1= B(1)+B(2)*X1+B(3)*X1**2+B(4)*X1**3                                   754
    B2= B(1)+B(2)*X2+B(3)*X2**2+B(4)*X2**3                                   755
    ALX1=ALOG(X1)                                                            756
    ALX2=ALOG(X2)                                                            757
    DENOM=ALX2-ALX1                                                          758
    IF(C1.GT.0.0.AND.C2.GT.0.0) GOTO 115                                     759
    Y1=0.0                                                                   760
    GOTO 120                                                                 761
115 AC1=(ALOG(C1)*ALX2-ALOG(C2)*ALX1)/DENOM                                  762
    AC2=(ALOG(C2)-ALOG(C1))/DENOM                                            763
    Y1=EXP(AC1+AC2*ALOG(X))*NUMUN(N)*CI                                      764
120 IF(B1.GT.0.0.AND.B2.GT.0.0) GOTO 125                                     765
    Y2=0.0                                                                   766
    GOTO 130                                                                 767
125 AB1=(ALOG(B1)*ALX2-ALOG(B2)*ALX1)/DENOM                                  768
    AB2=(ALOG(B2)-ALOG(B1))/DENOM                                            769
    Y2=EXP(AB1+AB2*ALOG(X))*ELEC*ENFT/102.6                                  770
130 RETURN                                                                   771
    END                                                                      772
    SUBROUTINE ORANGE(Y1,Y2,Y3,Y4,Y5,X)                                      773
    REAL M,L                                                                 774
    DIMENSION E(4),M(4),L(4),D(4),G(4),NUMUN(150),VAR(22)                    775
    COMMON NUMUN,N/B/OTOP,OBOT,E,M,L,D,G,CR9                                 776
    COMMON/C/ENGR,SITE,SUBSUR,STNBY,RATE,YEARS,CLAND,ELEC,                   777
   : HOURLY,FUEL,GASCST,ENFT,CI1,CI2,CI3,CI4,CI5,CI6,CI7,CI8,CI9,            778
   : CI10                                                                    779
    EQUIVALENCE(ENGR,VAR(1))                                                 780
    F1(A1,A2)=(ALOG(A1)*ALX2-ALOG(A2)*ALX1)/DENOM                            781
    F2(A1,A2)=(ALOG(A2)-ALOG(A1))/DENOM                                      782
    IF(X.LE.0.0) GOTO 98                                                     783
    GOTO 99                                                                  784
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 98 Y1=0.0                                                              785
    Y2=0.0                                                              786
    Y3=0.0                                                              787
    Y4=0.0                                                              788
    Y5=0.0                                                              789
    GOTO 160                                                            790
 99 IF(X-OTOP.GT.0.0) GOTO 100                                          791
    X1=OBOT                                                             792
    X2=2.0*OBOT                                                         793
    GOTO 110                                                            794
100 X1=OTOP                                                             795
    X2=(OTOP+OBOT)/2.0                                                  796
110 X12=X1**2                                                           797
    X13=X1**3                                                           798
    X22=X2**2                                                           799
    X23=X2**3                                                           800
    E1=E(1)+E(2)*X1+E(3)*X12+E(4)*X13                                   801
    E2=E(1)+E(2)*X2+E(3)*X22+E(4)*X23                                   802
    ALX2=ALOG(X2)                                                       803
    ALX1=ALOG(X1)                                                       804
    DENOM=ALX2-ALX1                                                     805
    IF(E1.GT.0.0.AND.E2.GT.0.0) GOTO 115                                806
    Y1=0.0                                                              807
    GOTO 120                                                            808
115 AE1=F1(E1,E2)                                                       809
    AE2=F2(E1,E2)                                                       810
    Y1=EXP(AE1+AE2*ALOG(X))*ELEC*NUMUN(N)                               811
120 TM1=M(1)+M(2)*X1+M(3)*X12+M(4)*X13                                  812
    TM2=M(1)+M(2)*X2+M(3)*X22+M(4)*X23                                  813
    IF(TM1.GT.0.0.AND.TM2.GT.0.0) GOTO 125                              814
    Y2=0.0                                                              815
    GOTO 130                                                            816
125 AM1=F1(TM1,TM2)                                                     817
    AM2=F2(TM1,TM2)                                                     818
    Y2=EXP(AM1+AM2*ALOG(X))*CR9*NUMUN(N)                                819
130 TL1=L(1)+L(2)*X1+L(3)*X12+L(4)*X13                                  820
    TL2=L(1)+L(2)*X2+L(3)*X22+L(4)*X23                                  821
    IF(TL1.GT.0.0.AND.TL2.GT.0.0) GOTO 135                              822
    Y3=0.0                                                              823
    GOTO 140                                                            824
135 AL1=F1(TL1,TL2)                                                     825
    AL2=F2(TL1,TL2)                                                     826
    Y3=EXP(AL1+AL2*ALOG(X))*HOURLY*NUMUN(N)                             827
140 D1=D(1)+D(2)*X1+D(3)*X12+D(4)*X13                                   828
    D2=D(1)+D(2)*X2+D(3)*X22+D(4)*X23                                   829
    IF(D1.GT.0.0.AND.D2.GT.0.0) GOTO 145                                830
    Y4=0.0                                                              831
    GOTO 150                                                            832
145 AD1=F1(D1,D2)                                                       833
    AD2=F2(D1,D2)                                                       834
    Y4=EXP(AD1+AD2*ALOG(X))*FUEL*NUMUN(N)                               835
150 G1=G(1)+G(2)*X1+G(3)*X12+G(4)*X13                                   836
    G2=G(1)+G(2)*X2+G(3)*X22+G(4)*X23                                   837
    IF(G1.GT.0.0.AND.G2.GT.0.0) GOTO 155                                838
    Y5=0.0                                                              839
    GOTO 160                                                            840
155 AG1=F1(G1,G2)                                                       841
    AG2=F2(G1,G2)                                                       842
    Y5=EXP(AG1+AG2*ALOG(X))*GASCST*NUMUN(N)                             843
160 RETURN                                                              844
    END                                                                 845
```

SECTION 9

CRV.DAT FILE

The CRV.DAT file contains all the cost information for the water treatment processes. The WATER program reads this file in a random or direct access mode. Each line of data contains 80 characters, so that if a record length of 80 is established on the system, the location of the first line of data of any process is given by:

$$(NP-1) \times 5 + 1$$

where NP is the number of the process shown in Table 4. For example, data for process 21, RAPID MIX, G=300, begins at line (21-1) x 5 + 1 = 101 and continues through line 105. If the CRV.DAT is not established on the computing system as a random or direct access formatted file, the WATER program will have to be modified accordingly.

A copy of the CRV.DAT file is given on the following pages. The file is 655 lines long and contains 52,400 characters. Some systems may include a carraige return and line feed at the end of each line of data. In this case, the file will contain 82 characters per line and a total of 53,710. characters.

CRV.DAT FILE

```
CL2 FEED-CYLINDER STORAGE          LB/DAYLB/DAY 1.00E+01 1.00E+04 1.00E+00   1  101
  1.20E+04  9.43E+01 -1.44E-02  8.69E-07  5.45E+02  9.98E-01  7.14E-04 -5.05E-08
  1.53E+03  2.39E+00 -4.38E-04  2.68E-08  4.01E+02  7.93E-01 -5.59E-05  2.66E-09
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  8.19E+03  1.13E+02 -1.22E-02  8.03E-07 0.00 0.50 0.00 0.00 0.06 0.04 0.06 0.34
CL2 FEED-ON SITE STORAGE TANK      LB/DAYLB/DAY 2.00E+03 1.00E+04 1.00E+00   1  101
  1.83E+05 -7.18E-01  1.97E-03 -7.97E-08  9.13E+02  1.84E-01  1.22E-04 -6.32E-09
  4.15E+03  2.14E-01  3.55E-05 -1.61E-09  6.35E+02  1.92E-01 -2.55E-05  1.14E-09
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
 -2.63E+02  3.23E+00 -3.15E-04  9.92E-09 0.00 0.81 0.00 0.02 0.08 0.03 0.05 0.01
CL2 FEED FROM RAIL CAR             LB/DAYLB/DAY 2.00E+03 1.00E+04 1.00E+00   1  101
  1.52E+05  2.44E+00  3.75E-04  1.94E-08  9.13E+02  1.84E-01  1.22E-04 -6.32E-09
  4.15E+03  2.14E-01  3.55E-05 -1.61E-09  6.96E+03  3.80E-01 -4.92E-05  2.12E-09
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
 -2.63E+02  3.23E+00 -3.15E-04  9.92E-09 0.00 0.82 0.00 0.00 0.06 0.04 0.06 0.02
CHLORINE DIOXIDE GENERATING,FEEDLB/DAYLB/DAY 1.00E+01 3.50E+03 1.00E+00  17-1201
  2.74E+04  2.55E+02 -7.17E-02  8.09E-06  2.94E+03  6.31E+00  2.61E-04 -8.13E-08
  1.47E+03  5.30E+00 -1.70E-03  1.89E-07  5.88E+02  1.85E+00 -3.19E-04  2.99E-08
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  1.28E+04  6.80E+01 -2.20E-02  2.72E-06 0.00 0.41 0.00 0.00 0.32 0.02 0.03 0.22
OZONE GENERATION SYSTEMS           LB/DAYLB/DAY 1.00E+01 3.50E+03 1.00E+00   1    1
  4.12E+04  1.78E+03 -7.83E-01  1.31E-04  1.75E+04  3.33E+03 -6.98E-01  1.55E-04
  1.26E+03  1.83E+01 -6.29E-03  9.52E-07  4.74E+02  1.06E+00 -1.37E-05 -2.61E-08
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  6.71E+03  1.60E+01  1.06E-02 -1.58E-06 0.00 0.79 0.00 0.00 0.17 0.00 0.00 0.04
OZONE CONTACT CHAMBER              CU FT CU FT  4.60E+02 9.20E+04 1.00E+00   1    1
  4.06E+03  4.93E+00 -1.04E-04  8.00E-10  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.06 0.00 0.19 0.32 0.43 0.00 0.00 0.00
ON-SITE HYPOCHLORITE GENERATION LB/DAYLB/DAY 1.00E+01 1.00E+04 1.00E+00  35-1101
  1.58E+04  3.58E+02 -5.97E-02  3.37E-06 -4.90E+01  9.16E+02 -4.97E-03  3.67E-07
  9.23E+02  1.06E+01 -9.70E-04  6.49E-08  3.76E+02  8.98E-01 -1.21E-04  6.59E-09
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  4.85E+03  8.09E+01 -1.50E-02  8.54E-07 0.00 0.60 0.00 0.00 0.21 0.00 0.06 0.13
ALUM FEED-LIQUID STOCK             LB/HR LB/HR  5.40E+00 5.40E+03 1.00E+00  24  101
  1.91E+04  1.14E+02 -3.86E-02  5.16E-06  3.24E+03  4.26E+00  1.80E-05  5.24E-07
  7.38E+01  6.30E-02  4.15E-06 -1.17E-09  6.15E+01  6.92E-03  9.17E-06 -3.44E-10
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  5.43E+03  8.22E+01 -3.30E-02  3.32E-06 0.00 0.42 0.00 0.00 0.08 0.03 0.12 0.35
ALUM FEED-DRY STOCK                LB/HR LB/HR  1.00E+01 5.00E+03 1.00E+00  24  101
  2.09E+04  1.40E+02 -4.64E-02  7.40E-06  4.84E+03  2.28E+00 -7.93E-04  1.07E-07
  1.99E+02  1.30E-01  4.46E-06  3.40E-09  2.68E+02  8.11E-01  2.87E-05 -4.02E-09
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  5.67E+03  9.81E+01 -3.57E-02  5.87E-06 0.00 0.40 0.00 0.00 0.03 0.07 0.06 0.44
POLYMER FEED SYSTEMS               LB/DAYLB/DAY 1.00E+00 2.00E+02 1.00E+00   1  110
  2.00E+04  1.73E+01  3.38E-01 -9.09E-04  1.73E+04  3.37E-03  1.05E-05  6.28E-08
  2.59E+02  1.72E+00 -2.04E-02  8.58E-05  1.96E+02  3.33E-01 -2.16E-03  7.20E-06
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  7.99E+03  2.26E+01 -1.49E-01  4.68E-04 0.00 0.69 0.00 0.00 0.04 0.01 0.07 0.19
LIME FEED-NO RECALCINATION         LB/HR LB/HR  1.00E+01 1.00E+03 1.00E+00  24  101
  4.37E+04  2.84E+02 -4.56E-01  2.44E-04  3.25E+03  9.61E+00 -1.47E-02  7.94E-06
  7.02E+02  2.52E+00 -4.47E-03  2.64E-06  5.20E+02  5.53E+00 -9.68E-03  5.68E-06
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  2.22E+04  1.67E+01  6.71E-02 -4.20E-05 0.00 0.53 0.00 0.00 0.02 0.13 0.07 0.49
LIME FEED-WITH RECALCINATION       LB/HR LB/HR  1.00E+03 1.00E+04 1.00E+00  24  108
  5.98E+04  2.30E+01 -3.54E-03  2.12E-07  1.35E+03  4.00E+00 -4.51E-04  3.34E-08
  1.35E+03 -2.61E-03  1.30E-05 -7.11E-10  6.99E+02  1.47E+00 -1.76E-04  8.88E-09
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  1.63E+04  7.24E+00 -3.31E-04  8.73E-09 0.00 0.67 0.00 0.00 0.02 0.05 0.10 0.16
POTASSIUM PERMANGANATE FEED        LB/DAYLB/DAY 1.00E+00 5.00E+02 1.00E+00   1  101
  9.63E+03  2.41E+01 -4.69E-02  4.13E-05  3.08E+03  2.00E+00  1.56E-02 -1.17E-05
  7.24E+01  3.48E-01 -6.92E-04  6.97E-07  2.06E+02  2.57E+00 -9.02E-03  1.03E-05
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  1.45E+03  1.61E+01 -4.65E-02  5.69E-05 0.00 0.33 0.00 0.00 0.06 0.10 0.33 0.18
SULFURIC ACID FEED SYSTEMS         GPD   GPD    1.00E+01 5.00E+03 1.00E+00 153-1101
  8.60E+03  2.26E+01 -5.78E-03  7.24E-07  1.60E+03 -1.53E-01  2.54E-04 -3.15E-08
  6.48E+01  4.90E-02 -1.46E-05  1.57E-09  7.88E+01  1.60E-01 -3.34E-05  4.67E-09
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  2.88E+03 -9.94E-01  3.52E-04 -3.79E-08 0.00 0.46 0.00 0.00 0.11 0.11 0.22 0.10
SODIUM HYDROXIDE FEED SYSTEMS      LB/DAYLB/DAY 1.00E+01 1.00E+04 1.00E+00   1  101
  1.44E+04  7.94E+00 -4.89E-04  4.34E-08  3.20E+03  8.66E-01 -3.39E-05 -2.79E-10
  1.39E+02  2.86E-02  2.28E-06 -1.33E-10  1.20E+02  1.59E-02 -3.08E-06  3.03E-10
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  1.06E+03  1.47E+01 -2.03E-03  1.39E-07 0.00 0.39 0.00 0.00 0.05 0.05 0.18 0.33
FERROUS SULFATE FEED SYSTEMS       LB/HR LB/HR  1.07E+01 5.35E+03 1.00E+00  24  101
  1.96E+04  1.20E+02 -3.21E-02  4.61E-06  4.70E+03  2.09E+00 -5.59E-04  6.54E-08
  1.85E+02  1.26E-01 -1.86E-05  6.45E-09  2.67E+02  7.95E-01 -4.06E-05  8.10E-09
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  5.71E+03  8.93E+01 -2.89E-02  4.44E-06 0.00 0.38 0.00 0.00 0.03 0.06 0.06 0.47
```

```
FERRIC SULFATE FEED SYSTEMS      LB/HR LB/HR  1.33E+01 6.60E+03 1.00E+00  24  101
  1.95E+04  9.79E+01 -2.26E-02  2.68E-06  4.79E+03  1.57E+00 -2.19E-04  1.46E-08
  1.88E+02  4.81E-02  3.59E-05 -2.62E-09  2.72E+02  5.38E-01  7.17E-05 -8.18E-09
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  5.80E+03  6.71E+01 -1.41E-02  1.76E-06 0.00 0.38 0.00 0.00 0.03 0.06 0.06 0.47
ANHYDROUS AMMONIA FEED FACILITY  LB/DAYLB/DAY 2.50E+02 5.00E+03 1.00E+00   1  101
  1.85E+04  5.70E+01 -1.68E-02  1.89E-06 -9.13E+01  3.41E+00  3.13E-03 -4.49E-07
  2.27E+03  2.48E+00 -6.03E-04  6.59E-08  4.57E+02  2.27E-01 -5.25E-05  5.71E-09
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  9.44E+03  2.53E+00 -1.05E-03  1.46E-07 0.00 0.55 0.00 0.00 0.15 0.10 0.11 0.09
AQUA AMMONIA FEED FACILITY       LB/DAYLB/DAY 2.50E+02 5.00E+03 1.00E+00  34-1101
  8.94E+03  1.58E+01 -3.50E-03  3.58E-07  5.70E+02  4.73E-07 -2.01E-10  1.69E-14
  3.99E+01  2.52E-01 -5.49E-05  5.43E-09  1.52E+02  1.26E-07 -5.51E-11  4.55E-15
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.71 0.00 0.00 0.06 0.05 0.18 0.00
POWDERED ACTIVATED CARBON FEED   LB/HR LB/HR  3.50E+00 7.00E+03 1.00E+00  24  101
  7.01E+04  3.07E+02 -6.09E-02  5.35E-06  7.94E+03  1.36E+03 -3.62E-01  3.10E-05
  2.36E+03  2.00E+01 -3.67E-03  3.07E-07  9.29E+02  2.04E+00 -3.98E-04  4.50E-08
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  1.03E+04  7.39E-06 -4.71E-09  3.94E-13 0.01 0.44 0.02 0.04 0.05 0.15 0.24 0.05
RAPID MIX, G=300                 CU FT CU FT  1.00E+02 2.00E+04 1.00E+00   1    1
  1.38E+04  7.45E+00  2.16E-04 -4.63E-09 -9.19E-04  5.09E+01 -7.63E-10  1.48E-13
  2.05E+01  1.45E-02 -4.44E-07  2.21E-11  4.54E+02 -6.88E-03  9.09E-06 -2.95E-10
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.03 0.31 0.07 0.11 0.18 0.00 0.30 0.00
RAPID MIX, G=600                 CU FT CU FT  1.00E+02 2.00E+04 1.00E+00   1    1
  1.41E+04  1.05E+01  1.15E-04 -9.31E-10  1.50E+01  1.02E+02  1.23E-05 -1.90E-10
  2.05E+01  1.45E-02 -4.44E-07  2.21E-11  4.54E+02 -6.88E-03  9.09E-06 -2.95E-10
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.02 0.40 0.06 0.09 0.17 0.00 0.26 0.00
RAPID MIX, G=900                 CU FT CU FT  1.00E+02 2.00E+04 1.00E+00   1    1
  1.41E+04  1.99E+01  2.46E-05  1.90E-09 -7.51E+01  3.40E+02 -7.42E-05  2.91E-09
  2.05E+01  1.45E-02 -4.44E-07  2.21E-11  4.54E+02 -6.88E-03  9.09E-06 -2.95E-10
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.01 0.60 0.04 0.06 0.12 0.00 0.17 0.00
FLOCCULATION-HORIZ PADDLE, G=20  CU FT CU FT  1.80E+03 1.00E+06 1.00E+00   1    1
  3.40E+04  3.41E+00 -4.93E-06  3.32E-12 -2.55E+01  1.98E-01 -8.37E-09  8.71E-15
  3.66E+02  3.70E-02 -2.61E-08  1.77E-14  1.30E+02  2.68E-03 -5.51E-09  3.76E-15
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.04 0.24 0.12 0.17 0.25 0.00 0.18 0.00
FLOCCULATION-HORIZ PADDLE, G=50  CU FT CU FT  1.80E+03 1.00E+06 1.00E+00   1    1
  3.29E+04  3.80E+00 -5.18E-06  3.51E-12 -7.31E+01  1.19E+00 -1.71E-08  1.57E-14
  3.66E+02  3.70E-02 -2.61E-08  1.77E-14  1.30E+02  2.68E-03 -5.51E-09  3.76E-15
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.04 0.27 0.10 0.17 0.26 0.00 0.16 0.00
FLOCCULATION-HORIZ PADDLE, G=80  CU FT CU FT  1.80E+03 5.00E+05 1.00E+00   1    1
  2.82E+04  5.56E+00 -1.69E-05  2.25E-11  4.58E+01  3.36E+00  6.58E-09 -3.07E-14
  3.66E+02  3.70E-02 -2.61E-08  1.77E-14  1.30E+02  2.68E-03 -5.51E-09  3.76E-15
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.02 0.34 0.08 0.13 0.24 0.00 0.19 0.00
FLOCCULATION-VERT TURBINE, G=20  CU FT CU FT  1.80E+03 2.50E+04 1.00E+00   1    1
  1.11E+04  1.17E+01 -3.61E-04  4.46E-09 -2.55E+01  1.98E-01 -8.37E-09  8.71E-15
  3.66E+02  3.70E-02 -2.61E-08  1.77E-14  1.30E+02  2.68E-03 -5.51E-09  3.76E-15
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.02 0.27 0.07 0.12 0.27 0.00 0.26 0.00
FLOCCULATION-VERT TURBINE, G=50  CU FT CU FT  1.80E+03 2.50E+04 1.00E+00   1    1
  1.11E+04  1.17E+01 -3.61E-04  4.46E-09 -7.31E+01  1.19E+00 -1.71E-08  1.57E-14
  3.66E+02  3.70E-02 -2.61E-08  1.77E-14  1.30E+02  2.68E-03 -5.51E-09  3.76E-15
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.03 0.18 0.09 0.14 0.25 0.00 0.32 0.00
FLOCCULATION-VERT TURBINE, G=80  CU FT CU FT  1.80E+03 2.50E+04 1.00E+00   1    1
  1.04E+04  1.22E+01 -4.31E-04  6.92E-09  4.21E+01  3.37E+00 -2.54E-08  2.87E-14
  3.66E+02  3.70E-02 -2.61E-08  1.77E-14  1.30E+02  2.68E-03 -5.51E-09  3.76E-15
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.03 0.23 0.09 0.15 0.29 0.00 0.22 0.00
CIRCULAR CLARIFIER-LIME SLUDGE   SQ FT SQ FT  7.07E+02 3.14E+04 1.00E+00   1    3
  5.83E+04  3.63E+01 -4.99E-04  6.35E-09  4.64E+03  4.18E-01 -2.09E-06 -4.35E-11
  1.01E+02  2.14E-01 -6.35E-06  1.14E-10  1.35E+02  2.24E-02 -6.61E-07  1.01E-11
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.02 0.31 0.08 0.37 0.14 0.05 0.03 0.00
CIRC CLARIFIER-FECL3 & ALUM SLDGSQ FT SQ FT  7.07E+02 3.14E+04 1.00E+00   1    3
  5.83E+04  3.63E+01 -4.99E-04  6.35E-09  3.09E+03  3.79E-01 -9.65E-06  1.84E-10
  1.01E+02  2.14E-01 -6.35E-06  1.14E-10  1.35E+02  2.24E-02 -6.61E-07  1.01E-11
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.02 0.31 0.08 0.37 0.14 0.05 0.03 0.00
RECTANGULAR CLARIFIER-LIME SLDG  SQ FT SQ FT  2.40E+02 4.80E+03 1.00E+00   1    3
  2.38E+04  6.43E+01 -6.31E-03  7.38E-07  3.04E+03  9.62E-01  1.40E-04  1.40E-08
  2.53E+02  1.32E-01 -2.13E-06  3.64E-09  1.49E+02  8.61E-02 -4.09E-06  3.63E-10
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.04 0.27 0.10 0.25 0.21 0.11 0.02 0.00
RECT CLARIFIER-FECL3 & ALUM SLG  SQ FT SQ FT  2.40E+02 4.80E+03 1.00E+00   1    3
  2.38E+04  6.43E+01 -6.31E-03  7.38E-07  3.08E+03  8.15E-01 -4.68E-05  2.35E-08
  2.53E+02  1.32E-01 -2.13E-06  3.64E-09  1.49E+02  8.61E-02 -4.09E-06  3.63E-10
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.04 0.27 0.10 0.25 0.21 0.11 0.02 0.00
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UPFLOW SOLIDS CONTACT CLAR,G=70 SQ FT SQ FT  2.55E+02 1.45E+04 1.00E+00   1    3
  6.59E+04  5.44E+01 -2.29E-03  2.52E-08  5.92E+03  8.73E+00 -2.79E-04  1.82E-08
  5.04E+02  2.71E-01 -1.57E-05  3.90E-10  4.23E+02  7.33E-02 -7.32E-06  2.47E-10
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.04 0.53 0.07 0.10 0.25 0.00 0.01 0.00
UPFLOW SOLIDS CONTACT CLAR,G=110SQ FT SQ FT  2.55E+02 1.45E+04 1.00E+00   1    3
  6.59E+04  5.44E+01 -2.29E-03  2.52E-08  2.82E+03  2.09E+01 -1.32E-03  8.80E-08
  5.04E+02  2.71E-01 -1.57E-05  3.90E-10  4.23E+02  7.33E-02 -7.32E-06  2.47E-10
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.04 0.53 0.07 0.10 0.25 0.00 0.01 0.00
UPFLOW SOLIDS CONTACT CLAR,G=150SQ FT SQ FT  2.55E+02 1.45E+04 1.00E+00   1    3
  6.59E+04  5.44E+01 -2.29E-03  2.52E-08  7.68E+03  2.22E+01  2.14E-03 -1.15E-07
  5.04E+02  2.71E-01 -1.57E-05  3.90E-10  4.23E+02  7.33E-02 -7.32E-06  2.47E-10
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.04 0.53 0.07 0.10 0.25 0.00 0.01 0.00
TUBE SETTLING MODULES         SQ FT SQ FT  2.80E+02 5.60E+04 1.00E+00   1    1
  2.86E+03  2.55E+01 -2.00E-04  1.91E-09  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.50 0.00 0.33 0.17 0.00 0.00 0.00
GRAVITY FILTRATION STRUCTURE  SQ FT SQ FT  1.40E+02 2.80E+04 1.00E+00   1    1
  1.16E+05  3.92E+02 -2.04E-02  4.82E-07  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  4.31E+02  2.78E+00 -1.37E-04  3.03E-09  8.46E+02  8.04E-01 -3.28E-05  9.39E-10
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  1.72E+04  1.93E+02 -4.11E-03  8.71E-08 0.01 0.16 0.07 0.05 0.24 0.24 0.07 0.16
FILTRATION MEDIA-RAPID SAND   SQ FT SQ FT  3.70E+02 7.48E+04 1.00E+00   1    1
  3.80E+03  7.99E+00 -3.52E-05  3.78E-10  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
FILTRATION MEDIA-DUAL MEDIA   SQ FT SQ FT  1.40E+02 2.99E+04 1.00E+00   1    1
  2.82E+03  2.03E+01 -7.01E-04  1.68E-08  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
FILTRATION MEDIA-MIXED MEDIA  SQ FT SQ FT  1.40E+02 2.99E+04 1.00E+00   1    1
  4.68E+03  2.91E+01 -6.82E-04  1.63E-08  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
BACKWASH PUMPING FACILITIES   GPM   SQ FT  1.26E+03 2.30E+04 1.22E+00   1    1
  2.98E+04  1.05E+01 -1.29E-04  5.53E-10 -5.92E-01  2.39E+01 -2.50E-06  1.74E-10
  6.23E+02  6.64E-01 -4.19E-05  8.85E-10  1.93E+02  2.47E-02 -1.32E-06  2.36E-11
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.49 0.00 0.00 0.06 0.23 0.22 0.00
HYDRAULIC SURFACE WASH SYSTEMS SQ FT SQ FT  1.40E+02 2.80E+04 1.00E+00   1    1
  2.60E+04  2.91E+01 -1.05E-03  3.21E-08  3.41E+02  1.40E+01 -5.15E-05  2.16E-09
  2.08E+02  4.85E-02 -2.86E-06  5.82E-11  7.03E+01  6.70E-02 -5.02E-06  1.28E-10
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.52 0.00 0.00 0.08 0.10 0.30 0.00
AIR-WATER BACKWASH FACILITIES SQ FT SQ FT  1.40E+02 2.80E+04 1.00E+00   1    1
  7.04E+04  4.24E+01 -2.34E-03  5.58E-08  7.00E+00  2.42E+01  1.39E-06  6.57E-11
  6.23E+02  6.64E-01 -4.19E-05  8.85E-10  1.94E+02  2.58E-02 -1.46E-06  2.72E-11
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.41 0.00 0.00 0.09 0.39 0.11 0.00
WASH WATER SURGE BASINS       GAL   GAL    1.00E+04 5.00E+05 1.00E+00   1    1
  1.88E+04  3.33E+00 -1.04E-05  1.11E-11  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.01 0.00 0.30 0.18 0.44 0.05 0.00 0.02
FILTER MOD-RAP SAND TO HIGH RATESQ FT SQ FT  1.40E+02 2.80E+04 1.00E+00   1    1
  2.05E+04  3.28E+01 -1.41E-03  3.21E-08  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.00 0.00 0.00 0.38 0.45 0.17 0.00
CONTINUOUS AUTO. BACKWASH FILTERSQ FT SQ FT  3.60E+02 7.04E+04 1.00E+00   1    1
  1.54E+05  1.76E+02  1.77E-03 -1.75E-08  7.32E+02  8.33E+00  1.80E-04 -1.79E-09
  5.09E+02  5.35E-01  1.62E-06 -2.49E-11  7.00E+02  6.51E-02  8.76E-06 -8.79E-11
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  5.67E+04  1.53E+02  3.50E-03 -3.29E-08 0.01 0.50 0.07 0.03 0.15 0.03 0.02 0.19
RECARBONATION BASIN           CU FT CU FT  7.70E+02 3.52E+04 1.00E+00   1    3
  5.42E+03  3.95E+00 -1.28E-04  2.41E-09  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.07 0.00 0.20 0.32 0.39 0.02 0.00 0.00
RECARBONATION-LIQUID CO2 FEED LB/DAYLB/DAY 3.80E+02 1.50E+04 1.00E+00   1  101
  3.96E+04  2.01E+01 -1.41E-03  7.69E-08 -7.16E+01  1.90E+01 -3.18E-04  1.53E-08
  2.48E+03  1.19E+00 -9.17E-05  3.06E-09  7.14E+01  2.52E-02 -1.45E-06  4.43E-11
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  9.83E+03  1.34E+00 -1.22E-04  5.38E-09 0.00 0.59 0.00 0.00 0.21 0.09 0.00 0.11
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CRV.DAT FILE (CONTINUED)

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RECARB-CO2 FROM SUBMERGED BURNERLB/DAYLB/DAY 5.00E+02 1.00E+04 1.00E+00   1    3
  5.05E+04  6.33E+00  1.58E-04 -2.34E-08  1.71E+04  7.14E+01 -8.45E-03  4.76E-07
  1.36E+03  4.31E-01 -6.59E-05  3.57E-09  8.00E+01 -6.73E-09  4.09E-12  6.88E-16
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  8.65E+03  3.14E+03  5.61E-03 -4.81E-07
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.56 0.00 0.00 0.20 0.17 0.07 0.00
RECARBONATION-CO2 FROM STACK GASLB/DAYLB/DAY 2.50E+03 5.00E+04 1.00E+00   1    1
  8.84E+03  1.13E+01 -3.89E-04  4.68E-09 -1.05E+02  1.74E+01 -5.38E-06  8.69E-11
  1.28E+03  3.09E-01 -7.47E-06  7.90E-11  3.17E+01  2.88E-02 -6.18E-07  6.60E-12
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.42 0.00 0.00 0.27 0.15 0.16 0.00
MULTIPLE HEARTH RECALCINATION   SQ FT SQ FT  1.79E+02 2.93E+03 1.00E+00   1    3
  4.89E+05  2.27E+03 -8.47E-01  1.28E-04  1.75E+05  9.27E+02 -4.21E-01  1.35E-04
  3.26E+03  1.67E+01 -4.01E-03  8.45E-07  1.10E+03  1.13E+01 -3.23E-03  5.39E-07
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  1.76E+07  4.88E+04  2.44E+01 -2.17E-03
  1.78E+03  3.08E+01 -1.45E-02  2.47E-06 0.00 0.63 0.00 0.00 0.27 0.01 0.01 0.08
CONTACT BASIN-DIRECT FILTRATION CU FT CU FT  2.64E+03 5.28E+04 1.00E+00   1    3
  1.06E+04  3.83E+00 -7.18E-05  7.16E-10  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.07 0.00 0.20 0.34 0.39 0.00 0.00 0.00
PRESSURE DIATOMITE FILTERS      MGD   MGD    1.00E+00 2.00E+02 1.00E+00   1  302
  2.03E+05  7.27E+04  1.09E+02 -4.53E-01 -1.63E+03  1.27E+05 -2.42E+02  9.40E-01
  1.10E+03  3.91E+02 -6.72E-01  1.58E-03  2.39E+03  6.09E+02 -5.47E+00  1.64E-02
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  1.42E+05  1.66E+04 -1.84E+01  6.76E-02 0.01 0.62 0.01 0.01 0.15 0.04 0.07 0.09
VACUUM DIATOMITE FILTERS        MGD   MGD    1.00E+00 2.00E+02 1.00E+00   1  302
  4.83E+04  1.01E+05 -5.06E+01  2.09E-01  7.54E+03  5.64E+04  1.80E+01 -6.34E-02
  2.95E+02  4.49E+02 -5.04E-01  2.96E-07  2.39E+03  6.09E+02 -5.47E+00  1.64E-02
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  1.52E+04  6.17E+04 -1.06E+02  3.75E-01 0.01 0.32 0.01 0.01 0.22 0.22 0.05 0.16
PRESSURE FILTRATION PLANTS      SQ FT SQ FT  1.40E+02 2.80E+04 1.00E+00   1    1
  2.23E+05  2.01E+02  2.57E-02 -6.69E-07  2.90E+03  2.34E+02  2.36E-04 -5.36E-09
  5.17E+02  4.94E+00 -1.89E-04  4.09E-09  1.25E+03  1.37E+00 -6.16E-05  1.32E-09
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  2.01E+05  2.11E+01  9.00E-03 -2.26E-07 0.01 0.45 0.01 0.01 0.07 0.25 0.12 0.08
IN-PLANT PUMPING                MGD   MGD    1.00E+00 2.00E+02 1.00E+00   1    5
  2.23E+04  5.47E+03 -1.53E+01  6.48E-02  1.41E+02  5.24E+04  1.64E+00 -4.59E-03
  2.13E+02  1.32E+02  4.54E-01 -2.49E-03  5.09E+02  2.20E+01 -1.90E-02  1.24E-04
  3.50E+01  7.50E+01  5.68E-08  4.00E-10  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  2.23E+04  5.47E+03 -1.53E+01  6.48E-02 0.01 0.22 0.02 0.03 0.28 0.27 0.11 0.06
WASH WATER STORAGE TANKS        GAL   GAL    2.10E+04 9.00E+05 1.00E+00   1    1
  2.12E+03  3.89E-01 -3.82E-07  2.98E-13  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.02 0.00 0.01 0.43 0.54 0.00 0.00 0.00
REVERSE OSMOSIS                 MGD   MGD    1.00E+00 2.00E+02 1.00E+00   1  302
  2.46E+05  5.32E+05 -1.50E+03  4.28E+00  2.24E+05  2.19E+06  3.69E+02 -1.27E+00
  2.26E+04  6.85E+04 -7.22E+01  2.46E-01  1.81E+03  9.13E+01 -6.70E-01  2.30E-03
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  2.17E+04  8.33E+04 -1.09E+02  3.49E-01 0.00 0.61 0.00 0.00 0.12 0.00 0.15 0.12
PRESSURE ION EXCHANGE-SOFTENING MGD   MGD    1.10E+00 1.23E+02 1.00E+00 490 1101
  4.95E+04  8.59E+04  2.76E+02 -2.03E+00 -1.15E+00  2.06E+03 -7.18E-02  5.50E-04
  2.38E+02  4.33E+03  1.26E-02 -3.83E-03  2.11E+03  1.28E+02 -8.58E-01  4.75E-03
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  2.59E+04  2.78E+04  1.88E+02 -1.63E+00 0.01 0.52 0.01 0.01 0.01 0.16 0.16 0.12
GRAVITY ION EXCHANGE-SOFTENING  MGD   MGD    1.50E+00 1.50E+02 1.00E+00 490 1101
  1.17E+05  6.81E+04 -2.15E+02  7.80E-01 -1.53E+00  9.81E+02  4.15E-02 -3.23E-04
  1.08E+03  3.93E+03 -2.31E+00  8.75E-03  2.11E+03  1.08E+02 -1.96E-01  1.07E-03
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  1.69E+04  1.82E+04 -4.30E+01  1.16E-01 0.01 0.59 0.04 0.03 0.09 0.10 0.06 0.08
PRESSURE ION EXCHANG-NO3 REMOVALMGD   MGD    1.10E+00 1.23E+01 1.00E+00 121 2101
  2.04E+05  2.28E+04  3.35E+04 -1.72E+03 -8.31E-01  1.73E+03 -2.09E+00  1.28E-01
  2.43E+03  2.08E+04  5.64E+02 -3.15E+01  2.06E+03  1.05E+02  1.00E+01 -7.74E-01
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  2.48E+04  2.82E+04  1.70E+02 -4.61E+01 0.01 0.68 0.01 0.01 0.11 0.06 0.06 0.06
ACTIV. ALUMINA-FLUORIDE REMOVAL MGD   MGD    7.00E-01 1.35E+02 1.00E+00   1  202
  4.46E+04  5.97E+04  1.94E+02 -1.05E+00  9.29E+00  6.22E-01 -7.15E-03  4.36E-05
  6.16E+02  1.60E+03  1.98E+01 -1.14E-01  2.41E+03  6.26E+01  7.21E-01 -2.60E-03
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  3.35E+03  2.09E+04 -8.13E-01 -2.39E-01 0.00 0.52 0.00 0.00 0.12 0.16 0.05 0.15
GRAVITY GAC CONTACTORS-CONCRETE CU FT SQ FT  3.50E+02 1.06E+04 1.40E+02  28 3004
  6.47E+04  5.83E+01 -6.53E-03  2.96E-07  9.41E+00  4.86E+00  1.20E-06 -2.55E-11
  4.31E+02  2.78E+00 -1.37E-04  3.03E-09  8.46E+02  8.04E-01 -3.28E-05  9.39E-10
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  1.72E+04  1.93E+02 -4.11E-03  8.71E-08 0.01 0.14 0.05 0.03 0.20 0.41 0.02 0.14
GRAVITY GAC CONTACTORS-STEEL    CU FT CU FT  6.28E+03 1.41E+04 3.14E+04 628 3004
  1.41E+04  2.68E+01 -3.93E-04  7.46E-09 -8.24E+01  3.86E-01 -2.13E-08  2.85E-14
  5.46E+02  1.61E-01 -3.12E-07  3.21E-13  2.32E+03  1.89E-02  9.37E-08 -9.64E-14
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
 -4.52E+03  2.17E+01 -1.22E-05  1.26E-11 0.01 0.43 0.01 0.01 0.08 0.19 0.06 0.21
PRESSURE CARBON CONTACTORS      CU FT SQ FT  3.90E+02 2.26E+03 1.57E+02 679 1004
  3.94E+04  7.63E+01 -2.69E-02  4.52E-06  1.21E+02  5.00E+00  2.12E-04 -1.41E-08
  9.25E+02  4.10E+00  1.60E-04  2.88E-09  8.90E+02  7.30E-01  3.52E-05 -3.07E-09
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  4.59E+04  3.97E+02 -6.00E-02  6.91E-06 0.01 0.47 0.01 0.01 0.06 0.17 0.10 0.17
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CONVERT FILTER TO GAC CONTACTOR SQ FT SQ FT  3.70E+02 7.00E+04 1.00E+00   1    1
  2.03E+04  5.10E+01 -2.52E-04  1.97E-09  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.12 0.00 0.00 0.25 0.61 0.02 0.00
GRANULAR ACT CARBON-CONSTR COST LB    LB      1.00E+04 1.00E+07 1.00E+00   1    1
  1.02E+03  6.07E-01 -6.54E-09 -5.61E-17  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
MAKEUP CARBON COST-O&M ONLY     LB/YR LB/YR  1.00E+04 1.00E+07 1.00E+00   1    1
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  1.02E+03  6.07E-01 -6.54E-09 -5.61E-17  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
CAPPING SAND FILTER W/ANTHRACITESQ FT SQ FT  3.50E+02 7.00E+04 1.00E+00   1    1
  4.08E+02  6.17E+00 -9.55E-06  9.53E-11  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.00 0.68 0.00 0.32 0.00 0.00 0.00
REGIONAL GAC REGEN-TRANS & STOR CU FT LB/YR  1.00E+03 2.00E+04 3.00E+04   3 6006
  1.83E+04  7.21E+00  1.87E-03 -6.84E-08  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  2.46E-03  1.99E-05  1.35E-13 -1.14E-21 -1.16E-02  2.30E-05  7.07E-14  4.37E-21
 -9.54E-03  1.93E-05  4.08E-14  2.60E-21  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.01 0.16 0.02 0.39 0.37 0.05 0.00 0.00
REGIONAL MULTI HEARTH GAC REGEN SQ FT SQ FT  2.70E+01 1.51E+03 1.00E+00   1   12
  4.68E+05  3.74E+03 -2.71E+00  8.31E-04  2.49E+05  1.26E+03 -8.58E-01  3.22E-04
  2.48E+03  2.78E+01 -2.95E-02  1.13E-05  2.51E+02  2.19E+01 -1.46E-02  4.94E-06
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  1.69E+06  1.59E+05 -4.87E+01  2.29E-02
  1.39E+04  2.17E+01  1.89E-02 -1.25E-05 0.00 0.53 0.00 0.00 0.28 0.02 0.01 0.16
MULTIPLE HEARTH GAC REGENERATIONSQ FT SQ FT  2.70E+01 1.51E+03 1.00E+00   1    3
  4.68E+05  3.74E+03 -2.71E+00  8.31E-04  2.49E+05  1.26E+03 -8.58E-01  3.22E-04
  2.48E+03  2.78E+01 -2.95E-02  1.13E-05  2.51E+02  2.19E+01 -1.46E-02  4.94E-06
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  1.69E+06  1.59E+05 -4.87E+01  2.29E-02
  1.39E+04  2.17E+01  1.89E-02 -1.25E-05 0.00 0.53 0.00 0.00 0.28 0.02 0.01 0.16
INFRARED CARBON REGEN FURNACE   LB/DAYLB/DAY 2.40E+03 6.00E+04 1.00E+00   1    1
  2.19E+05  3.15E+01 -3.64E-04  4.03E-09 -6.19E+04  3.28E+02 -4.27E-03  6.50E-08
  6.06E+03  1.24E+00 -2.46E-05  1.95E-10  2.03E+03  1.14E-01  2.17E-06 -2.35E-11
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
 -3.49E+00  3.31E+00 -7.03E-05  6.95E-10 0.00 0.64 0.00 0.00 0.18 0.01 0.08 0.09
FLUIDIZED BED GAC REGENERATION  LB/DAYLB/DAY 6.00E+03 2.40E+04 1.00E+00   1    3
  7.74E+05  3.19E+01 -5.94E-04  5.97E-09 -4.60E+00  2.10E+01 -1.98E-08  1.43E-12
  1.09E+04  8.46E-01 -3.46E-05  6.28E-10  2.39E+03 -5.59E-02  7.67E-06 -1.65E-10
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 -1.64E+05  1.14E+03 -4.05E-03  9.73E-08
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.68 0.00 0.00 0.22 0.00 0.01 0.09
POWDERED CARB REGEN-FLUIDIZED BDLB/DAYLB/DAY 2.09E+02 3.34E+04 1.00E+00   1    1
  5.74E+05  3.28E+02 -1.56E-02  3.01E-07 -1.89E+03  4.52E+02 -1.91E-02  3.84E-07
  2.59E+03  2.35E-01 -7.94E-06  1.44E-10  1.20E+03  2.82E-02  5.15E-06 -1.12E-10
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  1.89E+05  3.49E+03 -4.93E-02  9.28E-07
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.49 0.00 0.00 0.35 0.00 0.15 0.01
POWDERED CARB REGEN-ATOMIZED SUSLB/DAYLB/DAY 1.00E+03 1.00E+04 1.00E+00   1    1
  1.04E+05  2.29E+02 -4.87E-03  2.13E-07  2.03E+04  2.23E+01  4.30E-03 -2.28E-07
  1.93E+03  4.43E-02  2.41E-05 -1.69E-09  9.04E+02  1.28E-01 -1.23E-05  5.60E-10
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 -2.98E+05  6.42E+03 -1.21E-01  3.27E-06
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.76 0.00 0.00 0.00 0.00 0.12 0.12
CHEM SLUDGE PUMPING-UNTHICKENED GPM   GPM     2.00E+01 1.00E+04 1.00E+00   1    1
  3.28E+04  6.07E+01 -9.22E-03  5.49E-07  2.36E+00  6.39E+01  3.07E-05 -2.00E-09
  2.27E+03  7.39E+00 -9.64E-04  6.00E-08  1.07E+02  3.08E-01 -5.16E-05  2.91E-09
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  9.71E+03  3.26E+00 -5.88E-04  3.75E-08 0.01 0.15 0.06 0.06 0.24 0.23 0.14 0.11
CHEM SLUDGE PUMPING-THICKENED   GPM   GPM     5.00E+00 1.25E+03 1.00E+00   1    1
  8.46E+03  1.69E+02 -2.43E-01  1.17E-04  2.98E+03  4.62E+02 -2.14E-01  9.60E-05
  1.10E+03  2.21E+01 -3.06E-02  1.47E-05  4.77E+01  9.40E-01 -1.26E-03  5.90E-07
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  4.95E+03  6.05E+00 -2.38E-03  7.70E-07 0.00 0.64 0.00 0.00 0.13 0.04 0.07 0.12
GRAVITY SLUDGE THICKENER-LIME   SQ FT SQ FT  3.14E+02 1.78E+04 1.00E+00   1    3
  4.18E+04  4.06E+01 -3.99E-03  1.58E-07  2.83E+03  1.44E+00  1.11E-04 -4.34E-09
  9.36E+01  1.59E-01  1.17E-06 -1.63E-10  1.16E+02  3.59E-02 -2.69E-06  8.67E-11
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.03 0.41 0.12 0.16 0.27 0.00 0.01 0.00
GRAV SLDG THICKENER-ALUM & FECL3SQ FT SQ FT  3.14E+02 1.78E+04 1.00E+00   1    3
  4.18E+04  4.06E+01 -3.99E-03  1.58E-07  2.76E+03  1.69E+00 -8.49E-05  4.05E-09
  9.36E+01  1.59E-01  1.17E-06 -1.63E-10  1.16E+02  3.59E-02 -2.69E-06  8.67E-11
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.03 0.41 0.12 0.16 0.27 0.00 0.01 0.00
VACUUM FILTERS                  SQ FT SQ FT  9.40E+00 1.32E+03 1.00E+00   1    1
  1.62E+05  7.36E+02 -2.69E-01  1.12E-04  7.78E+04  1.50E+03  1.84E-01 -7.19E-06
  1.63E+03  1.52E+02 -1.66E-01  7.35E-05  6.12E+02  1.58E+01 -1.39E-02  5.99E-06
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  1.27E+05  3.81E+02 -5.67E-01  3.18E-04 0.00 0.46 0.00 0.00 0.16 0.02 0.02 0.34
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BELT FILTER PRESS                GPM   GPM     1.50E+01 4.50E+02 1.00E+00   1    1
  1.20E+05  5.65E+03  1.13E+01 -1.82E-02  4.69E+04  3.40E+03  8.73E+00 -1.31E-02
  5.71E+02  5.25E+01  1.23E-01 -2.09E-04  8.03E+02  1.75E+01  2.87E-02 -2.76E-05
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  9.79E+04  1.34E+03 -3.83E+00  6.90E-03 0.00 0.69 0.00 0.00 0.21 0.02 0.01 0.07
FILTER PRESS                     CU FT CU FT  4.30E+00 8.96E+02 1.00E+00   1    1
  2.03E+05  5.06E+03 -1.03E+01  7.89E-03  1.66E+04  1.92E+03 -2.34E+00  1.93E-03
  9.57E+02  2.88E+01 -4.96E-02  3.64E-05  7.00E+03  7.33E+00  5.26E-02 -3.01E-05
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  1.32E+05  1.92E+03 -4.14E+00  3.05E-03 0.00 0.61 0.00 0.00 0.18 0.01 0.01 0.19
DECANTER CENTRIFUGES             GPM   GPM     1.00E+01 5.00E+02 1.00E+00   1    3
  1.47E+05  1.92E+03 -4.01E+00  4.02E-03  5.16E+02  1.16E+03  8.29E-01 -1.05E-03
  6.39E+02  9.18E+01 -3.09E-01  3.67E-04  5.64E+02  1.72E+01 -6.16E-02  7.64E-05
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  9.86E+04  7.87E+02 -1.62E+00  1.20E-03 0.00 0.48 0.00 0.00 0.17 0.04 0.03 0.28
BASKET CENTRIFUGES               GPD   GPD     3.60E+03 7.20E+05 1.00E+00   1    1
  1.75E+05  7.66E-01  6.13E-06 -6.15E-12  6.08E+04  7.85E-01  1.11E-05 -1.07E-11
  1.71E+03  1.30E-02  8.22E-08 -7.34E-14  4.78E+03  4.13E-02  1.38E-07 -1.38E-13
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  7.76E+04  8.30E-01  1.17E-05 -1.15E-11 0.00 0.53 0.00 0.00 0.17 0.05 0.01 0.24
SAND DRYING BEDS                 SQ FT SQ FT  5.00E+03 4.00E+05 1.00E+00   1    1
  7.45E+03  2.97E+00  5.07E-07 -6.77E-12  0.00E+00  0.00E+00  0.00E+00  0.00E+00
 -7.41E+00  3.16E-02 -9.43E-09  1.83E-14  5.74E+02  2.84E-02  6.47E-08 -9.80E-14
 -1.75E-04  6.00E-02  1.12E-13 -2.90E-19  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.06 0.00 0.08 0.02 0.64 0.20 0.00 0.00
SLUDGE DEWATERING LAGOONS        CU FT CF/YR  4.00E+04 8.00E+06 6.25E-01   1    1
  6.79E+03  8.13E-02 -2.06E-09 -2.55E-17  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  4.22E+01  8.85E-04 -8.68E-11 -2.92E-20  1.80E+01  7.71E-03 -3.45E-10 -2.32E-18
  7.54E+00  9.27E-03 -1.55E-10 -1.17E-18  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.51 0.00 0.04 0.01 0.28 0.16 0.00 0.00
SLUDGE DISPOSAL-SANITARY SEWER   GPM   GPM     2.00E+01 1.00E+04 1.00E+00   1   11
  4.94E+01  8.43E+02 -2.11E-04  2.55E-08  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  5.00E+03  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
LIQUID SLUDGE HAULING            MG/YR MG/YR  1.25E+00 1.00E+02 1.00E+00   1    7
  7.23E+04  2.03E+03  6.45E+01 -3.71E-01  5.65E+04  1.76E+04 -5.40E+01  4.24E-01
  7.33E+00  5.94E+02  4.53E-02 -2.70E-04 -9.35E-01  2.09E+02  4.07E-02 -3.77E-04
  6.53E+01  5.07E+02  4.17E-01 -3.05E-03  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
DEWATERED SLUDGE HAULING         CY/YR CY/YR  1.00E+03 3.00E+05 1.00E+00   1    7
  4.86E+04  1.34E+00 -7.65E-06  1.98E-11  4.10E+04  4.59E+00 -1.83E-05  4.27E-11
  1.21E+02  9.79E-02  1.27E-07 -3.05E-13  8.96E+01  2.93E-02  1.11E-07 -2.74E-13
  1.31E+02  8.85E-02  7.88E-08 -1.95E-13  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
RAW WATER PUMPING FACILITY       MGD   MGD     1.00E+00 2.00E+02 1.00E+00   1    5
  1.92E+04  3.43E+03 -2.89E+00  8.85E-03 -5.38E-03  4.49E+04 -9.78E-05 -1.42E-07
  2.17E+02  1.33E+02  2.80E-01 -1.63E-03  4.99E+02  2.37E+01 -3.57E-02  1.66E-04
  3.00E+01  1.00E+02  4.89E-04  1.34E-05  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  1.97E+04  5.06E+03 -8.25E+00  3.51E-02 0.00 0.42 0.00 0.00 0.17 0.32 0.09 0.00
FINISHED WATER PUMPING FACILITY  MGD   MGD     1.50E+00 3.00E+02 1.00E+00   1    5
  3.75E+04  2.82E+03  1.50E+01 -3.27E-02  8.19E-04  5.00E+04  8.10E-05 -3.33E-07
  1.89E+02  1.47E+02 -1.36E-01  1.97E-04  5.06E+02  2.13E+01  5.23E-03  1.22E-05
  1.00E+02  3.00E+02 -2.19E-03  4.28E-04  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  4.07E+04  8.88E+03 -2.05E+01  5.27E-02 0.00 0.41 0.00 0.00 0.11 0.22 0.26 0.00
CLEARWELL STORAGE-BELOW GROUND   GAL   GAL     1.00E+04 7.50E+06 1.00E+00   1    1
  3.10E+04  4.22E-01 -2.78E-08 -1.39E-17  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.01 0.00 0.35 0.17 0.44 0.00 0.03 0.00
CLEARWELL STORAGE-GROUND LEVEL   GAL   GAL     8.50E+03 9.40E+06 1.00E+00   1    1
  2.70E+04  2.07E-01 -9.72E-09 -3.95E-17  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.71 0.08 0.06 0.01 0.09 0.05 0.00
DIFFUSED AERATION BASIN          CU FT CU FT  1.90E+03 3.80E+05 1.00E+00   1    1
  5.43E+04  2.99E+01 -9.75E-05  1.75E-10 -6.46E+02  1.48E+02  3.14E-05 -6.90E-11
  2.98E+03  1.61E-01 -5.72E-07  8.65E-13  1.30E+03  1.27E-01 -3.12E-07  6.54E-13
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  1.47E+04  5.73E-01 -2.71E-06  5.08E-12 0.01 0.61 0.02 0.03 0.16 0.00 0.15 0.02
AERATION-AERATION TOWERS         CU FT CU FT  6.80E+02 2.56E+05 1.00E+00   1    1
  2.45E+04  1.36E+01 -6.96E-05  1.76E-10 -4.02E+03  1.07E+01 -7.18E-06  2.11E-11
  5.48E+02  7.07E-02  2.19E-07 -4.83E-13  4.68E+01  1.03E-02 -5.01E-08  1.38E-13
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.01 0.67 0.06 0.08 0.14 0.00 0.04 0.00
ADMIN,LAB & MAINTENANCE BUILDINGMGD   MGD     1.00E+00 2.00E+02 1.00E+00   1    1
  1.83E+04  6.96E+03 -5.69E+01  1.65E-01  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  1.80E+03  2.52E+02 -1.71E+00  4.52E-03  1.28E+03  2.68E+02 -2.42E+00  7.31E-03
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  4.16E+04  1.59E+04 -1.30E+02  3.76E-01 0.00 0.00 0.00 0.00 0.00 0.00 0.00 1.00
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PACKAGE COMPLETE TREATMENT PLANTGPM   GPM    4.00E+00 1.40E+03 1.00E+00   1  409
  5.70E+04  2.27E+03 -7.84E+00  1.81E-02  7.27E+01  1.30E+02 -4.88E-01  1.36E-03
  2.85E+02  3.75E+01 -2.28E-01  4.70E-04  1.25E+03  4.87E+01 -3.26E-01  7.33E-04
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  2.80E+04  1.98E+03 -4.70E+00  8.99E-03 0.01 0.44 0.01 0.00 0.09 0.02 0.18 0.25
PACKAGE GRAVITY FILTER PLANTS   GPM   GPM    8.00E+01 1.40E+03 1.00E+00   1  409
  9.17E+04  1.84E+03 -9.25E+00  2.65E-02 -9.69E+01  1.06E+02 -1.38E-01  4.04E-04
  7.49E+02  1.01E+01 -5.35E-02  1.49E-04  2.68E+03  4.41E+00  3.56E-02 -1.06E-04
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  9.05E+04  2.20E+03 -1.68E+01  4.41E-02 0.01 0.22 0.15 0.00 0.08 0.06 0.17 0.31
PACKAGE PRESSURE FILTRATION PLNTGPM   GPM    7.00E-01 3.50E+02 1.00E+00   1  409
  1.82E+04  5.01E+03 -1.03E+02  8.27E-01  7.09E+00  1.22E+02  8.55E-01 -1.01E-02
  4.64E+01  1.97E+01 -4.43E-01  3.58E-03  3.57E+02  5.17E+00 -6.18E-02  9.14E-04
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  2.40E+04  1.75E+03  6.24E+00 -1.64E-01 0.01 0.43 0.01 0.00 0.13 0.02 0.12 0.28
FILTER MEDIA-RAPID SAND         SQ FT SQ FT  4.00E+00 2.80E+02 1.00E+00   1    1
  4.50E+01  4.71E+01 -1.85E-01  4.30E-04  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
FILTER MEDIA-DUAL MEDIA         SQ FT SQ FT  4.00E+00 2.80E+02 1.00E+00   1    1
  9.56E+01  5.56E+01 -1.34E-01  3.15E-04  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
FILTER MEDIA-MIXED MEDIA        SQ FT SQ FT  4.00E+00 2.80E+02 1.00E+00   1    1
  1.41E+02  8.11E+01 -1.54E-01  2.91E-04  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
FILTER MEDIA-MIXED,INST W/MF SUPSQ FT SQ FT  4.00E+00 2.80E+02 1.00E+00   1    1
  1.08E+03  8.91E+01 -2.18E-01  4.42E-04  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
PACKAGE PRESS DIATOMITE FILTERS GPD   GPD    2.80E+04 1.00E+06 1.00E+00   1  402
  4.43E+04  8.79E-02  1.07E-07 -7.25E-14  1.58E+01  4.86E-02  1.39E-10  2.87E-15
  1.09E+02  1.66E-03 -2.33E-09  1.32E-15  6.27E+02  2.06E-03 -2.20E-09  2.41E-15
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  2.29E+04  9.16E-02 -1.05E-07  6.71E-14 0.01 0.55 0.01 0.01 0.09 0.04 0.05 0.24
PACKAGE VACUUM DIATOMITE FILTERSGPM   GPM    3.00E+01 7.20E+02 1.00E+00   1  402
  4.39E+04  3.15E+02 -4.98E-01  4.57E-04  6.00E+03  1.17E+02  7.13E-02 -1.70E-04
  7.10E+01  2.83E+00 -5.79E-03  4.40E-06  6.54E+02  2.45E+00 -1.36E-03  3.23E-06
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  2.26E+04  1.22E+02 -1.45E-01  1.09E-04 0.01 0.65 0.01 0.01 0.05 0.05 0.02 0.20
PACKAGE ULTRAFILTRATION PLANTS  GPD   GPD    2.50E+03 1.00E+06 1.00E+00   1  302
  9.01E+03  9.28E-01 -8.97E-07  5.66E-13  1.15E+03  7.39E-02 -4.18E-08  2.75E-14
  3.08E+01  6.74E-02  1.90E-08 -1.47E-14  3.52E+02  6.76E-04  2.97E-10 -2.26E-16
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  1.01E+04  3.05E-01 -2.48E-07  2.24E-13 0.01 0.64 0.01 0.00 0.07 0.01 0.13 0.13
PACKAGE GRAN ACT CARBON COLUMNS GPD   GPD    2.50E+03 5.00E+05 1.00E+00   1    1
  8.79E+03  3.50E-01 -1.09E-06  1.29E-12 -1.16E+01  5.27E-02 -9.29E-08  1.67E-13
  8.11E+01  7.40E-03  1.93E-08 -3.00E-14  9.62E+01  7.32E-04 -1.37E-09  1.12E-15
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  5.27E+03  3.54E-01 -1.09E-06  1.11E-12 0.01 0.25 0.02 0.00 0.22 0.15 0.03 0.32
POTASSIUM PERMANGANATE FEED SYSTLB/DAYLB/DAY 1.00E-01 1.00E+01 1.00E+00   1  101
  7.36E+03 -9.62E-03  6.09E-04  8.27E-05  1.80E+03 -2.34E-03  1.49E-04  2.05E-05
  5.00E+01 -6.52E-05  4.10E-06  5.70E-07  1.01E+02 -1.32E-04  8.18E-06  1.16E-06
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  2.05E+03 -2.66E-03  1.65E-04  2.36E-05 0.00 0.22 0.00 0.00 0.05 0.05 0.03 0.65
POLYMER FEED SYSTEMS            LB/DAYLB/DAY 1.00E-01 1.00E+01 1.00E+00   1  110
  1.90E+04 -9.51E-03 -1.19E-03 -2.62E-05  1.73E+04 -8.79E-03 -1.07E-03 -2.58E-05
  2.40E+02 -1.23E-04 -1.51E-05 -3.20E-07  1.98E+02 -1.04E-04 -1.24E-05 -2.76E-07
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  8.21E+03 -4.17E-03 -5.61E-04 -1.32E-05 0.00 0.67 0.00 0.00 0.04 0.02 0.07 0.20
POWDERED ACT CARBON FEED SYSTEMSLB/HR LB/HR  1.00E+00 1.00E+01 1.00E+00   1  101
  2.93E+03  4.68E+02 -5.01E+01  2.29E+00  1.95E+03  1.69E+02 -8.96E+00  9.72E-01
  3.89E+01  1.24E+01 -1.12E+00  6.91E-02  1.34E+02  7.33E+01 -7.12E+00  3.98E-01
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.79 0.00 0.00 0.11 0.00 0.10 0.00
DIRECT FEED GAS CHLORINATION    LB/DAYLB/DAY 1.00E-01 1.00E+02 1.00E+00   1  101
  4.31E+03  3.92E-04  1.84E-05  4.87E-08  1.63E+03  1.48E-04  6.99E-06  1.85E-08
  4.00E+01  3.62E-06  1.70E-07  4.72E-10  1.83E+02  1.64E-05  7.79E-07  2.09E-09
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  2.56E+03  2.32E-04  1.09E-05  2.93E-08 0.00 0.35 0.00 0.00 0.08 0.03 0.05 0.49
SODIUM HYPOCHLORITE SOLUTN FEED LB/DAYLB/DAY 1.00E-01 1.00E+02 1.00E+00   1  101
  4.31E+03  3.92E-04  1.84E-05  4.87E-08  5.70E+02  5.15E-05  2.44E-06  6.37E-09
  2.00E+01  1.81E-06  8.51E-08  2.36E-10  3.65E+02  3.33E-05  1.55E-06  4.27E-09
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  2.56E+03  2.32E-04  1.09E-05  2.93E-08 0.00 0.29 0.00 0.00 0.08 0.08 0.05 0.50
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OZONE GENERATING AND FEED          LB/DAYLB/DAY 5.00E-01 1.00E+01 1.00E+00    1    1
  2.10E+04  2.55E+03 -8.76E+00 -3.49E-01  3.78E+02  4.37E+03 -7.69E+00 -3.22E+00
  1.11E+02  1.77E+01  1.49E-02  3.37E-04  3.42E+02  5.98E+01 -6.71E+00  2.81E-01
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  6.57E+03  4.02E-03 -1.14E-03 -4.66E-06 0.00 0.68 0.00 0.00 0.11 0.00 0.00 0.21
OZONE CONTACT CHAMBER              GAL   GAL     8.50E+02 1.35E+04 1.00E+00    1    1
  9.27E+02 -3.12E-02  1.84E-04 -8.89E-09  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.84 0.03 0.01 0.12 0.00 0.00 0.00
CHLORINE DIOXIDE GENERATING/FEEDLB/DAYLB/DAY 1.00E-01 5.00E+01 1.00E+00    1  201
  9.67E+03  7.32E-04 -2.92E-05  5.93E-07  1.24E+03  9.50E-05 -3.82E-06  7.70E-08
  1.00E+02  7.72E-06 -3.08E-07  6.05E-09  3.65E+02  2.78E-05 -1.10E-06  2.22E-08
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  4.10E+03  3.18E-04 -1.24E-05  2.52E-07 0.00 0.48 0.00 0.00 0.07 0.06 0.05 0.34
ULTRAVIOLET LIGHT DISINFECTION     GPM   GPM     1.00E+01 7.80E+02 1.00E+00    1    1
  3.38E+03  3.36E+01  1.58E-03  1.45E-06  2.80E+01  4.17E+01 -7.22E-03  7.24E-06
  5.91E+01  4.07E+00  3.80E-04 -3.25E-07  2.31E+01  1.69E-02  3.17E-05 -2.87E-08
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  9.65E+03  6.48E+00 -3.90E-03  2.08E-06 0.01 0.72 0.02 0.00 0.03 0.04 0.04 0.14
REVERSE OSMOSIS                    GPD   GPD     2.50E+03 1.00E+06 1.00E+00    1  302
  9.96E+03  1.41E+00 -1.71E-06  1.06E-12  1.68E+03  2.65E+00 -6.22E-07  3.79E-13
  8.34E+00  9.66E-02  2.54E-09 -1.84E-15  7.56E+02  3.97E-03 -6.28E-09  3.40E-15
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  7.64E+03  7.78E-02  4.61E-08 -2.63E-14 0.00 0.71 0.00 0.00 0.14 0.00 0.09 0.06
PRESSURE ION EXCHANGE-SOFTENING GPD   GPD     7.00E+04 8.60E+05 1.00E+00  49-4101
  5.39E+04  1.59E-01 -1.44E-07  8.54E-14  7.54E+00  1.87E-03  2.87E-10 -2.06E-16
  3.89E+02  4.50E-03 -7.15E-10  3.65E-16  8.08E+02  3.01E-03 -3.92E-09  2.21E-15
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  1.02E+04  4.93E-02 -3.67E-08  1.75E-14 0.01 0.32 0.02 0.03 0.10 0.15 0.26 0.11
PRESSURE ION EXCHANG-NO3 REMOVALGPD   GPD     7.00E+04 8.30E+05 1.00E+00 121-4101
  5.29E+04  2.16E-01 -1.56E-07  1.03E-13 -1.40E+01  2.03E-03 -4.25E-10  3.07E-16
  2.85E+02  2.32E-02 -3.52E-09  2.49E-15  7.92E+02  3.29E-03 -4.69E-09  2.81E-15
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  1.00E+04  5.28E-02 -4.35E-08  2.22E-14 0.01 0.49 0.01 0.01 0.06 0.12 0.21 0.09
ACTIVATED ALUMINA FLUORIDE REMOVGPD   GPD     1.27E+04 9.10E+05 1.00E+00    1  202
  3.79E+04  2.46E-01 -3.71E-07  2.25E-13  8.07E-01  2.73E-05 -7.66E-11  7.95E-17
  3.89E+02  2.56E-03 -8.74E-10  2.33E-16  7.75E+02  4.41E-03 -7.96E-09  4.94E-15
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  6.90E+03  3.41E-02 -2.26E-08  1.96E-14 0.00 0.29 0.00 0.00 0.12 0.20 0.29 0.10
BONE CHAR FLUORIDE REMOVAL         GPD   GPD     1.63E+04 8.00E+05 1.00E+00 952-6201
  5.37E+04  2.18E-01 -1.53E-07  7.81E-14  1.66E+01  1.66E-04  9.52E-10 -7.61E-16
  5.21E+02  5.02E-03 -3.36E-09  2.31E-15  7.47E+02  3.97E-03 -6.53E-09  4.23E-15
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  1.86E+04  4.99E-02  1.45E-07 -1.35E-13 0.00 0.33 0.00 0.00 0.13 0.15 0.21 0.18
PACKAGE RAW WATER PUMPING-TDH=50GPM   GPM     2.00E+01 7.00E+02 1.00E+00    1    1
  1.04E+04  6.20E+01 -1.25E-01  1.05E-04  4.81E-01  1.16E+02  8.61E-04 -9.36E-07
  4.13E+01  4.71E-01 -1.06E-03  8.36E-07  4.83E+01  1.11E-01 -6.50E-05  7.86E-08
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.07 0.59 0.05 0.00 0.17 0.08 0.04 0.00
PACKAGE HIGH SERVICE PUMP STATN GPM   GPM     3.00E+01 1.10E+03 1.00E+00    1    1
  1.05E+04  1.32E+01 -1.68E-03 -8.47E-07 -6.08E+02  1.47E+02  1.79E-01 -1.24E-04
  2.84E+01  5.46E-02 -4.27E-05  4.00E-08  9.75E+01  1.48E-01 -1.97E-04  9.20E-08
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.80 0.00 0.00 0.12 0.06 0.02 0.00
STEEL BACKWASH/CLEARWELL TANKS     GAL   GAL     5.00E+02 3.00E+04 1.00E+00    1    1
  9.23E+02  1.36E+00 -4.19E-05  8.89E-10  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.01 0.00 0.04 0.89 0.06 0.00 0.00 0.00
LIQUID SLUDGE HAULING              GPD   GPD     6.80E+01 4.11E+04 1.00E+00    1    7
  3.97E+04  7.39E+00 -3.13E-04  4.93E-09  4.06E+04  1.10E+01 -2.45E-04  3.41E-09
  3.96E+01  1.54E-01  5.69E-06 -1.01E-10  2.68E+01  3.53E-02  3.98E-06 -7.15E-11
  4.04E+01  1.33E-01  5.53E-06 -1.02E-10  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
DEWATERED SLUDGE HAULING           CY/YR CY/YR  1.00E+02 5.00E+04 1.00E+00    1    7
  2.84E+03  4.26E-01 -1.01E-05  8.12E-11  3.02E+04  8.54E+00 -2.40E-04  2.79E-09
  1.92E+02  5.09E-02  3.29E-06 -4.47E-11  6.40E+00  6.09E-02 -1.74E-06  2.62E-11
  7.03E+00  1.55E-01 -4.18E-06  6.20E-11  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
SLUDGE DISPOSAL-SANITARY SEWER     GPD   GPD     5.00E+01 2.50E+04 1.00E+00    1   11
 -1.69E-02  2.40E-01 -1.63E-06  5.50E-11  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  5.00E+03  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00
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CRV.DAT FILE (CONTINUED)

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SLUDGE DEWATERING LAGOONS        CU FT CF/YR  1.50E+03 3.00E+04 5.00E-01   1    1
  1.63E+03  2.48E-01 -1.12E-05  2.63E-10  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  4.60E+01  5.63E-03 -4.40E-07  1.29E-11  1.49E+01  1.28E-04  1.35E-06 -5.36E-11
  1.85E+00  1.06E-02  3.90E-07 -1.74E-11  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.31 0.00 0.13 0.00 0.29 0.27 0.00 0.00
SAND DRYING BEDS                 SQ FT SQ FT  2.00E+02 8.00E+02 1.00E+00   1    1
  9.18E+02  5.80E+00  1.77E-04 -7.98E-07  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  3.33E+00  3.33E-02  3.68E-09  6.99E-13  1.11E+02  2.40E-01 -3.73E-06  1.99E-07
  2.33E+01  3.33E-02  8.64E-09 -1.09E-11  0.00E+00  0.00E+00  0.00E+00  0.00E+00
  0.00E+00  0.00E+00  0.00E+00  0.00E+00 0.05 0.00 0.37 0.05 0.24 0.29 0.00 0.00
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TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA-600/2-79-162d		

4. TITLE AND SUBTITLE
ESTIMATING WATER TREATMENT COSTS
Volume 4. Computer User's Manual for Retrieving and Updating Cost Data

5. REPORT DATE
August 1979 (Issuing Date)

6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S)
Thomas S. Lineck, Robert C. Gumerman, and Russell L. Culp

8. PERFORMING ORGANIZATION REPORT NO.

9. PERFORMING ORGANIZATION NAME AND ADDRESS
Culp/Wesner/Culp
Consulting Engineers
2232 S.E. Bristol, Suite 210
Santa Ana, California 92707

10. PROGRAM ELEMENT NO.
1CC614, SOS 1, Task 38

11. CONTRACT/GRANT NO.
68-03-2516

12. SPONSORING AGENCY NAME AND ADDRESS
Municipal Environmental Research Laboratory--Cin.,OH
Office of Research and Development
U.S. Environmental Protection Agency
Cincinnati, Ohio 45268

13: TYPE OF REPORT AND PERIOD COVERED
Final

14. SPONSORING AGENCY CODE
EPA/600/14

15. SUPPLEMENTARY NOTES Project Officer: Robert M. Clark (513) 684-7488.
See also EPA-600/2-78-182 (NTIS PB284274/AS); Volume 1, EPA-600/2-79-162a; Volume 2, EPA-600/2-79-162b; and Volume 3, EPA-600/2-79-162c.

16. ABSTRACT

This report discusses unit processes and combinations of unit processes that are capable of removing contaminants included in the National Interim Primary Drinking Water Regulations. Construction and operation and maintenance cost curves are presented for 99 unit processes that are considered to be especially applicable to contaminant removal. The report is divided into four volumes. Volume 1 is a summary volume. Volume 2 presents cost curves applicable to large water supply systems with treatment capacities between 1 and 200 mgd, as well as information on virus and asbestos removal. Volume 3 includes cost curves applicable to flows of 2,500 gpd to 1 mgd. And Volume 4 is a computer program user's manual for the curves included in the report. For each unit process included in this report, conceptual designs were formulated, and construction cost curves were checked for accuracy by a second consulting engineering firm, Zurheide-Herrmann, Inc., using cost-estimating techniques similar to those used by general contractors in preparing their bids. Operation and maintenance requirements were determined individually for three categories: Energy, maintenance material, and labor. Energy requirements for the building and the process are presented separately. Costs are in October 1978 dollars.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Economic analysis, Environmental engineering, Operating costs, Computer programming, Water treatment, Cost indexes, Water supply, Cost estimates, Cost analysis	Energy costs, Cost curves, Safe Drinking Water Act, Interim primary standards, Unit processes, Treatment efficiency	13B

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
Release to Public	Unclassified	88
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

EPA Form 2220-1 (Rev. 4-77)

☆ U.S. GOVERNMENT PRINTING OFFICE: 1980--757-064/0174