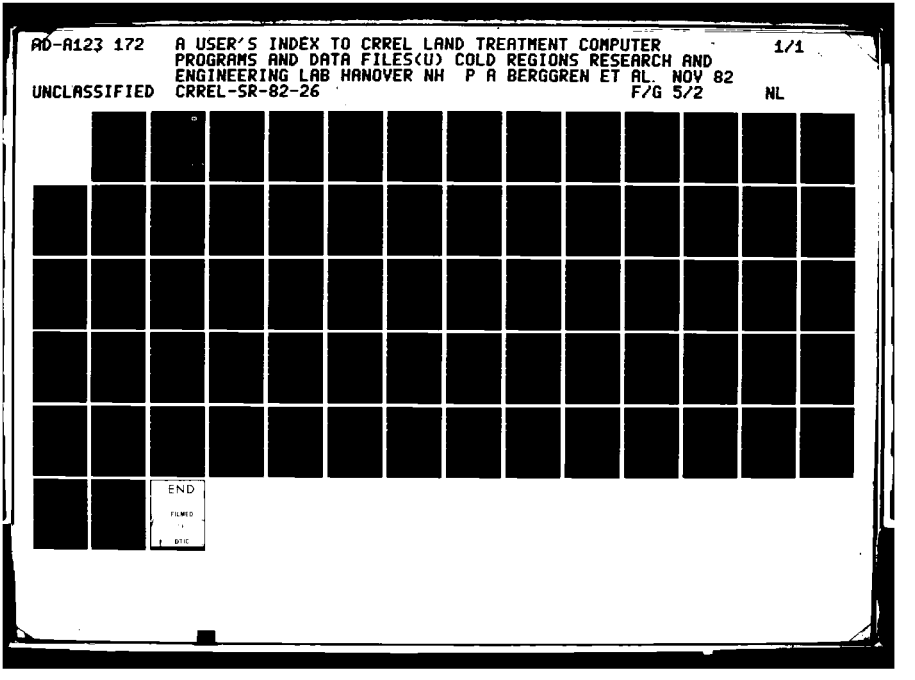
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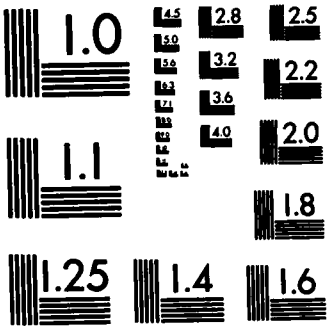

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Special Report 82-26

November 1982

US Army Corps of Engineers
Cold Regions Research & Engineering Laboratory

A user's index to CRREL land treatment computer programs and data files

P.A. Berggren and I.K. Iskandar

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This user's index is a directory for the computer programs and data files developed at CRREL on land treatment of wastewater. Two computers are used, a Prime 400 located at CRREL and the Dartmouth Time Sharing System (DTSS) located at Dartmouth College, Hanover, New Hampshire. The objective of this directory is to allow users to locate and use or request desired programs or data files, to maintain a permanent record of programs and data files developed under the land treatment program, and to assist in technology transfer. Appendix A contains

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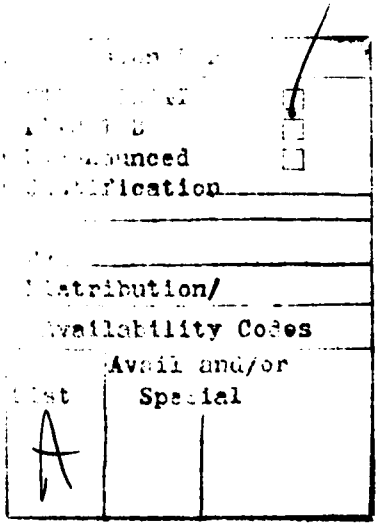
20. Abstract (cont'd)

a list of published papers and technical reports related to the computer programs and the data files. The program or file of concern is listed at the end of each citation. The main User File Directory (UFD), which is called "ALEXIS," is hierarchically divided into five sub-UFDs named "EXPER," "MODEL," "TAPES," "UTILITY," and "WDBASE." These sub-UFDs are further divided as necessary to maintain a logical arrangement of programs and other files within the account. The overall objective of the file structure is to provide easy access to individual programs while assuring that logically unrelated files remain separated.

PREFACE

This report was prepared by Peter A. Berggren, Computer Technician, Engineering and Measurement Services Branch, Technical Services Division, and Dr. I.K. Iskandar, Research Chemist, Earth Sciences Branch, Research Division, Cold Regions Research and Engineering Laboratory (CRREL), Hanover, New Hampshire.

The authors express their appreciation to Gary DeCoff, Computer Programmer, Engineering and Measurement Services Branch, Technical Services Division, CRREL, for valuable assistance during the development and operation of the programs. The computer programs and data files were developed by many people, whose names are listed with each program or file. Financial support was provided by the U.S. Army Corps of Engineers Civil Works project CWIS 31633, Optimization of Automated Procedures for Design and Management of Land Treatment Systems, and GE Civil OCE 1300-2547-00, Land Treatment Model Maintenance. This manuscript was technically reviewed by Gary DeCoff and Gregor Fellers of CRREL.



CONTENTS

ILLUSTRATIONS

A USER'S GUIDE TO CRREL LAND TREATMENT COMPUTER PROGRAMS AND DATA FILES

by

P.A. Berggren and I.K. Iskandar

1. INTRODUCTION

From 1975 to 1981 many computer programs were developed at the U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) related to the land treatment of wastewater. In addition, data files were maintained to evaluate such models, to obtain simplified regression analysis, and to permanently document the results from many experiments. The computer programs varied greatly in their complexity, length and purpose. Some of these programs were developed using the Dartmouth Time Sharing System (DTSS) and transferred to the CRREL computer system (a Prime 400). The objective of this report is to provide new users with a method of locating and accessing the programs and data files produced under the land treatment program.

A brief description of each model or data file is presented in Section 3, "File Descriptions." For programs and data files produced at other installations, the user may find out more from The Corps of Engineers Land Treatment Research Program: An Annotated Bibliography.* A selected list of publications related to the data files and computer programs in this report is presented in Appendix A.

Hard copies and magnetic tapes of any of the programs or data files may be purchased from CRREL Technical Services Division, Attention: Gary DeCoff, U.S. Army Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire, 03755, for a nominal fee to cover the cost of reproduction.

2. CRREL COMPUTER INSTALLATION

The CRREL computer installation is a time-sharing system running on a Prime 400 computer. This is a 16-bit machine having one million words of physical memory and a virtual memory operating system. Peripheral devices include dual 80-megabyte disk drives, 3 nine-track tape drives, a high-

*Parker, L., P.A. Berggren, I.K. Iskandar, D. Irwin, T.F. Jenkins and C. McDade (In press) The Corps of Engineers Land Treatment Research Program: An Annotated Bibliography. CRREL Special Report.

speed line printer, and a four-color Zeta hard-copy plotter.

The system uses Prime FORTRAN, a superset of the American National Standards Institute standard FORTRAN. Programs are developed using a line editor, and are compiled and run in either R-mode (for programs occupying less than 64K of memory) or V-mode (for programs requiring more than 64K of memory). Although the Prime system includes a batch simulator, none of the programs in the ALEXIS account are specifically designed to run as background jobs. A version of BASIC, known as BASIC/VM, is also supported.

Information concerning the conversion of Prime programs into forms that can be run on other computer systems is included in Section 5, "Export and Conversion."

2.1 File system and account organization

The Prime file system is essentially a tree structure (Fig. 1) with the account name (ALEXIS) constituting the root catalog, called the "home" or "main" User File Directory (abbreviated UFD). Sub-catalogs may be created above the home UFD, forming upward branches in the tree. These sub-catalogs are referred to as sub-UFDs. Each sub-UFD is assigned a name at its creation, but since sub-UFDs exist as files within the parent directory, sub-UFDs that are siblings may not have the same name. There is no limit to the number of generations an account may contain, but ease of use requires that frequently accessed directories be kept close to the bottom level.

The ALEXIS account takes full advantage of this hierarchical file system. The main UFD provides temporary work space, while all other files are grouped according to subject and reside within sub-UFDs with descriptive names. There are five second-generation catalogs within the account: EXPER, MODEL, TAPES, UTILITY and WDBASE. Each of these catalogs contains sub-UFDs of its own, assuring that files relating to a particular subject may be easily located and are not confused with unrelated files. The sub-UFD subject naturally becomes more specific as one moves up the tree. For instance, while ALEXIS > MODEL > MEHRAN (the sub-UFD MEHRAN above the sub-UFD MODEL in the UFD ALEXIS) contains files pertaining to Mohsen Mehran's modeling work, ALEXIS > MODEL > MEHRAN > DYNAMIC contains files

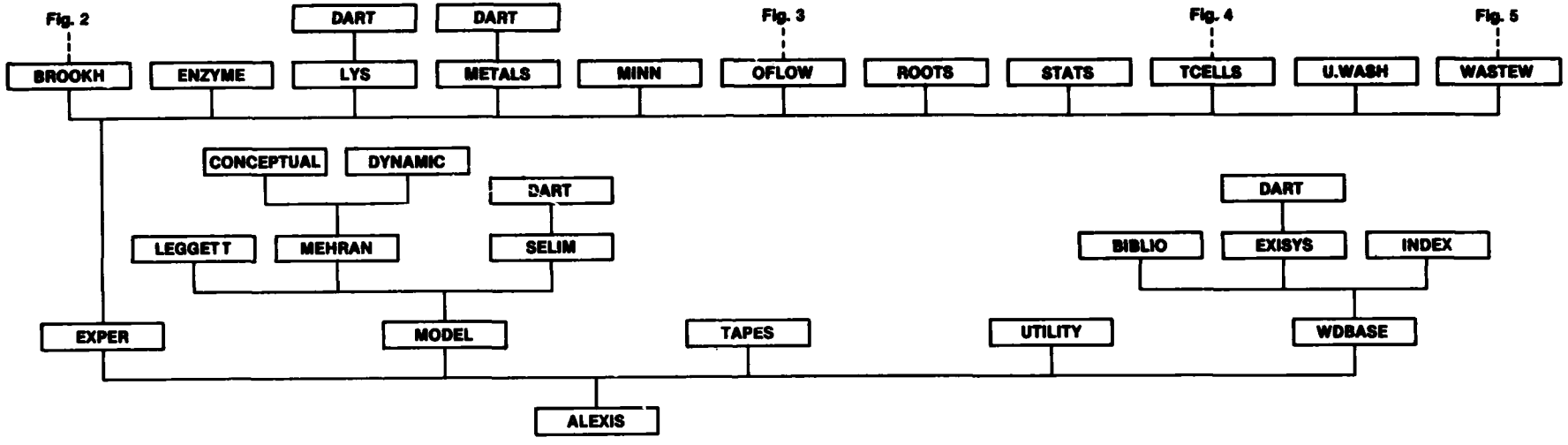


Figure 1. Structure of the ALEXIS file.

specifically related to his dynamic modeling work. The notation UFD > SUBUFDN > ... > SUBUFDN > FILENAME is generally referred to as the "treename" of the file called FILENAME.

An explanation of each sub-UFD and the files it contains is included in Section 3. Information on exporting individual files and entire sub-UFDs is included in Section 5.

2.2 Run-file naming conventions

The names of the files that constitute the ALEXIS account conform to the Prime recommended naming conventions for executable files (run-files). Thus, a name of the form "*<filename>" is an executable core image of the file called "<filename>," intended to run in R-mode. A name of the form "#<filename>" is an executable core image of the file called "<filename>," intended to run in V-mode. V-mode run-files are created when the source program is too large to fit into a single 64K segment of memory, but the differences in the way the run-file is executed by the computer are transparent to the user.

2.3 The Dartmouth account

Many of the programs and data files that have been developed under the land treatment project were created and run on the Dartmouth Time Sharing System (DTSS). Since all computer work by CRREL projects has since moved in-house, many of the files in the ALEXIS account formerly existed on the DTSS. Not all of these files have been translated into a Prime-compatible format. Those that have been translated are included in the appropriate sub-UFD, while those still waiting to be translated reside in a sub-UFD called DART, which is attached to the one in which they belong. Thus, there are several sub-UFD's called DART, each containing files that are not intended to be run on the Prime system. These sub-UFDs are available for export in the same manner as any other sub-UFD, though the conversion techniques will differ from those employed for a Prime-compatible file. (See Section 5 for more information on this.)

3. FILE DESCRIPTIONS

Each part of this section contains the file descriptions for a particular sub-UFD. Division by sub-UFD is also a division by subject. This organization is intended to make it easier for users to

locate files that are related to the subject of interest. Each file description includes the file name, type and size.

FILE NAME

This is the name of the file as it exists on the Prime system.

TYPE

There are thirteen types of files on the ALEXIS account. An alphabetical list of these types, each accompanied by a more detailed description, follows:

BACKGROUND: A Dartmouth system command file, not usable on the Prime system.

BASIC: A source file written in Dartmouth BASIC and not usable on the Prime system.

BASIC/VM: A source file written in Prime BASIC/VM.

COMINPUT: Stands for "common input;" a Prime system command file.

COMOUTPUT: Stands for "common output;" a file that contains a record of all text which appeared on the terminal screen between the issuance of the Prime commands "COMOUTPUT FILENAME" and "COMOUTPUT -END." While COMOUTPUT is in effect, all output to the terminal is also written to a file with the user-specified file name. This command is useful for saving a record of information that was printed on the terminal during a run of a particular program.

DATA: A file which is used as input by some program. The description corresponding to a file of this type will specify which program(s) use the file as input.

FORTRAN: A source file written in Prime FORTRAN.

OUTPUT: A file created in the process of running a program; it is usually used to store the results of the run. The description corresponding to a file of this type will specify which program(s) the file is output from.

PL1: A source file written in Dartmouth PL1 and not usable on the Prime system.

PMA: A source file written in Prime Assembly Language (PMA).

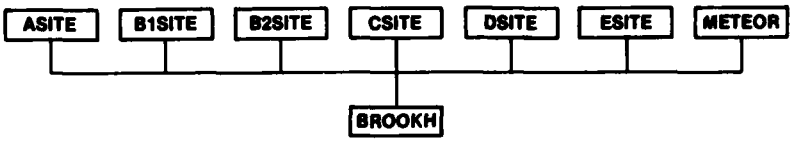


Figure 2. Structure of the BROOKH sub-UFD.

R-COMPILED: A compiled file containing a Prime-executable core image in binary form, intended to run in R-mode.

TEXT: A file that contains documentation.

V-COMPILED: A compiled file containing a Prime-executable core image in binary form, intended to run in V-mode.

SIZE

This figure is the size of the file in "records." Prime records consist of 440 words of 16 bits each.

3.1 EXPER

This sub-UFD contains programs and data files that are directly related to one or more of the several experimental studies carried out under the Corps of Engineers Land Treatment Research Program. For each of these experiments there is a separate sub-UFD that contains the files that are related to that particular experiment. This sub-UFD contains 9491 records.

3.1.1 EXPER > BROOKH

This sub-UFD contains data from the Brookhaven experiment. It is divided into seven sub-UFDs called ASITE (chemistry data from site A), B1SITE (chemistry data from site B1), B2SITE (chemistry data from site B2), CSITE (chemistry data from site C), DSITE (chemistry data from site D), ESITE (chemistry data from site E), and METEOR (meteorological data for all the sites) (Fig. 2). Data files in the chemistry data sub-UFDs are named as follows:

BOD. . . . . biological oxygen demand
CA . . . . . calcium
CD . . . . . cadmium
CL . . . . . chloride
COD. . . . . chemical oxygen demand
CR . . . . . chromium
CU . . . . . copper
F. . . . . fluorine
FCOLF. . . . . fecal coliform
FE . . . . . iron

FSTRP. . . . . fecal streptococcus
INPO4. . . . . inorganic phosphate
K. . . . . potassium
KJ . . . . . kjeldahl nitrogen
LTOP . . . . . total dissolved phosphorus
MBAS . . . . . methylene-blue-active substances
MG . . . . . magnesium
MN . . . . . manganese
NA . . . . . sodium
NH3. . . . . ammonium
NI . . . . . nickel
NO2. . . . . nitrite
NO2O3. . . . . nitrite + nitrate
NO3. . . . . nitrate = NO2O3 - NO2
PH . . . . . pH
SNITR. . . . . total nitrogen in filtered residue
SPC. . . . . specific conductivity
TAC. . . . . total carbon
TCOLF. . . . . total coliform
TDS. . . . . total dissolved solids
TIC. . . . . total inorganic carbon
TOC. . . . . total organic carbon
TOTNIT . . . . total nitrogen = KJ + NO2O3
TOTPHS . . . . total phosphorus = TSOP + LTOP
TS . . . . . total solids
TSOP . . . . . total phosphorus in filterable residue
TSS. . . . . total suspended solids
TURB . . . . . turbidity
TVS. . . . . total volatile solids
TVSS . . . . . total volatile suspended solids
WTEMP. . . . . water temperature
ZN . . . . . zinc

Data files in the meteorological data sub-UFD are named as follows:

AWS. . . . . average wind speed
FMR. . . . . unknown
INSLT. . . . . incoming solar radiation
MAXAT. . . . . maximum air temperature
MEANT. . . . . mean air temperature
MINAT. . . . . minimum air temperature
RLHUM. . . . . relative humidity
RNFL . . . . . precipitation

All of the data files adhere to the same format. The first line is alphanumeric and gives the units in which the parameter was measured. Each of the remaining lines specifies the modifier, data value, and date for a single measurement, and is in the FORTRAN format (A2,F10.2,8X,3I2). The modifier may be blank (meaning the value is to be taken as is), "<" (meaning the actual value is less than the data value given), or ">" (meaning the actual value is greater than the value given). The date is in the format DDMMYY. This sub-UFD contains 1030 records.

3.1.2 EXPER > ENZYME

This sub-UFD contains a non-linear multiple regression program to analyze the kinetic parameters Vm and Km as functions of pH. Also included are the input, output, and comoutput files used or produced in an example run of the program. This sub-UFD contains 115 records. See publication 81-003 (App. A).

FILE NAME	TYPE	SIZE
EZF	FORTRAN	12

A non-linear multiple regression program to analyze the kinetic parameters Vm and Km as functions of pH, assuming that the activity of particular enzyme forms is determined by the ionization of two groups, the active form of the enzyme being the half-ionized species. EZF is based on the program presented in a paper by R.B. Gregory and J. Kinderlerer entitled "The Effect of pH on Enzyme-Catalyzed Reactions: A Computer Program to Determine pK Values of Enzyme Ionizable Groups from Kinetic Data."

#EZF	V-COMPILED	85

Executable version of EZF (V-mode).

INPUT1	DATA	1

Sample data taken from the article discussed above.

INPUT2	DATA	1

Sample data taken from the article discussed above.

OUTPUT	COMOUTPUT	4

Record of the sample run of EZF that used the data files above and produced the output files below.

PLTOT1	OUTPUT	3

Zeta plot file containing a plot of pH vs Vm.

PLTOT2	OUTPUT	3

Zeta plot file containing a plot of pH vs Vm/Km.

PLTOT3	OUTPUT	2

Zeta plot file containing a plot of pH vs Km.

3.1.3 EXPER > LYS

This sub-UFD contains data from the wastewater lysimeter study carried out at CRREL during 1978 and 1979, as well as related programs to tabulate, plot and update this data. This sub-UFD contains 532 records. See publications 81-001 and 81-002 (App. A).

FILE NAME	TYPE	SIZE
INSERT	BASIC/VM	2

Program to insert new data from NEWDAT into the proper LYS### file.

LYS.ZP	FORTRAN	30

Program to plot lysimeter data according to user specifications. The output file is user-specified. Complete documentation is included along with the source code.

---

*LYS.ZP	R-COMPILED	75

Executable version of LYS.ZP (R-mode).

LYS781	DATA	15

Lysimeter data from 1978 for Charlton soil.

LYS782	DATA	12

Lysimeter data from 1978 for Windsor soil.

LYS791	DATA	7

Lysimeter data from 1979 for Charlton soil.

LYS792	DATA	7

Lysimeter data from 1979 for Windsor soil.

N15	BASIC/VM	2

Program to print calculated and running totals of NO3-N15 lysimeter data.

N15781	COMOUTPUT	35

Table of NO3-N15 data from 1978 for Charlton soil.

N15782	COMOUTPUT	24

Table of NO3-N15 data from 1978 for Windsor soil.

N15791	COMOUTPUT	12

Table of NO3-N15 data from 1979 for Charlton soil.

N15792	COMOUTPUT	12

Table of NO3-N15 data from 1979 for Windsor soil.

NEWDAT	DATA	4

Data file containing one parameter's updated values. The file contains a description of the correct format.

NO1XXX	DATA	3

Calculated and measured values for NO3 concentration at 7.5 cm. The file is set up for input to ZPLOT (see ALEXIS > UTILITY).

TABL781	COMOUTPUT	80

Table of 1978 data for Charlton soil, produced by a run of WWLYS.

TABL782	COMOUTPUT	55

Table of 1978 data for Windsor soil, produced by a run of WWLYS.

TABL791	COMOUTPUT	36

Table of 1979 data for Charlton soil, produced by a run of WWLYS.

TABL792	COMOUTPUT	37

Table of 1979 data for Windsor soil, produced by a run of WWLYS.

WWAPP	BASIC/VM	2

Program to print just the wastewater application data.

WWAPP78	COMOUTPUT	6

Table of wastewater application data from 1978.

WWAPP79	COMOUTPUT	3

Table of wastewater application data from 1979.

WWDAT78	DATA	3

Wastewater application data for 1978.

WWDAT79	DATA	2

Wastewater application data for 1979.

WWLYS	BASIC/VM	4

Program to print lysimeter data in tabular form.

3.1.3.1 EXPER > LYS > DART

This sub-UFD contains programs and other files related to the lysimeter study that were imported from Dartmouth. As such, none of these programs are usable on the Prime system. This sub-UFD contains 63 records.

FILE NAME	TYPE	SIZE
FOUR	BASIC	5
LYSPLOT	BASIC	6
LYSPLOT1	BASIC	6
LYSPLOT2	BASIC	6
LYSPLOT3	BASIC	6

PLOTCOL1	BASIC	20
PLOTCOMP	BASIC	13

All of the files above are Tektronix plotting programs to plot lysimeter data according to user specifications. They were replaced on the Prime system by LYS.ZP.

3.1.4 EXPER > METALS

This sub-UFD contains a data storage and retrieval package for the heavy metals study carried out at CRREL. This sub-UFD contains 242 records.

FILE NAME	TYPE	SIZE
GETMETAL	FORTRAN	6

Program to retrieve and print user-specified portions of the heavy metals data. The output may be written at the terminal, to a file, or both, at the user's choice. It reads data from PPMDATA and SYMBOLS.

PPMDATA	DATA	117

Contains the raw data from the heavy metals study. The sample names are listed at the beginning of the file, followed by one data block for each sample. Each data block contains nine lines -- one line for the sample name and eight lines in the FORTRAN format (A1,E8.4,5(X,A1,E8.4)). This gives a total of 48 data values, one for each metal in the study. The data values are listed in the same order as the chemical abbreviations for the metals found in SYMBOLS. This file is simply a new format of the data file ALEXIS > EXPER > METALS > DART > DATAMETL, which was transferred from Dartmouth.

SYMBOLS	DATA	1

Contains the chemical abbreviations for the metals included in the study. There are eight lines of data, each of which is in the FORTRAN format (12A2). The order in which the metals occur in this file is the same as the order in which the data occurs in each data block of PPMDATA. This file is simply a new format of ALEXIS > EXPER > METALS > DART > METAL, which was transferred from Dartmouth.

3.1.4.1 EXPER > METALS > DART

This sub-UFD contains the original Dartmouth version of the heavy metals data storage and retrieval package. It contains 117 records.

FILE NAME	TYPE	SIZE
DATAMETL	DATA	85

Contains the heavy metals data. This file was stored in random-access form on the Dartmouth system, but since the Prime system does not support random-access files, DATAMETL is a sequential access file with one data value per line.

METAL	DATA	1

Chemical abbreviations for all the metals in the study. Like DATAMETL, this file was random-access on the Dartmouth system but has been stored on the Prime with one value per line.

METALS	BASIC	9

Program to print heavy metals data in tabular form. It reads from METAL and DATAMETL.

NUMBER	BASIC	1

Program to print the entire heavy metals data file in raw form. It reads from DATAMETL.

NUMERO	BASIC	2

Program to print out a user-specifiable section of the heavy metals data in a tabular form. It reads from METAL and DATAMETL.

NUMERO1	BASIC	2

Same as NUMERO, except that there is a printing limit of 11 samples.

UPMETAL	BASIC	16

Program to update and print the heavy metals data. It reads from METAL and DATAMETL.

3.1.5 EXPER > MINN

This sub-UFD contains experimental data from the studies carried out at Apple Valley, Minnesota. It contains only one record.

3.1.6 EXPER > OFLOW

This sub-UFD contains data from the overland flow experiment carried out at CRREL. The data are divided into three sub-UFDs, called CLIMATE (soil temperature and meteorological data), HARVEST (plant harvest data) and WATERQ (water quality data) (Fig. 3). There are 1146 records in this sub-UFD.

3.1.6.1 EXPER > OFLOW > CLIMATE

This sub-UFD contains temperature data from the overland flow experiment. The data files have names in the format OF<YY><MM>, where <MM> is a two-digit number representing the month and <YY> is a two-digit number representing the year. For instance, the data file named "OF7906" contains the temperature data for June of 1979.

The data files each consist of a variable number of data blocks. The first line of each block contains the hour, minute and day when the measurements were taken (in FORTRAN format: I2,I3,I4). Each data line within the block specifies the channel number and data value for a single measurement (in FORTRAN format: I3,F7.1). The channel numbers are as follows:

40 - blank
41 - blank
42 - test section A, top, 3" depth.
43 - test section B, top, 3" depth.
44 - test section C, top, 3" depth.
45 - air

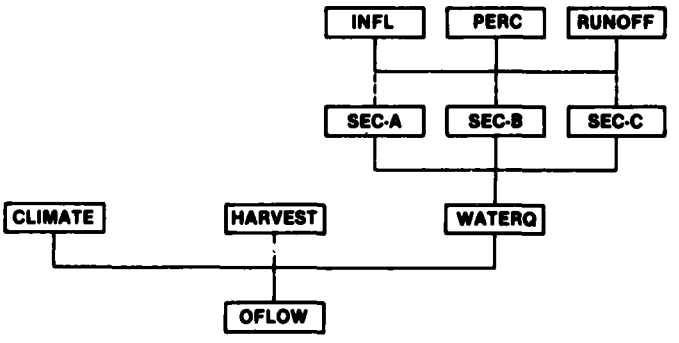


Figure 3. Structure of the OFLOW sub-UFD.

46 - test section A, middle, 0.5" depth.
47 - test section B, middle, 0.5" depth.
48 - test section C, middle, 0.5" depth.
49 - runoff water

A data line with a channel number of 999 marks the end of each data block. The total size of this sub-UFD is 683 records.

3.1.6.2 EXPER > OFLOW > HARVEST

This sub-UFD contains harvest data from the overland flow experiment; it contains 2 records. See publication 80-001 (App. A).

FILE NAME	TYPE	SIZE
HARVDATA	DATA	1

Contains overland flow harvest data. There is one data block for each harvest date, and each data block consists of four lines: one line for the date and three lines for data. The date is in MM/YY format. The data lines are in FORTRAN format 3(F6.1), where the first value is the plant yield, the second value is the N uptake, and the third value is the P uptake, all in units of kg/ha. The first data line corresponds to test section A, the second to section B, and the third to section C.

3.1.6.3 EXPER > OFLOW > WATERQ

This sub-UFD contains water quality data from the overland flow experiment. The data is divided into three sub-UFDs, called SEC-A (test section A), SEC-B (test section B), and SEC-C (test section C) (Fig. 3). Each of these sub-UFDs is further divided into three sub-UFDs, according to the type of water being analyzed: INFL (influent wastewater), PERC (percolate water), and RUNOFF (runoff water). For example, the sub-UFD ALEXIS > EXPER > OFLOW > WATERQ > SEC-A > RUNOFF contains the data files from the analysis of runoff water quality from test section A. The data files themselves are named as follows:

AMMON. . . . . ammonium
BOD. . . . . biological oxygen demand
CA . . . . . calcium
CARTOT . . . . total carbon
CL . . . . . chloride
COND . . . . . specific conductance
FCOLF. . . . . fecal coliform
FOSFAT . . . . phosphate
FOSTOT . . . . total phosphorus

FSTRP. . . . . fecal streptococcus
INGCAR . . . . inorganic carbon
MAG. . . . . magnesium
NA . . . . . sodium
NITK . . . . . kjeldahl nitrogen
NITRAT . . . . nitrate
NITRIT . . . . nitrite
NITTOT . . . . total nitrogen
ORGCAR . . . . organic carbon
ORGNIT . . . . organic nitrogen
PH . . . . . pH
POTAS. . . . . potassium
TSS. . . . . total suspended solids
VSS. . . . . volatile suspended solids
WATER. . . . . water volume

All of these data files adhere to the same format. The first line is alphanumeric and gives the units in which the data is expressed. Each of the remaining lines contains a data value, the date on which the measurement was taken, and a code number corresponding to the type of measurement being made. The FORTRAN format for each data line is (F10.4,2X,3I2,I4).*

This sub-UFD contains 460 records. See publications 78-003, 79-006 and 80-004 (App. A).

3.1.7 EXPER > ROOTS

This sub-UFD contains the data from the root characteristics study carried out as part of the test cell experiment at CRREL. Also included is a data storage and retrieval package to manipulate the data and to calculate parameters that can be determined from the measured values. There are 192 records in this sub-UFD.

FILE NAME	TYPE	SIZE
AUGOUT	OUTPUT	5
Output from SYS using AUGU79 as input (see SAMPL.RUN).		
AUGU79	DATA	2
Sample file of raw roots data in a format for input to SYS.		

*Contact Tom Jenkins, Earth Sciences Branch, CRREL, for more information on these data.

DMLCDT	DATA	3

Dry mass total and total root length data for Charlton soil, set up for input to ZPLOT (see ALEXIS > UTILITY).

DMLWDT	DATA	4

Dry mass total and total root length data for Windsor soil, set up for input to ZPLOT (see ALEXIS > UTILITY).

ROOT	BASIC/VM	3

Program to calculate root characteristics from the count, the dry mass total, and the dry subsample mass.

ROOTOUT	COMOUTPUT	5

Sample output from ROOT using existing data.

ROOT$$	DATA	61

Main roots data file (maintained by SYS).

RTDATA	OUTPUT	36

Complete list of roots data, in a printable format. This is the output from SYS.

SAMPLE.RUN	COMOUTPUT	1

Sample run of SYS demonstrating its options.

SYS	FORTRAN	18

The main program for the calculation and management of roots data.

---

*SYS	R-COMPILED	34

Executable version of SYS (R-mode).

TABLES	FORTRAN	5

Program reads roots data from TBLDAT (which presently does not exist), computes the mean values for LV, LA, R and D, and prints its results in the file TBLOUT. Complete documentation is included along with the source code.

TBLOUT	OUTPUT	1

Tables of roots data, in a printable format. This is the output from TABLES.

TLOG FORTRAN 4

Program reads roots data from TLDATA (which presently does not exist), performs some simple calculations, and outputs its results to LENDAT in a raw form. Complete documentation is included along with the source code.

TPLT FORTRAN 4

Program reads roots data for R, DV and LA from the file PLTDAT (which presently does not exist), computes the mean values for each month, soil type and depth, and outputs results to six output files (one for each soil and data type). Complete documentation is included along with the source code.

3.1.8 EXPER > STATS

This sub-UFD contains many small data files and two statistical programs to analyze them. There are 138 records in this sub-UFD. See publication 80-003 (App. A).

FILE NAME TYPE SIZE

AMNSOC DATA 1

Ammonium values for October showing the effect of N-serve.

STATCELL BASIC/VM 18

This program determines the means for user-specified main effects and interactions for analysis of the possible designs: comlete factorial (fully crossed design), complete factorial with replications, completely nested and partially nested designs, and split plot and repeated measures.

GRASS DATA 1

Percent nitrogen of test cell grasses for the summer of 1978.

HARVEST DATA 1

Plant yield study -- June, August and October comparison.

LMLRE	FORTRAN	23

This program performs a multiple linear regression of up to 99 observations on up to 40 variables. It prints the matrix of corrected sums of squares and cross products, the Gaussian multipliers, the sample partial correlation coefficients, their standard errors, an analysis of variance, the best coefficients, and a step-down regression.

LOGNH4-3	DATA	3

Natural logarithm of ammonium values in test cell cores: cell 3.

LOGNH4-4	DATA	3

Natural logarithm of ammonium values in test cell cores: cell 4.

LOGNO3-3	DATA	3

Natural logarithm of nitrate values in test cell cores: cell 3.

LOGNO3-4	DATA	3

Natural logarithm of nitrate values in test cell cores: cell 4.

NH4	DATA	5

Ammonium values in test cell cores: cells 3 and 4.

NH4--3	DATA	3

Ammonium values in test cell cores: cell 3.

NH4--4	DATA	3

Ammonium values in test cell cores: cell 4.

NH4-COM	DATA	1

Ammonium values for July - October comparison.

NH4-JULY	DATA	4

Ammonium values in test cell cores: cells 3 and 4.

NH4-OCT DATA 1

Ammonium values for 0-7.5cm depths: cells 3 and 4.

NHNSOCT DATA 1

Ammonium values for 9 days in October showing the effect of N-serve.

NO3--3 DATA 3

Nitrate values in test cell cores: cell 3.

NO3--4 DATA 3

Nitrate values in test cell cores: cell 4.

NO3-COM DATA 1

Nitrate values for July - October comparison.

NO3-JULY DATA 4

Nitrate values in test cores: cells 3 and 4.

NO3-OCT DATA 1

Nitrate values for 0-7.5cm depth: cells 3 and 4.

NONSOCT DATA 1

Nitrate values for 9 days in October showing the effect of N-serve.

NSERVNHJ DATA 1

Ammonium values for July showing the effect of N-serve.

NSERVNOJ DATA 1

Nitrate values for July showing the effect of N-serve.

NTNSOCT DATA 1

Nitrate values for October showing the effect of N-serve.

OUTPUT1- DATA 3

Revised ammonium values for test cell 3 (July 1978).

PLOTS DATA 1

Forage yield for test cells in June 1978 showing the effect of distance.

RNH-COM DATA 1

Ammonium values for July - October comparison (0-7.5 cm depth).

RNH3SE DATA 5

Revised ammonium values for the test cells in July 1978 showing the effect of soil.

RNH3TW DATA 4

Revised ammonium values for July 1978 showing the effect of soil, the day and the week.

RNO-COM DATA 1

Nitrate values for July - October comparison (0-7.5 cm depth).

RNO3SE DATA 5

Revised nitrate values for the test cells in July 1978 showing the effect of soil.

RNO3TW DATA 4

Revised nitrate values for July 1978 showing the effect of soil, the day and the week.

SALAHNH4 DATA 2

Nitrification inhibition (N-serve: NH4).

SALAHNO3 DATA 2

Nitrification inhibition (N-serve: NO3).

SALAHNS3	DATA	2

Nitrapyrin and sodium trithiocarbonate comparison: NO3.

SALAHNS4	DATA	2

Nitrapyrin and sodium trithiocarbonate comparison: NH4.

TABLE1	DATA	3

Revised ammonium values for test cell 3 in July 1978.

TABLE2	DATA	3

Revised nitrate values for test cell 3 in July 1978.

TABLE3	DATA	3

Revised ammonium values for test cell 4 in July 1978.

TABLE4	DATA	3

Revised nitrate values for test cell 4 in July 1978.

TCDIFJ	DATA	1

Comparison NH4 values in July showing the effect of N-serve (untreated).

TCHAR	DATA	1

Test cell forage yield for June 1978.

TCYIELD	DATA	1

Plant yield study showing the effect of N-serve.

3.1.9 EXPER > TCELLS

This sub-UFD contains data from the test cells experiment carried out at CRREL. The data are divided into four sub-UFDs, called CLIMATE (soil temperature and meteorological data), HARVEST (plant harvest data), WATERQ (water quality data), and SOILCHEM (soil chemistry data) (Fig. 4). This sub-UFD contains 4447 records.

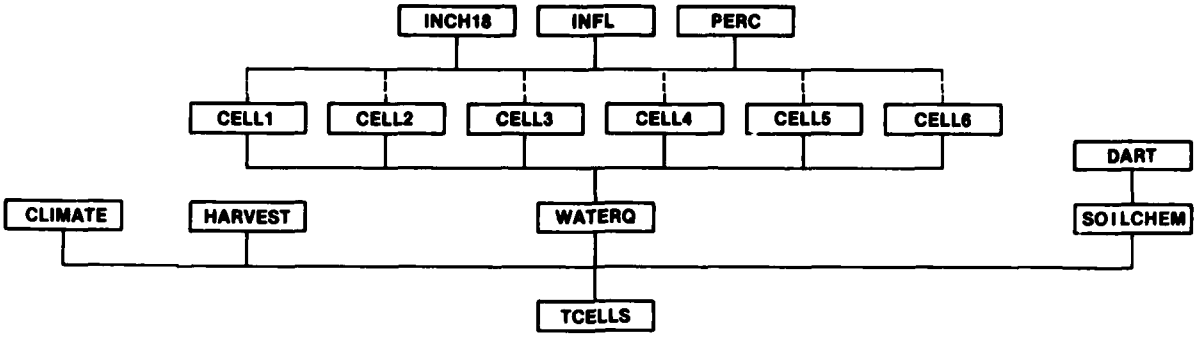


Figure 4. Structure of the TCELLS sub-UFD.

3.1.9.1 EXPER > TCELLS > CLIMATE

This sub-UFD contains temperature data for the test cells experiment. The data files have names in the format TC<YY><MM>, where <MM> is a two-digit number representing the month and <YY> is a two-digit number representing the year. For instance, the data file named "TC7810" contains the temperature data for October of 1978.

The data files each consist of a number of data blocks. The first line of each block contains the hour, minute and day when the measurements were taken (in FORTRAN format: I2,I3,I4). Each data line within the block specifies the channel number and data value for a single measurement (in FORTRAN format: I3,F7.1). The channel numbers are as follows:

00 - Air	01 - Surface	02 - C1 WT at 0"
03 - C1 WT at 6"	04 - C1 WT at 12"	05 - C1 WT at 24"
06 - C2 WFX at 3"	07 - C2 WFX at 12"	08 - C2 WFX at 24"
09 - C2 WT at 0"	10 - C2 WT at 3"	11 - C2 WT at 6"
12 - C2 WT at 12"	13 - C2 WT at 24"	14 - C2 WXR at 0"
15 - C2 WXR at 3"	16 - C2 WXR at 6"	17 - C2 WXR at 12"
18 - C2 WXR at 24"	19 - C3 WT at 0"	20 - C3 WT at 3"
21 - C3 WT at 6"	22 - C3 WT at 12"	23 - C3 WT at 24"
24 - C4 CX at 3"	25 - C4 CX at 6"	26 - C4 CX at 12"
27 - C4 CX at 24"	28 - C4 CT at 0"	29 - C4 CT at 6"
30 - C4 CT at 12"	31 - C4 CT at 24"	32 - C5 CT at 0"
33 - C5 CT at 6"	34 - C5 CT at 12"	35 - C5 CT at 24"
36 - C6 CT at 0"	37 - C6 CT at 6"	38 - C6 CT at 12"
39 - C6 CT at 24"		

This sub-UFD contains 2601 records. See publication 78-006 (App. A).

3.1.9.2 EXPER > TCELLS > HARVEST

This sub-UFD contains harvest data from the test cells experiment. It

contains 10 records. See publications 76-002, 77-002, 78-004, 79-004, 81-005 and 81-008 (App. A).

FILE NAME	TYPE	SIZE
FORMAT	TEXT	2

Contains an explanation of the format of HARVDATA.

HARVDATA	DATA	7

Contains test cells harvest data. The format of this file is explained in FORMAT.

3.1.9.3 EXPER > TCELLS > WATERQ

This sub-UFD contains water quality data from the test cells experiment. The data is divided into six sub-UFDs, called CELL1 (test cell 1), CELL2 (test cell 2), CELL3 (test cell 3), CELL4 (test cell 4), CELL5 (test cell 5) and CELL6 (test cell 6) (Fig. 4). Each of these sub-UFDs is further divided into three sub-UFDs called INCH18 (water quality at the 18 in. soil depth), INFL (influent water quality) and PERC (percolate water quality). For instance, the sub-UFD ALEXIS > EXPER > TCELLS > WATERQ > CELL6 > INFL contains the data from the analysis of influent wastewater for test cell 6 of the test cell experiment. The data files themselves are named as follows:

AMMON. . . . . ammonium
BOD. . . . . biological oxygen demand
CA . . . . . calcium
CARTOT . . . . total carbon
CL . . . . . chloride
COND . . . . . specific conductance
FCOLF. . . . . fecal coliform
FOSFAT . . . . phosphate
FOSTOT . . . . total phosphorus
FSTRP. . . . . fecal streptococcus
INGCAR . . . . inorganic carbon
MAG. . . . . magnesium
NA . . . . . sodium
NITK . . . . . kjeldahl nitrogen
NITRAT . . . . nitrate
NITRIT . . . . nitrite
NITTOT . . . . total nitrogen
ORGCAR . . . . organic carbon
ORGNIT . . . . organic nitrogen
PH . . . . . pH
POTAS. . . . . potassium

TSS. . . . . total suspended solids
VSS. . . . . volatile suspended solids
WATER. . . . . water volume

All of these data files adhere to the same format. The first line is alphanumeric and gives the units in which the data is expressed. Each of the remaining lines contains a data value, the date when the measurement was taken, and a code number corresponding to the type of measurement being made. The FORTRAN format for each data line is (F10.4,2X,3I2,I4).* This sub-UFD contains 1425 records. See publications 76-001, 77-001, 78-002, 78-008 and 81-008 (App. A).

3.1.9.4 EXPER > TCELLS > SOILCHEM

This sub-UFD contains the test cell soil chemistry data and related files. There are 410 records in this sub-UFD. See publications 75-001, 78-002, 79-005 and 81-008 (App. A).

FILE NAME	TYPE	SIZE
COLDAT	DATA	60
Test cell soil chemistry data. This is DATACOL in a new format.		
DATAFILE	DATA	30
Test cell soil chemistry data. This is created by MAKEFILE, which has data in DATA statements.		
DATAFILE1	DATA	40
Test cell soil chemistry data. This is in the format brought over from Dartmouth (one number per line).		
MAKEFILE	BASIC/VM	35
Program to create DATAFILE. This file has the data in DATA statements.		
OUTPUT1	COMOUTPUT	26
Sample output from PRINTER with the following sort parameters: 4,5,6,7,8,9,10,11,12,13,14,15.		
OUTPUT2	COMOUTPUT	19
Sample output from PRINTER with the following sort parameters: 4,5,16,17,18,19,20,21.		

*Contact Tom Jenkins, Earth Sciences Branch, CRREL, for more information on these data.

PRINTER BASIC/VM 29

Program to sort and print soil chemistry data in tabular form.

SOIL.ZP1 FORTRAN 20

Zeta plotting program to plot soil chemistry data vs depth according to user specifications. It reads from COLDAT and the output file is user-specified. The complete documentation is included along with the source code.

SOIL.ZP2 FORTRAN 19

Zeta plotting program to plot soil chemistry data vs year according to user specifications. It reads from COLDAT and the output file is user-specified. The complete documentation is included along with the source code.

SOIL.ZP3 FORTRAN 15

Zeta plotting program to plot one type of soil chemistry data vs another according to user specifications. Reads from COLDAT, output file is user-specified. Complete documentation is included along with the source code.

SPACE_COMMA COMINPUT 1

Program to change all spaces to commas in output of MAKEFILE.

3.1.9.4.1 EXPER > TCELLS > SOILCHEM > DART

This sub-UFD contains the original Dartmouth versions of the soil chemistry data files and related programs. It contains 114 records.

NAME	TYPE	SIZE

COLUMN1 BASIC 18

Main program for updating and printing soil chemistry data (in DATACOL).

DATACOL DATA 24

Test cell soil chemistry data.

PLOTCVSC	BASIC	31

Tektronix plotting program to plot one type of soil chemistry data vs another according to user specificatins. It reads from DATACOL. It is replaced by SOIL.ZP3 on the Prime system.

PLOTTER	BASIC	34

Tektronix plotting program to plot soil chemistry data vs year or vs depth, according to user specifications. It reads from DATACOL. It is replaced by SOIL.ZP1 and SOIL.ZP2 on the Prime system.

PRTCOL1	BACKGROUND	1

Program to print COLUMN1 on the high-speed line printer.

SORTCOL1	BASIC	5

Program to shell-sort soil chemistry data (in DATACOL) by day, month and year.

3.1.10 EXPER > U.WASH

This sub-UFD contains data from the land treatment experiments carried out at the University of Washington. It contains 1298 records. See publications 77-003, 78-001, 79-001, 79-003 and 81-006 (App. A).

FILE NAME	TYPE	SIZE
FIELD	DATA	1208

Field data. This file consists of 4480 data "blocks," each of which contains 32 data "fields." These fields occupy a total of four lines, which are labeled in column 1 of the line as "A," "B," "C" and "D," respectively. For alphanumeric fields, a blank field indicates no data. For numeric fields, a value of "********" indicates no data. The field number, data type, location in block, name, and possible values for each field are as follows:

Field #1 (alphanumeric, line A, cols 3-5): vegetation area. The possible values are BR = barren plot, CT = cottonwood plot, DF = douglas fir plot, GR = grass plot, IRR = irrigated plot, FR = forest plot, and UF = undisturbed forest plot.

Field #2 (alphanumeric, line A, cols 7-11): treatment. The possible values are MW = model water, RW = river water, WW = wastewater, PREC = precipitation, CHEK, LAB, and LT.

Field #3 (alphanumeric, line A, cols 13-14): soil horizon. The possible values are A = horizon A, B = horizon B, C = horizon C, and L = horizon L.

Field #4 (alphanumeric, line A, cols 16-21): sampling device. The possible values are FC = field candle, PL = lysimeter plate, TANK, and FIELD.

Field #5 (alphanumeric, line A, cols 23-25): sample period. The values are of three possible formats: I, D<N>, or M<N>, where <N> is an integer, I = initial, D<N> = integrated on a daily basis with <N> measurements during period M<N>, and M<N> = integrated on a monthly basis.

Field #6 (numeric, line A, cols 27-32): date. The format is YYMMDD.

Field #7 (numeric, line A, cols 34-39): volume.
Field #8 (numeric, line A, cols 41-48): conductivity.
Field #9 (numeric, line A, cols 50-57): pH.
Field #10 (numeric, line A, cols 59-66): alka.
Field #11 (numeric, line A, cols 68-75): Kjeldahl nitrogen.
Field #12 (numeric, line B, cols 3-10): ammonium.
Field #13 (numeric, line B, cols 12-19): nitrate.
Field #14 (numeric, line B, cols 21-28): total phosphorus.
Field #15 (numeric, line B, cols 30-37): phosphate.
Field #16 (numeric, line B, cols 39-46): potassium.
Field #17 (numeric, line B, cols 48-55): calcium.
Field #18 (numeric, line B, cols 57-64): manganese.
Field #19 (numeric, line B, cols 66-73): sulfate.
Field #20 (numeric, line C, cols 3-10): total organic carbon.
Field #21 (numeric, line C, cols 12-19): drops.
Field #22 (numeric, line C, cols 21-28): sodium.
Field #23 (numeric, line C, cols 30-37): chlorine.
Field #24 (numeric, line C, cols 39-46): sampling period.
Field #25 (numeric, line C, cols 48-55): total carbon.
Field #26 (numeric, line C, cols 57-64): sulfur.
Field #27 (numeric, line C, cols 66-73): rainfall.
Field #28 (numeric, line D, cols 3-10): irrigated water.
Field #29 (numeric, line D, cols 12-19): runoff water.
Field #30 (numeric, line D, cols 21-28): percolate water.
Field #31 (numeric, line D, cols 30-37): nitrite.
Field #32 (numeric, line D, cols 39-46): INIRR.

METEOR DATA 89

Meteorological data for August 1976 to September 1979. The data are arranged in a tabular format with the following column headings: 1)

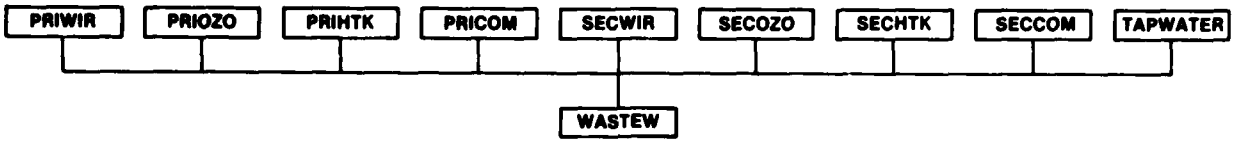


Figure 5. Structure of the WASTEW sub-UFD.

ID, 2) date, 3) solar radiation, 4) wind speed, 5) minimum air temperature, 6) maximum air temperature, 7) average air temperature, 8) soil temperature #1, 9) soil temperature #2, 10) precipitation, 11) dew point, and 12) potential evapotranspiration.

3.1.11 EXPER > WASTEW

This sub-UFD contains data from the analysis of wastewater used in the test cells and overland flow experiments at CRREL. The data are divided into nine sub-UFDs according to the general data type: PRIWIR (Primary view), PRIOZO (Primary ozone), PRIHTK (Primary holding tank), PRICOM (Primary composite), SECWIR (Secondary view), SECOZO (Secondary ozone), SECHTK (Secondary holding tank), SECCOM (Secondary composite), and TAPWATER (tapwater) (Fig. 5). Within each of these sub-UFDs there are data files that are named according to the following convention:

AMMON. . . . . ammonium
BOD. . . . . biological oxygen demand
CA . . . . . calcium
CARTOT . . . . total carbon
CL . . . . . chloride
COND . . . . . specific conductance
FCOLF. . . . . fecal coliform
FOSFAT . . . . phosphate
FOSTOT . . . . total phosphorus
FSTRP. . . . . fecal strepto
INGCAR . . . . inorganic carbon
MAG. . . . . magnesium
NA . . . . . sodium
NITK . . . . . Kjeldahl nitrogen
NITRAT . . . . nitrate
NITRIT . . . . nitrite
NITTOT . . . . total nitrogen
ORGCAR . . . . organic carbon
ORGNIT . . . . organic nitrogen
PH . . . . . pH
POTAS. . . . . potassium
TSS. . . . . total suspended solids
VSS. . . . . volatile suspended solids
WATER. . . . . water volume

All of these data files adhere to the same format. The first

line is alphanumeric and gives the units in which the data is expressed. Each of the remaining lines contains a data value, the date when the measurement was taken, and a code number corresponding to the type of measurement being made. The FORTRAN format for each data line is (F10.4,2X,3I2,I4).* This sub-UFD contains 350 records.

3.2 MODEL

This sub-UFD contains files related to mathematical modeling or computer simulation programs. These files are divided into separate sub-UFDs according to the developer of the model. This sub-UFD contains 1602 records.

3.2.1 MODEL > LEGGETT

This sub-UFD contains Dan Leggett's modeling work. It contains 47 records. See publication 81-003 (App. A).

FILE NAME	TYPE	SIZE
DAN6	BASIC	46

Program for simulating nitrification in soil amended with NH4+. The dynamics of NH4+, NO2-, and NO3- concentrations are computed, as are NH4+ oxidizer and NO2- oxidizer populations. The inputs required are temperature (degrees C.), pH, initial NH4+ oxidizer population (ml**-1), initial NO2- oxidizer population (ml**-1), initial NH4+ concentration (mg/l), initial NO2- concentration (mg/l), initial NO3- concentration (mg/l), and length of simulation (weeks). A subroutine that plots the results is included.

3.2.2 MODEL > MEHRAN

This sub-UFD contains the modeling work of Mohsen Mehran. His work is divided into two sub-UFDs called CONCEPTUAL (conceptual modeling) and DYNAMIC (dynamic modeling). This sub-UFD contains 560 records. See publication 81-004 (App. A).

FILE NAME	TYPE	SIZE
MEHRAN	FORTRAN	36

A large nitrogen simulation program that reads from MEHDAT, THETAX, SINKXX and FLUXXX, and writes to THETAX, SINKXX, FLUXXX and KINDMO. The program includes documentation along with the source code.

*Contact Tom Jenkins, Earth Sciences Branch, CRREL, for more information on these data.

MM	DATA	3

Measured and calculated values of plant uptake, leaching losses, and nitrogen concentration for test cells 1-6 (1973-78), unformatted.

MMOUT	TEXT	6

Table of measured vs calculated values of plant uptake, leaching losses, and concentration for test cells 1-6 (1973-78).

MTC3W1	DATA	1
MTC3W2	DATA	1
MTC4W1	DATA	1
MTC4W2	DATA	1
MWINW2	DATA	1

3.2.2.1 MODEL > MEHRAN > CONCEPTUAL

This sub-UFD contains Mehran's conceptual modeling work. There are 41 records in this sub-UFD. See publication 81-004 (App. A).

FILE NAME	TYPE	SIZE
CONCEPTUAL	FORTRAN	12

Transient state conceptual model for estimating mass emissions of nitrogen from cropped lands. Documentation is included along with the source code.

*CONCEPTUAL	R-COMPILED	18

Executable version of CONCEPTUAL (R-mode).

INPUT	DATA	1

Data file used by CONCEPTUAL.

OUTPUT	OUTPUT	9

Output file from CONCEPTUAL that uses FORTRAN printer control characters.

3.2.2.2 MODEL > MEHRAN > DYNAMIC

This sub-UFD contains Mehran's dynamic modeling work. It contains 467 records. See publication 81-004 (App. A).

FILE NAME	TYPE	SIZE
FLUXMM	DATA	52

Data file used by ND.

ND	FORTRAN	23

Dynamic nitrogen simulation model for transport, transformations, and plant uptake of NO3 and NH4 in land-applied secondary sewage operations. It reads from FLUXMM, SINKMM, THETAM and NINPUT, and outputs to NOUTPT. The documentation is included along with the source code.

#ND	V-COMPILED	34

Executable version of ND (V-mode).

NINPUT	DATA	2

Data file used by ND.

NOUTPT	OUTPUT	253

Output from ND, including FORTRAN printer control characters.

SINKMM	DATA	51

Data file used by ND.

THETAM	DATA	51

Data file used by ND.

3.2.3 MODEL > SELIM

This sub-UFD contains H.M. Selim's modeling work. There are 992 records in this sub-UFD. See publications 78-005, 80-002 and 80-005 (App. A).

FILE NAME	TYPE	SIZE
H.COND.D	DATA	1

Input file for H.COND.Z.

H.COND.Z	FORTRAN	9

Zeta plotting program to predict hydraulic conductivity of a soil sample from its moisture content vs water tension graph and from a single point of the hydraulic conductivity graph (the sample value at saturation). The input and output files are user-selectable. Documentation is included as part of the source. This program is intended as a replacement for the Dartmouth Tektronix plotting program H.COND.

P_TRIALN	COMINPUT	1

Program to run TRIALN as a phantom user.

SEL	DATA	1

Input data for old TRIALN (16-day simulation).

SELOUT	OUTPUT	202

Output from TRIALN using SEL as input. Includes FORTRAN printer control characters.

SEL7	DATA	1

Input data for old TRIALN (7-day simulation).

SEL7OUT	OUTPUT	22

Output from TRAILN using SEL7 as input. Includes FORTRAN printer control characters.

TRIAL	DATA	5

Input data for TRIALN (122 day simulation).

TRIALN	FORTRAN	47

Program to predict the behavior of ammonium and nitrate nitrogen species in the soil in land treatment systems. The documentation is included along with the source code.

TRIALOUT	OUTPUT	691

Output from TRIALN using TRIAL as input. Includes FORTRAN printer control characters.

TRIALRUN	COMOUTPUT	1

Record of a run of P_TRIALN.

3.2.3.1 MODEL > SELIM > DART

This sub-UFD contains Dartmouth files written by H.M. Selim. It contains 10 records.

FILE NAME	TYPE	SIZE
H.COND	BASIC	8

Tektronix plotting program to predict hydraulic conductivity of a soil sample from its moisture content vs water tension graph and from a single point of the hydraulic conductivity graph (the sample value at saturation). The input and output files are user-selectable.

H.COND.D	DATA	1

Input file for H.COND.

3.3 TAPES

This sub-UFD contains MAGRST tape indexes for each position (logical file) on the four magnetic tapes used by the ALEXIS account. The file naming convention is as follows: C<I>_LT<J> is the tape index for tape number <I> at position number <J>. For example, CR0073_LT73 contains a tape index for position 3 of tape 73. The four tapes used by the ALEXIS account are numbers 73, 74, 137 and 138.

3.4 UTILITY

This sub-UFD contains programs that are of general application throughout the account. There are 113 records in this sub-UFD.

FILE NAME	TYPE	SIZE
ASTATS	FORTRAN	4

Program to compute the correlation coefficient, mean and standard deviation for two sets of data. The documentation is included as part of the source.

DOUBLE	FORTRAN	5

Program to convert all the single precision real constants in a source file to double precision. The user may require that the program prompt at the terminal for permission to go ahead before making each change.

HOLFIL	FORTRAN	6

Program to fill the gaps in a table of data according to the Yates method. The documentation is included as part of the source.

INLN$A	FORTRAN	1

Subroutine to print a user-supplied message and then read a line of integers from the terminal.

LINEAR	BASIC/VM	4

Calculates the best linear fit for several independent variables to a single dependent variable. It also computes the correlations between the independent and dependent variables. The documentation is included as part of the source.

MAGLINES	TEXT	1

File contains the standard MAGNET (magnetic tape utility) commands used to write a single file in exportable format.

MAKESPOOLER	FORTRAN	2

Program to create a command file that will spool all the printable files in the currently attached sub-UFD with line numbers. Directory

files (for sub-UFDs or V-mode run files) and files whose names begin with "*" or "B_" are not spooled. The files are spooled in alphabetical order. There is a maximum of 100 files, set by the parameter MAXFIL.

---

*MAKESPOOLER R-COMPILED 18

Executable version of MAKESPOOLER (R-mode).

MAKETAPER FORTRAN 3

Program to create a command file that will write an exportable mag tape of the entire currently attached sub-UFD, except for segmented files. The files are written in alphabetical order, with one exception: files with names of the form *<FNAME> or B_<FNAME> are written immediately following the file named <FNAME> (if one exists). There is a maximum of 100 files, set by the parameter MAXFIL. The record length is specified at run time.

---

*MAKETAPER R-COMPILED 17

Executable version of MAKETAPER (R-mode).

MAXLEN BASIC/VM 1

Program to determine the length of the longest line in a user-specified input file.

PLTWWD FORTRAN 26

Zeta plotting program to draw a data vs date plot according to user specifications.

STRPAC1 PMA 6

Package of machine language subroutines to facilitate the manipulation of characters and strings in FORTRAN.

STRPAC2 FORTRAN 7

Package of FORTRAN subroutines to facilitate the manipulation of characters and strings. The documentation included as part of the source.

UPCASE BASIC/VM 1

Program to convert an entire file from lower case to upper case.

ZPLOT	FORTRAN	10

Zeta plotting program to plot one set of data vs another according to user specifications. The complete documentation is included along with the source code.

3.5 WDBASE

This sub-UFD contains data storage and retrieval packages for string and numeric data not associated with any particular land treatment experiment. It contains 914 records.

3.5.1 WDBASE > BIBLIO

This sub-UFD contains bibliographical entries for journals, reports, technical letters and other publications related to the land treatment of wastewater, as well as a FORTRAN program to selectively sort and print this data according to user specifications. This sub-UFD contains 313 records.

FILE NAME	TYPE	SIZE
BIBDATA	DATA	1

Input file for BIBSORT. It contains entry type definitions and output format strings.

BIBREP	TEXT	7

RUNOFF data for the cover page, preface, title page and abstract of The Corps of Engineers Land Treatment Research Program: An Annotated Bibliography.

BIBSORT	FORTRAN	17

Program to selectively sort and print bibliographical data according to user specifications.

#BIBSORT	V-COMPILED	93

Executable version of BIBSORT (V-mode).

CRUNCH	FORTRAN	2

Program to read a sorted list of author names and page numbers and to output runoff data for an author index.

DTLS	DATA	10

Bibliographical data for draft translations.

ETLS	DATA	8

Bibliographical data for engineering technical letters.

INDEXP	OUTPUT	6

Output from CRUNCH.

INTREPS	DATA	24

Bibliographical data for internal reports.

JOURNALS	DATA	80

Bibliographical data for publications in open literature.

PRESENTS	DATA	16

Bibliographical data for abstracts of presentations.

REPORTS	DATA	39

Bibliographical data for technical reports.

THESES	DATA	8

Bibliographical data for theses.

3.5.2 WDBASE > EXISYS

This sub-UFD contains the existing systems data base, which was originally created and developed on the Dartmouth Time Sharing System. As of 1 September 1982 no part of this data base had been converted to a Prime-compatible format. There are 212 records in this sub-UFD. See publications 78-007 and 79-002 (App. A).

3.5.2.1 WDBASE > EXISYS > DART

This sub-UFD contains Dartmouth versions of the existing systems data base files. It contains 211 records.

FILE NAME	TYPE	SIZE
BLANK	BASIC	3

Program to remove blank entries from domestic and foreign existing systems data files.

DATESORT	BASIC	11

Program to separate existing systems data by date created.

DOM.LOC	DATA	6

Names and locations of domestic existing systems.

DOM.NUM	DATA	11

Numeric data for domestic systems.

DOM.PAP	DATA	42

Bibliographical data on papers concerning domestic existing systems.

FOR.LOC	DATA	2

Names and locations of foreign existing systems.

FOR.NUM	DATA	3

Numeric data for foreign systems.

FOR.PAP	DATA	14

Bibliographical data on papers concerning foreign existing systems.

PATCH	BASIC	2

Program to make direct changes to existing systems data files.

SEARCH1	BASIC	20

Program to selectively sort and print existing systems data.

SEARCH2 BASIC 20

Revised version of SEARCH1.

SRCHBAS BASIC 13

Revised version of SEARCH1, written in the simpler of Dartmouth's BASIC dialects.

SRCHPL1 PL1 11

Revised version of SEARCH1, written in PL/1.

SUBSORT BASIC 1

Package of sorting subroutines used by SEARCH1.

UPDATBAS BASIC 21

Revised version of UPDATE1, written in the simpler of Dartmouth's BASIC dialects.

UPDATE1 BASIC 23

Program to update existing systems data files.

WWBIBLIO BASIC 7

Program to produce an alphabetically ordered bibliography of existing systems data.

3.5.3 WDBASE > INDEX

This sub-UFD contains the programs and data files that are used to produce this report. See Section 6 for more information on this. This sub-UFD contains 388 records. See publication 81-007 (App. A).

FILE NAME TYPE SIZE

ABSTRACT DATA 8

Contains the RUNOFF code for the abstract of this report.

CON.PRINT	OUTPUT	4

Contains a printable version of the table of contents of this report. It is produced by using RUNOFF on the file CONTENTS.

CONTENTS	DATA	4

Contains the RUNOFF code for the table of contents of this report.

COVER	DATA	1

Contains the RUNOFF code for the cover page of this report.

DECIMAL	DATA	1

Contains the RUNOFF decimalization code.

DOC.PRINT	OUTPUT	135

Contains a printable version of this report.

DOCUMENT	DATA	1

Contains the RUNOFF commands used to process this report.

FILES	DATA	45

Contains a list of file names and descriptions used as input by FILPRO.

FILPRO	FORTRAN	3

Program to input the file names and descriptions from FILES and to output the corresponding RUNOFF code to SEC3.BODY.

---

*FILPRO	R-COMPILED	16

Executable version of FILPRO (R-mode).

FORMAT	DATA	1

Contains the RUNOFF commands for page format.

INDEXER	FORTRAN	5

Program to produce the RUNOFF code for an alphabetically ordered file index with page number references. It inputs from FILES and DOC.PRINT and outputs to SEC4.

---

*INDEXER R-COMPILED 52

Executable version of INDEXER (R-mode).

PREFACE DATA 2

Contains the RUNOFF code for the preface of this report.

SEC1 DATA 3

Contains the RUNOFF code for Section 1 of this report.

SEC2 DATA 7

Contains the RUNOFF code for Section 2 of this report.

SEC3.BODY DATA 74

Contains the RUNOFF code for the body of Section 3 of this report.

SEC3.HEAD DATA 4

Contains the RUNOFF code for the introduction to Section 3 of this report.

SEC4 DATA 15

Contains the RUNOFF code for Section 4 of this report (the file index).

SEC5 DATA 5

Contains the RUNOFF code for Section 5 of this report.

SEC6 DATA 8

Contains the RUNOFF code for Section 6 of this report.

---

4. INDEX

BIBDATA	DATA	WDBASE>BIBLIO>BIBDATA	37
BIBREP	TEXT	WDBASE>BIBLIO>BIBREP	37
BIBSORT	FORTRAN	WDBASE>BIBLIO>BIBSORT	37
#BIBSORT	V-COMPILED	WDBASE>BIBLIO>#BIBSORT	37
BLANK	BASIC	WDBASE>EXISYS>DART>BLANK	39
COLDAT	DATA	EXPER>TCELLS>SOILCHEM>COLDAT	25
COLUMN1	BASIC	EXPER>TCELLS>SOILCHEM>DART>COLUMN1	26
CON.PRINT	OUTPUT	WDBASE>INDEX>CON.PRINT	41
CONCEPTUAL	FORTRAN	MODEL>MEHRAN>CONCEPTUAL>CONCEPTUAL	31
*CONCEPTUAL	R-COMPILED	MODEL>MEHRAN>CONCEPTUAL>*CONCEPTUAL	31
CONTENTS	DATA	WDBASE>INDEX>CONTENTS	41
COVER	DATA	WDBASE>INDEX>COVER	41
CRUNCH	FORTRAN	WDBASE>BIBLIO>CRUNCH	37
DAN6	BASIC	MODEL>LEGGETT>DAN6	30
DATACOL	DATA	EXPER>TCELLS>SOILCHEM>DART>DATACOL	26
DATAFILE	DATA	EXPER>TCELLS>SOILCHEM>DATAFILE	25
DATAFILE1	DATA	EXPER>TCELLS>SOILCHEM>DATAFILE1	25
DATAMETL	DATA	EXPER>METALS>DART>DATAMETL	13
DATESORT	BASIC	WDBASE>EXISYS>DART>DATESORT	39
DECIMAL	DATA	WDBASE>INDEX>DECIMAL	41
DMLCDT	DATA	EXPER>ROOTS>DMLCDT	17
DMLWDT	DATA	EXPER>ROOTS>DMLWDT	17
DOC.PRINT	OUTPUT	WDBASE>INDEX>DOC.PRINT	41
DOCUMENT	DATA	WDBASE>INDEX>DOCUMENT	41
DOM.LOC	DATA	WDBASE>EXISYS>DART>DOM.LOC	39
DOM.NUM	DATA	WDBASE>EXISYS>DART>DOM.NUM	39
DOM.PAP	DATA	WDBASE>EXISYS>DART>DOM.PAP	39
DOUBLE	FORTRAN	UTILITY>DOUBLE	35
DTLS	DATA	WDBASE>BIBLIO>DTLS	38
ETLS	DATA	WDBASE>BIBLIO>ETLS	38
EZF	FORTRAN	EXPER>ENZYME>EZF	8
#EZF	V-COMPILED	EXPER>ENZYME>#EZF	8
FIELD	DATA	EXPER>U.WASH>FIELD	27
FILES	DATA	WDBASE>INDEX>FILES	41

FILPRO	FORTRAN	WDBASE>INDEX>FILPRO	41
*FILPRO	R-COMPILED	WDBASE>INDEX>*FILPRO	41
FLUXMM	DATA	MODEL>MEHRAN>DYNAMIC>FLUXMM	32
FOR.LOC	DATA	WDBASE>EXISYS>DART>FOR.LOC	39
FOR.NUM	DATA	WDBASE>EXISYS>DART>FOR.NUM	39
FOR.PAP	DATA	WDBASE>EXISYS>DART>FOR.PAP	39
FORMAT	DATA	WDBASE>INDEX>FORMAT	41
FORMAT	TEXT	EXPER>TCELLS>HARVEST>FORMAT	24
FOUR	BASIC	EXPER>LYS>DART>FOUR	11
GETMETAL	FORTRAN	EXPER>METALS>GETMETAL	12
GRASS	DATA	EXPER>STATS>GRASS	18
H.COND	BASIC	MODEL>SELIM>DART>H.COND	34
H.COND.D	DATA	MODEL>SELIM>H.COND.D	33
H.COND.D	DATA	MODEL>SELIM>DART>H.COND.D	34
H.COND.Z	FORTRAN	MODEL>SELIM>H.COND.Z	33
HARVDATA	DATA	EXPER>TCELLS>HARVEST>HARVDATA	24
HARVDATA	DATA	EXPER>OFLOW>HARVEST>HARVDATA	15
HARVEST	DATA	EXPER>STATS>HARVEST	18
HOLFIL	FORTRAN	UTILITY>HOLFIL	35
INDEXER	FORTRAN	WDBASE>INDEX>INDEXER	41
*INDEXER	R-COMPILED	WDBASE>INDEX>*INDEXER	42
INDEXP	OUTPUT	WDBASE>BIBLIO>INDEXP	38
INLN$A	FORTRAN	UTILITY>INLN$A	35
INPUT	DATA	MODEL>MEHRAN>CONCEPTUAL>INPUT	31
INPUT1	DATA	EXPER>ENZYME>INPUT1	8
INPUT2	DATA	EXPER>ENZYME>INPUT2	8
INSERT	BASIC/VM	EXPER>LYS>INSERT	9
INTREPS	DATA	WDBASE>BIBLIO>INTREPS	38
JOURNALS	DATA	WDBASE>BIBLIO>JOURNALS	38
LINEAR	BASIC/VM	UTILITY>LINEAR	35
LMLRE	FORTRAN	EXPER>STATS>LMLRE	19
LOGNH4-3	DATA	EXPER>STATS>LOGNH4-3	19
LOGNH4-4	DATA	EXPER>STATS>LOGNH4-4	19
LOGNO3-3	DATA	EXPER>STATS>LOGNO3-3	19

LOGNO3-4	DATA	EXPER>STATS>LOGNO3-4	19
LYS.ZP	FORTRAN	EXPER>LYS>LYS.ZP	9
*LYS.ZP	R-COMPILED	EXPER>LYS>*LYS.ZP	9
LYS781	DATA	EXPER>LYS>LYS781	9
LYS782	DATA	EXPER>LYS>LYS782	9
LYS791	DATA	EXPER>LYS>LYS791	9
LYS792	DATA	EXPER>LYS>LYS792	9
LYSPLOT	BASIC	EXPER>LYS>DART>LYSPLOT	11
LYSPLOT1	BASIC	EXPER>LYS>DART>LYSPLOT1	11
LYSPLOT2	BASIC	EXPER>LYS>DART>LYSPLOT2	11
LYSPLOT3	BASIC	EXPER>LYS>DART>LYSPLOT3	11
MAGLINES	TEXT	UTILITY>MAGLINES	35
MAKEFILE	BASIC/VM	EXPER>TCELLS>SOILCHEM>MAKEFILE	25
MAKESPOOLER	FORTRAN	UTILITY>MAKESPOOLER	35
*MAKESPOOLER	R-COMPILED	UTILITY>*MAKESPOOLER	36
MAKETAPER	FORTRAN	UTILITY>MAKETAPER	36
*MAKETAPER	R-COMPILED	UTILITY>*MAKETAPER	36
MAXLEN	BASIC/VM	UTILITY>MAXLEN	36
MEHRAN	FORTRAN	MODEL>MEHRAN>MEHRAN	30
METAL	DATA	EXPER>METALS>DART>METAL	13
METALS	BASIC	EXPER>METALS>DART>METALS	13
METEOR	DATA	EXPER>U.WASH>METEOR	28
MM	DATA	MODEL>MEHRAN>MM	31
MMOUT	TEXT	MODEL>MEHRAN>MMOUT	31
MTC3W1	DATA	MODEL>MEHRAN>MTC3W1	31
MTC3W2	DATA	MODEL>MEHRAN>MTC3W2	31
MTC4W1	DATA	MODEL>MEHRAN>MTC4W1	31
MTC4W2	DATA	MODEL>MEHRAN>MTC4W2	31
MWINW2	DATA	MODEL>MEHRAN>MWINW2	31
N15	BASIC/VM	EXPER>LYS>N15	9
N15781	COMOUTPUT	EXPER>LYS>N15781	10
N15782	COMOUTPUT	EXPER>LYS>N15782	10
N15791	COMOUTPUT	EXPER>LYS>N15791	10
N15792	COMOUTPUT	EXPER>LYS>N15792	10

ND	FORTRAN	MODEL>MEHRAN>DYNAMIC>ND	32
#ND	V-COMPILED	MODEL>MEHRAN>DYNAMIC>#ND	32
NEWDAT	DATA	EXPER>LYS>NEWDAT	19
NH4	DATA	EXPER>STATS>NH4	19
NH4--3	DATA	EXPER>STATS>NH4--3	19
NH4--4	DATA	EXPER>STATS>NH4--4	19
NH4-COM	DATA	EXPER>STATS>NH4-COM	19
NH4-JULY	DATA	EXPER>STATS>NH4-JULY	19
NH4-OCT	DATA	EXPER>STATS>NH4-OCT	19
NHNSOCT	DATA	EXPER>STATS>NHNSOCT	19
NINPUT	DATA	MODEL>MEHRAN>DYNAMIC>NINPUT	32
NO1XXX	DATA	EXPER>LYS>NO1XXX	10
NO3--3	DATA	EXPER>STATS>NO3--3	19
NO3--4	DATA	EXPER>STATS>NO3--4	19
NO3-COM	DATA	EXPER>STATS>NO3-COM	19
NO3-JULY	DATA	EXPER>STATS>NO3-JULY	19
NO3-OCT	DATA	EXPER>STATS>NO3-OCT	19
NONSOCT	DATA	EXPER>STATS>NONSOCT	19
NOUTPT	OUTPUT	MODEL>MEHRAN>DYNAMIC>NOUTPT	32
NSERVNHJ	DATA	EXPER>STATS>NSERVNHJ	19
NSERVNOJ	DATA	EXPER>STATS>NSERVNOJ	19
NTNSOCT	DATA	EXPER>STATS>NTNSOCT	19
NUMBER	BASIC	EXPER>METALS>DART>NUMBER	13
NUMERO	BASIC	EXPER>METALS>DART>NUMERO	13
NUMERO1	BASIC	EXPER>METALS>DART>NUMERO1	13
OUTPUT	OUTPUT	MODEL>MEHRAN>CONCEPTUAL>OUTPUT	32
OUTPUT	COMOUTPUT	EXPER>ENZYME>OUTPUT	8
OUTPUT1	COMOUTPUT	EXPER>TCELLS>SOILCHEM>OUTPUT1	25
OUTPUT1-	DATA	EXPER>STATS>OUTPUT1-	21
OUTPUT2	COMOUTPUT	EXPER>TCELLS>SOILCHEM>OUTPUT2	25
PATCH	BASIC	WDBASE>EXISYS>DART>PATCH	39
PLOTCOL1	BASIC	EXPER>LYS>DART>PLOTCOL1	12
PLOTCOMP	BASIC	EXPER>LYS>DART>PLOTCOMP	12
PLOTCVSC	BASIC	EXPER>TCELLS>SOILCHEM>DART>PLOTCVSC	27

PLOTS	DATA	EXPER>STATS>PLOTS	21
PLOTTER	BASIC	EXPER>TCELLS>SOILCHEM>DART>PLOTTER	27
PLTOT1	OUTPUT	EXPER>ENZYME>PLTOT1	8
PLTOT2	OUTPUT	EXPER>ENZYME>PLTOT2	8
PLTOT3	OUTPUT	EXPER>ENZYME>PLTOT3	9
PLTWWD	FORTRAN	UTILITY>PLTWWD	36
PPMDATA	DATA	EXPER>METALS>PPMDATA	12
PREFACE	DATA	WDBASE>INDEX>PREFACE	42
PRESENTS	DATA	WDBASE>BIBLIO>PRESENTS	38
PRINTER	BASIC/VM	EXPER>TCELLS>SOILCHEM>PRINTER	26
PRTCOL1	BACKGROUND	EXPER>TCELLS>SOILCHEM>DART>PRTCOL1	27
P_TRIALN	COMINPUT	MODEL>SELIM>P_TRIALN	33
REPORTS	DATA	WDBASE>BIBLIO>REPORTS	38
RNH-COM	DATA	EXPER>STATS>RNH-COM	21
RNH3SE	DATA	EXPER>STATS>RNH3SE	21
RNH3TW	DATA	EXPER>STATS>RNH3TW	21
RNO-COM	DATA	EXPER>STATS>RNO-COM	21
RNO3SE	DATA	EXPER>STATS>RNO3SE	21
RNO3TW	DATA	EXPER>STATS>RNO3TW	21
ROOT	BASIC/VM	EXPER>ROOTS>ROOT	17
ROOT$$	DATA	EXPER>ROOTS>ROOT$$	17
ROOTOUT	COMOUTPUT	EXPER>ROOTS>ROOTOUT	17
RTDATA	OUTPUT	EXPER>ROOTS>RTDATA	17
SALAHNH4	DATA	EXPER>STATS>SALAHNH4	21
SALAHNO3	DATA	EXPER>STATS>SALAHNO3	21
SALAHNS3	DATA	EXPER>STATS>SALAHNS3	22
SALAHNS4	DATA	EXPER>STATS>SALAHNS4	22
SAMPLE.RUN	COMOUTPUT	EXPER>ROOTS>SAMPLE.RUN	17
SEARCH1	BASIC	WDBASE>EXISYS>DART>SEARCH1	39
SEARCH2	BASIC	WDBASE>EXISYS>DART>SEARCH2	40
SEC1	DATA	WDBASE>INDEX>SEC1	42
SEC2	DATA	WDBASE>INDEX>SEC2	42
SEC3.BODY	DATA	WDBASE>INDEX>SEC3.BODY	42
SEC3.HEAD	DATA	WDBASE>INDEX>SEC3.HEAD	42

SEC4	DATA	WDBASE>INDEX>SEC4	42
SEC5	DATA	WDBASE>INDEX>SEC5	42
SEC6	DATA	WDBASE>INDEX>SEC6	42
SEL	DATA	MODEL>SELIM>SEL	33
SEL7	DATA	MODEL>SELIM>SEL7	33
SEL7OUT	OUTPUT	MODEL>SELIM>SEL7OUT	33
SELOUT	OUTPUT	MODEL>SELIM>SELOUT	33
SINKMM	DATA	MODEL>MEHRAN>DYNAMIC>SINKMM	32
SOIL.ZP1	FORTRAN	EXPER>TCELLS>SOILCHEM>SOIL.ZP1	26
SOIL.ZP2	FORTRAN	EXPER>TCELLS>SOILCHEM>SOIL.ZP2	26
SOIL.ZP3	FORTRAN	EXPER>TCELLS>SOILCHEM>SOIL.ZP3	26
SORTCOL1	BASIC	EXPER>TCELLS>SOILCHEM>DART>SORTCOL1	27
SPACE_COMMA	COMINPUT	EXPER>TCELLS>SOILCHEM>SPACE_COMMA	26
SRCHBAS	BASIC	WDBASE>EXISYS>DART>SRCHBAS	40
SRCHPL1	PL1	WDBASE>EXISYS>DART>SRCHPL1	40
STATCELL	BASIC/VM	EXPER>STATS>STATCELL	18
STRPAC1	PMA	UTILITY>STRPAC1	36
STRPAC2	FORTRAN	UTILITY>STRPAC2	36
SUBSORT	BASIC	WDBASE>EXISYS>DART>SUBSORT	40
SYMBOLS	DATA	EXPER>METALS>SYMBOLS	12
SYS	FORTRAN	EXPER>ROOTS>SYS	17
*SYS	R-COMPILED	EXPER>ROOTS>*SYS	17
TABL781	COMOUTPUT	EXPER>LYS>TABL781	10
TABL782	COMOUTPUT	EXPER>LYS>TABL782	10
TABL791	COMOUTPUT	EXPER>LYS>TABL791	10
TABL792	COMOUTPUT	EXPER>LYS>TABL792	10
TABLE1	DATA	EXPER>STATS>TABLE1	22
TABLE2	DATA	EXPER>STATS>TABLE2	22
TABLE3	DATA	EXPER>STATS>TABLE3	22
TABLE4	DATA	EXPER>STATS>TABLE4	22
TABLES	FORTRAN	EXPER>ROOTS>TABLES	17
TBLOUT	OUTPUT	EXPER>ROOTS>TBLOUT	17

TCDIFJ	DATA	EXPER>STATS>TCDIFJ	22
TCHAR	DATA	EXPER>STATS>TCHAR	22
TCYIELD	DATA	EXPER>STATS>TCYIELD	22
THESES	DATA	WDBASE>BIBLIO>THESES	30
THETAM	DATA	MODEL>MEHRAN>DYNAMIC>THETAM	32
TLOG	FORTRAN	EXPER>ROOTS>TLOG	18
TPLT	FORTRAN	EXPER>ROOTS>TPLT	18
TRIAL	DATA	MODEL>SELIM>TRIAL	33
TRIALN	FORTRAN	MODEL>SELIM>TRIALN	34
TRIALOUT	OUTPUT	MODEL>SELIM>TRIALOUT	34
TRIALRUN	COMOUTPUT	MODEL>SELIM>TRIALRUN	34
UPCASE	BASIC/VM	UTILITY>UPCASE	36
UPDATBAS	BASIC	WDBASE>EXISYS>DART>UPDATBAS	40
UPDATE1	BASIC	WDBASE>EXISYS>DART>UPDATE1	40
UPMETAL	BASIC	EXPER>METALS>DART>UPMETAL	13
WWAPP	BASIC/VM	EXPER>LYS>WWAPP	10
WWAPP78	COMOUTPUT	EXPER>LYS>WWAPP78	11
WWAPP79	COMOUTPUT	EXPER>LYS>WWAPP79	11
WWBIBLIO	BASIC	WDBASE>EXISYS>DART>WWBIBLIO	40
WWDAT78	DATA	EXPER>LYS>WWDAT78	11
WWDAT79	DATA	EXPER>LYS>WWDAT79	11
WWLYS	BASIC/VM	EXPER>LYS>WWLYS	11
ZPLOT	FORTRAN	UTILITY>ZPLOT	37

5. EXPORT AND CONVERSION

5.1 Hard copy and Tape Formats

Output is available in two primary forms: hard copy (produced by the high-speed line printer) and magnetic tape (produced by the tape drives). The hard-copy format is fairly straightforward -- the first page of each printout contains the banner for that printout, and the remaining pages contain the text of the file itself. The banner contains the name of the file in large letters, as well as other information such

as the time and date the file was spooled (printed) and the name of the installation (CRREL computer center). Each succeeding page of the printout is headlined with the first line of the file (which may be blank) as well as the page number. For the user's convenience, each line of the printout is labeled with the corresponding line number in the source file.

The format of the magnetic tapes is naturally more complex. The tapes are written using the Prime utility program called MAGNET, which is designed to read and write tapes to be exported or imported. Each disk file is written to its own logical file on tape. The format of the tapes may be summarized as follows:

Tracks: 9.
Density: 800 BPI (bits per inch).
Character Code: ASCII.
Logical Record Size: as required by the files being written. The record size of each file must be specified as it is written to tape, and therefore it appears in the COMOUTPUT listing file, "TAPERUN," which is exported with each tape. The most common sizes are 80, 132 and 480 characters.
Blocking Factor: 10 (10 logical records to each tape block).

With each tape comes a printout of a COMOUTPUT file, which contains a record of the MAGNET session that produced the tape. MAGNET is run once for each logical file written to tape, and the name of the disk file stored in that logical file is given following the MAGNET prompt "INPUT FILE:." Segmented run-files (V-mode files) are not written to tape.

5.2 Other Forms of Output

If the hard copy and magnetic tapes are inadequate, other forms of output are possible. The files could, for instance, be transmitted directly to the receiving system over the telephone lines, using acoustic couplers. The details would have to be worked out with CRREL's Technical Services Division, which supervises and maintains the CRREL computer system.*

5.3 Conversion Procedure

Once the desired files have been satisfactorily installed on the receiving system, discrepencies between Prime FORTRAN (or BASIC/VM) and

*Write to CRREL Technical Services Division, Attention: Gary DeCoff, U.S. Army Cold regions Research and Engineering Laboratory, Hanover, New Hampshire, 03755, or phone (603) 646-4392, extension 392, and ask for Gary DeCoff.

the new system's FORTRAN (or BASIC) will have to be resolved. Brief questions concerning the Prime-implemented languages may be brought directly to CRREL's Technical Services Division (telephone number 603-643-3200, extension 392). If further information is required, The FORTRAN Programmer's Guide and The BASIC/VM Programmer's Guide will come in handy.*

Whenever possible, example runs of the Prime programs have been made, and the input and output has been preserved. These example runs may be used to verify that a particular program has been successfully converted for use on the new system by running the new version with the sample input and comparing the results. Documentation on Dartmouth BASIC or Dartmouth file formats may be obtained by contacting the college.**

6. ABOUT THIS DOCUMENT

This report was produced using RUNOFF, a general-purpose text processing program. Using RUNOFF, copies of this document are produced by merging a number of separate files into a single output file, which is then printed on the high speed line printer. Each of the input files contains the RUNOFF code for a particular segment of this report. The two input files that contain the RUNOFF code for the file descriptions and the file index are themselves produced by FORTRAN programs designed to make this report easier to modify. Therefore, while changes to parts of this report other than Sections 3 and 4 require a detailed knowledge of RUNOFF, changes to those two sections may be made simply by following the instructions in Section 6.1. Although producing copies of this document and generating a table of contents requires some knowledge of RUNOFF, all of the necessary information is included in Sections 6.2 and 6.3, respectively. The programs and data files used to produce this report are located in ALEXIS > WDBASE > INDEX and are described in Section 3. All of the instructions and descriptions in this section assume a knowledge of the Prime system and its editors on the part of the reader.

*Available from PRIME Computer, Technical Publications Department, 500 Old Connecticut Path, Framingham, MA 01701.

**Documents and Supplies Office, Kiewit Computation Center, Dartmouth College, Hanover, NH 03755; Telephone (603) 646-2643.

6.1 UPDATING

The system of programs and other files used to produce this report has been designed to make updating and modifying as easy as possible. Changes to Sections 3 and 4, which are likely to be much more numerous than changes to other sections, may be made by an operator who has no knowledge of RUNOFF commands. He (or she) need only be familiar with the Prime system and its editors. Changes to other sections involve a direct modification of files containing RUNOFF code, and as such require some knowledge of RUNOFF commands and coding formats.

To make changes to parts of this document other than Sections 3 and 4, follow the procedure outlined below:

1) Familiarize yourself with RUNOFF; the manual is entitled The New User's Guide to Editor and Runoff and is located in the terminal room.
2) Consult Section 3 of this report to determine which file contains the RUNOFF code you wish to modify. To make changes in the Preface, for instance, you would need to modify the file whose treename is ALEXIS > WDBASE > INDEX > PREFACE.
3) Make the desired changes in the appropriate file, using the Editor.
4) You are now ready to print a new copy of this report (see Section 6.2).

Changes to Section 3 of this report (which imply a possible change in Section 4, the file index) are not made by directly modifying the RUNOFF code. A FORTRAN program called FILPRO has been written to facilitate this process and reduce errors in format. FILPRO reads a list of file names and descriptions from a file called FILES and then outputs the proper RUNOFF code to a file called SEC3.BODY. Changing the file descriptions in Section 3, then, only requires a change in FILES and then a run of the program FILPRO. The data contained in FILES is arranged according to the following rules:

1) FILES consists of a series of file entries — first the entry for a given sub-UFD and then the entries for each of the files

within that sub-UFD. File entries are separated by any line (or lines) beginning with two blanks.

2) Each file entry consists of a single header line followed by any number of file description lines. The type of entry is determined by FILPRO according to the first character of the header line. A ">" indicates that a new sub-UFD is being entered, while a "<" indicates that a file within the current sub-UFD is being described.

3) A new sub-UFD entry header line consists of a ">," a space, and then the treename of the new sub-UFD being entered. All file entries up to the next new sub-UFD entry will be considered to lie within the last entered sub-UFD.

4) A file description entry header line consists of a "<," the name of the file being described, another "<," the type of the file, another "<," and then the size of the file. The file type and size are as described by the introduction to Section 3.

5) The file description lines following either a new sub-UFD entry header line or a file description entry header line are entered into SEC3.BODY exactly as they appear in FILES. The number of characters on each file description line is irrelevent (so long as it does not exceed 80), since RUNOFF arranges the text to fill the pre-defined line width specified in FORMAT. Be careful not to begin a file description line with two spaces or with a dash, as these characters will cause FILPRO to interpret the line as something other than a file description line (see [1] and [6]).

6) Lines beginning with a dash ("-") are ignored by FILPRO and may therefore be inserted anywhere in FILES without affecting the output. This feature is intended to allow the user to make FILES more readable.

The format of FILES is probably best learned by example. Obtain a copy of the current version of FILES and examine it in conjunction with this description.

FILPRO is compiled in R-mode with the "-A" option (to include the applications library). When run, it will delete the old version of SEC3.BODY (if it exists) before writing the new version. The file entries in FILES are written to SEC3.BODY in the order in which they appear in FILES. If a problem is encountered by FILPRO as it reads FILES, the line number of the line in FILES that caused the problem will be printed, along with an error message, and program execution will cease.

A change in any section of this report that appears before Section 4, the file index, may necessitate a modification to Section 4 itself. This is done indirectly, by running a FORTRAN program called INDEXER. Before INDEXER can be run, a new printable version of this report containing at least Section 3 and all preceding sections must be processed and stored in a file called DOC.PRINT (see Section 6.2). INDEXER reads both DOC.PRINT and FILES, then outputs the RUNOFF code for the file index to a file called SEC4. If an old version of SEC4 already exists, INDEXER deletes it before writing the new version. INDEXER is compiled in R-mode and is loaded with both the applications library (APPLIB) and the in-core sorting library (MSORTS).

6.2 PRINTING COPIES

Copies of this report are obtained by running RUNOFF on a file called DOCUMENT. DOCUMENT contains the RUNOFF commands that merge the desired sections of this report into a single, printable output file. The procedure is outlined below:

1) DOCUMENT must be modified to produce the desired output. The first line of the file is of the form ".file filename," where "filename" is the name of the output file in which you want the printable text of this report to be placed. If the output file you specify on this line already exists when RUNOFF is run, it will ask for permission to delete the old version before doing so. The second line is ".insert FORMAT," which sets up the overall output format as specified in the file FORMAT. Subsequent lines are of the form ".insert filename," where "filename" is the name of the file which corresponds to the

section of this report you want to process (these files are described in Section 3). To produce this entire report, the file DOCUMENT would look like this:

```
.file DOC.PRINT
.insert FORMAT
.insert COVER
.insert PREFACE
.insert ABSTRACT
.insert DECIMAL
.insert SEC1
.insert SEC2
.insert SEC3.HEAD
.insert SEC3.BODY
.insert SEC4
.insert SEC5
.insert SEC6
```

The insert file DECIMAL is mandatory if any of the subsequent files are specified.

2) RUNOFF must be run. Type "RUNOFF DOCUMENT," and then simply hit return when the prompt "$" appears. RUNOFF will respond with "PROCESSING...," and a period of time proportional to the length of the output being produced will pass before you are returned to the Prime operating system.
3) The output file must be spooled. Type "SPOOL filename," where "filename" is the name of the output file you specified via the ".file" command in DOCUMENT.
4) The output is designed to be cut into 8.5 inch wide pages, burst, and bound in whatever manner the user desires.

6.3 GENERATING A TABLE OF CONTENTS

A file containing the RUNOFF code for a table of contents to this report may be produced by inserting a single line into DOCUMENT before running RUNOFF. The command line is of the form ".tofc filename," where "filename" is the name of the file in which you would like the RUNOFF table of contents code to be placed. It should be inserted immediately following the ".insert DECIMAL" command, and then DOCUMENT should be processed in the normal fashion (see Section 6.2). The table of contents code produced will reference only those portions of this report that are included in the run via the RUNOFF ".insert" commands

contained in DOCUMENT. Note that a change in this report anywhere after the title page may necessitate a change in (and therefore a rerun of) the table of contents.

Once the file containing the table of contents RUNOFF code has been produced, a single line may be added to improve the final table of contents format. Insert the line ".space 2" as the first line of the file. A printable table of contents file may then be produced using RUNOFF. Type "RUNOFF filename," where "filename" is the name of the file that contains the table of contents RUNOFF code. When RUNOFF prompts with a "$," type ".file filename," where "filename" is the name of the file in which you want the printable table of contents to be placed. After the next "$," hit return. RUNOFF will process the code, and the output file may then be spooled and burst as usual (see Section 6.2).

APPENDIX A. PUBLISHED REPORTS ON THE DATA FILES

Example 1: How to find a published paper or report on a specific computer program or data file.

Suppose you want to find publications on Mohsen Mehran's dynamic modeling work. Look in the table of contents under MODEL > MEHRAN > DYNAMIC, and turn to the indicated page. You will find a reference to publication 81-004. This is the fourth entry under 1981 in this appendix. Copies may be obtained from the authors or from CRREL.

Example 2: How to find a data file or computer program related to a certain publication.

Suppose you want to find the sub-UFD which contains the data referred to in publication 78-008, Five-year Performance of CRREL Land Treatment Test Cells. The citation for that report specifies the desired sub-UFD: EXPER > TCELLS > WATERQ. This is the name you specify when ordering a magnetic tape from CRREL.

82-001: Berggren, P.A. and I.K. Iskandar (1982) A users index to CRREL land treatment computer programs and data files. CRREL Special Report 82-26, November 1982 (WDBASE>INDEX).

A users index is prepared as a directory for the computer programs and data files developed at CRREL on land treatment of wastewater. Two computers were used, a Prime 400 located at CRREL and the Dartmouth Time Sharing System (DTSS) located at Dartmouth College, Hanover, New Hampshire. The objective of this directory is to allow users to locate and use or request copies of desired programs or data files, to maintain a permanent record of programs and data files developed under the land treatment program, and to assist in technology transfer.

81-001: Iskandar, I.K. and H.M. Selim (1981) Validation of a model for predicting nitrogen behavior in slow infiltration systems. In Modeling Wastewater Renovation - Land Treatment (I.K. Iskandar, ed.), John Wiley and Sons, New York, p. 508-533 (EXPER>LYS).

This chapter presents data for N model validation. The data come from a lysimeter study using N15 as a tracer. The water flow and N transport and transformation submodels of Selim and Iskandar (1981) are discussed.

81-002: Iskandar, I.K. and H.M. Selim (1981) Modeling nitrogen transport and transformations in soils: 2. Validation. Soil Science, vol. 131, p. 301-312 (EXPER>LYS).

This paper is a condensed version of the chapter by Iskandar and Selim (81-001).

81-003: Leggett, D.C. and I.K. Iskandar (1981) Evaluation of a nitrification model. In Modeling Wastewater Renovation - Land Treatment (I.K. Iskandar, ed.), John Wiley and Sons, New York, p. 313-358 (EXPER>ENZYME, MODEL>LEGGETT).

This chapter reviews the literature on modeling nitrification in soils and presents a model based on Michaelis-Menten kinetics. Model validation using laboratory data is also included.

81-004: Mehran, M., K.K. Tanji and I.K. Iskandar (1981) Compartmental modeling for prediction of nitrate leaching losses. In Modeling Wastewater Renovation - Land Treatment (I.K. Iskandar, ed.), John Wiley and Sons, New York, p. 444-477 (MODEL>MEHRAN>CONCEPTUAL, MODEL>MEHRAN>DYNAMIC).

This chapter presents a simple N model for land treatment. Evaluation of the model was accomplished by field data from Davis, California, and Hanover, New Hampshire.

81-005: Palazzo, A.J. (1981) Seasonal growth and accumulation of nitrogen, phosphorous, and potassium by orchardgrass irrigated with municipal wastewater. Journal of Environmental Quality, vol. 10, p. 64-68 (EXPER>TCELLS>HARVEST).

This two-year field study determined the seasonal growth and nutrient accumulation of a forage grass receiving 7.5 cm per week of domestic primary-treated wastewater. The average N and P concentrations in the wastewater were 31.5 and 6.1 mg per L, respectively. An established sward of 'Pennlate' orchardgrass was managed on an annual three-cutting system. Grass samples were taken periodically during the growing season to determine the plant dry matter accumulation and uptake of N, P, and K.

81-006: Riggan, P.J. and D.W. Cole (1981) Simulation of forest production and nitrogen uptake in a young Douglas Fir ecosystem. In Modeling Wastewater Renovation - Land Treatment (I.K. Iskandar, ed.), John Wiley and Sons, New York, p. 410-443 (EXPER>U.WASH).

This chapter presents a model for forest production and N uptake. The model is evaluated with field data from Pade Forest experimental site near Seattle, Washington.

81-007: Selim, H.M. and I.K. Iskandar (1981) WASTEN: A model for nitrogen behavior in soils irrigated with liquid waste. In Simulation of nitrogen behavior of soil-plant systems (M.J. Frissel and J.A. van Veen, eds.), Pudoc, Centre for Agricultural Publishing and Documentation, Wageningen, the Netherlands. (MODEL>SELIM).

This model 1) simulates the physical, chemical and biological processes of N transformation and transport in multilayered soil profiles for slow and rapid infiltration systems, 2) enables prediction of NO_3-N concentration in soil solution and leachate with time and space, 3) assists in estimating the application rate and schedule of water and N to a land treatment system.

81-008: Jenkins, T.F. and A.J. Palazzo (1981) Wastewater treatment by a slow rate land appliation system. CRREL Report 81-14 (ADA 106 975). (EXPER>TCELLS>WATERQ, EXPER>TCELLS>SOILCHEM, EXPER>TCELLS>HARVEST).

Six slow rate land treatment prototypes, three containing a Windsor sandy loam and three containing a Charlton silt loam, were studied from June 1974 to May 1980. The systems were spray irrigated with either primary or secondary wastewater at application rates ranging from 2.5 cm per week to 15 cm per week. Application schedules also were varied. The performance of forage grasses was studied to determine the yield and nutrient uptake under the various application regimes.

80-001: Palazzo, A.J., C.J. Martel and T.F. Jenkins (1980) Forage grass growth on overland flow systems. Proceedings of 1980 ASCE National Conference on Environmental Engineering, July, New York, p. 347-354 (EXPER>OFLOW>HARVEST).

This study 1) determined plant growth and nutrient removal on an overland flow slope receiving primary or secondary effluent, 2) provided information for the improvement of plant management procedures for maintaining maximum plant uptake of nitrogen and phosphorus, and 3) ascertained the feed quality and value of the plant material grown.

80-002: Iskandar, I.K., L. Parker, C. McDade, J. Atkinson and A.P. Edwards (1980) Dynamics of NH_4 and NO_3 in cropped soils irrigated with wastewater. CRREL Special Report 80-27, 20 p. (ADA 090 575) (EXPER>STATS).

This field study 1) obtained information on the dynamic behavior of wastewater NH_4 and NO_3 in soils, 2) determined the relative abundance of NH_4 and NO_3 in soils receiving wastewater, and 3) evaluated any seasonal affect on the fate of wastewater NH_4 applied to soils in a slow infiltration system. The study was conducted using an on-going test plot with two soil types and a forage grass cover.

80-003: Martel, C.J., T.F. Jenkins and A.J. Palazzo (1980) Wastewater treatment in cold regions by overland flow. CRREL Report 80-7, 20 p. (ADA 084 489) (EXPER>OFLOW>WATERQ).

In this study primary effluent, secondary effluent, and tapwater were applied to separate sections of a pilot-scale overland flow site in a cold regions environment. The average application rate for each section was 5.0 cm (2.0 in.) per week. Performance was evaluated for one year, May 1977 to June 1978.

80-004: Selim, H.M. and I.K. Iskandar (1980) Simplified model for prediction of nitrogen behavior in land treatment of wastewater. CRREL Report 80-12, 53 p. (ADA 085 191) (MODEL>SELIM).

A simplified model for simulation of nitrogen transformations and transport in land treatment of wastewater is presented. The purpose of the model is to predict the behavior of NH_4-N and NO_3-N in the soil profile in land treatment systems. The program is based on the solution of the transient soil water flow equation simultaneously with the equations describing the transformation, transport, and plant uptake of nitrogen in the soil. The program is valid for uniform as well as multilayered soil profiles and can be adapted to incorporate various nitrogen transformation mechanisms and boundary conditions.

79-001: Breuer, D.W., D.W. Cole and P. Schiess (1979) Nitrogen transformation and leaching associated with wastewater irrigation in Douglas-fir, poplar, grass and unvegetated systems. In Municipal Wastewater and Sludge Recycling on Forest Land and Disturbed Land (W.E. Sopper, ed.), Pennsylvania State University Press, University Park, Penn., p. 19-33 (University of Washington) (EXPER>U.WASH).

This study evaluates the nitrogen transformations and transport process in coniferous and deciduous forest systems. The study includes an experimental system at Pack Forest near Seattle, Washington. This paper gives an overview of the site and initial results on the nitrification process and nitrate leaching characteristics.

79-002: Iskandar, I.K. (1979) Selected design parameters of existing systems for land application of liquid waste: A computer file. Proceedings, 2nd Madison Annual Conference on Municipal Waste Management, Madison, Wisconsin, September, 1979, p. 65-88 (WDBASE>EXISYS).

A computer file is established to store and retrieve information on design parameters, performance characteristics and published information on existing land treatment systems. The purpose of establishing this file is to provide assistance to design engineers during the planning of new land treatment systems.

Two computer programs, both written in BASIC, are included. Program "SEARCH" was developed to locate systems with specific design parameters, such as flow rate, waste type, application rate and mode, ground cover, and length of operation (years). The printout from SEARCH includes a list of articles on similar systems in addition to the design parameters. The other program called "UPDATE" is constructed for updating or revising the file as information becomes available.

Currently there are about 350 domestic and 75 foreign systems on file. Two hypothetical examples are included for illustration.

79-003: Johnson, D.W., D.W. Breuer and D.W. Cole (1979) The influence of anion mobility on ionic retention in wastewater-irrigated soils. Journal of Environmental Quality, vol. 8, no. 2, p. 146-250 (University of Washington) (EXPER>U.WASH).

This paper offers a conceptual model of soil leaching mechanisms and provides baseline information that may be used to construct land treatment design guidelines incorporating total environmental fluxes. All the major anions are considered collectively. Their production and mobility are related to the total ionic leaching following irrigation of municipal wastewater on a forest soil.

79-004: Palazzo, A.J. and T.F. Jenkins (1979) Land application of wastewater: Effect on soil and plant potassium. Journal of Environmental Quality, vol. 8, p. 309-312 (EXPER>TCELLS>HARVEST).

This study reports on the removal of potassium by a forage grass mixture from soil that received applications of wastewater over a five-year period. The forages, which received wastewater at a rate of 5.0 cm per week, were grown on either Windsor sandy

loam (typic Udipsament) or Charlton silt loam (typic Dystrochrept) soil. The wastewater annually supplied from 231 to 433 kg per ha of N and 36 to 153 kg per ha of K.

79-005: Iskandar, I.K., S.T. Quarry, R.E. Bates and J. Ingersoll (1979) Documentation of soil characteristics and climatology during five years of wastewater application to CRREL test cells. CRREL Special Report 79-23, 87 p. (ADA 074 712)(EXPER>TCELLS>SOILCHEM).

This report is a collection of the information gathered during the past five years of a field study on slow infiltration land treatment of wastewater. Emphasis focuses on presenting actual data as well as detailed descriptions of the methods used. Very little discussion is included.

79-006: Jenkins, T.F. et al. (1979) Prototype overland flow test data: June 1977 - May 1978. CRREL Special Report 79-35, 97 p. (ADA 069 405) (EXPER>OFLOW>WATER).

This study presents data from a one-year study involving a prototype overland flow land treatment system. Water quantity and quality data are presented as well as plant yields and nutrient uptake. The soil chemical and physical parameters measured are also presented along with a table of initial site characteristics. The meteorological measurements obtained in support of this effort are included to complete the data base.

78-001: Cole, D.W. and P. Schiess (1978) Renovation of wastewater and response of forest ecosystems: The Pack Forest Study. In State of Knowledge in Land Treatment of Wastewater, Proceedings of International Symposium (H.L. McKim, Coordinator), Hanover, N.H., vol. 1, p. 323-331 (EXPER>U.WASH).

Wastewater from a secondary treatment facility is irrigated on seedlings, an established 45-year-old Douglas-fir forest, a barren plot, and a grass plot. Ion fluxes within the soil and nutrient utilization by the vegetative cover are monitored monthly. Calculation of the efficiencies of these forest systems in renovating applied wastewater is included.

78-002: Iskandar, I.K. (1978) The effect of wastewater reuse in cold regions on land treatment systems. Journal of Environmental Quality, vol. 7, p.361-368 (EXPER>TCELLS>WATERQ, EXPER>TCELLS> SOILCHEM).

Six outdoor test cells were used to investigate the effect of land treatment of municipal wastewater in a cold region on ground water quality, soils, and vegetation. The organic C, DOB, suspended solids, fecal coliform, and phosphorus levels were determined for the two soils used. The principal mechanisms for nitrogen removal are discussed. The movement of applied heavy metals was also monitored.

78-003: Jenkins, T.F., C.J. Martel, D.A. Gaskin, D.J. Fisk and H.L. McKim (1978) Performance of overland flow land treatment in cold climates. In State of Knowledge in Land Treatment of Wastewater, Proceedings of International Symposium (H.L. McKim, Coordinator), Hanover, N.H., vol. 2, p. 61-70 (EXPER>OFLOW>WATERQ).

This study evaluates the performance of overland flow systems, especially during the winter months. Primary wastewater, secondary wastewater, and tapwater were applied to separate sections of a prototype overland flow site. Composite water samples were analyzed for pH, BOD, TOC, SS, NO_3, TKN, NH_4, total P, major cations, fecal coliform, conductivity and chloride.

78-004: Palazzo, A.J. and H.L. McKim (1978) The growth and nutrient uptake of forage grasses when receiving various application rates of wastewater. In State of Knowledge in Land Treatment of Wastewater, Proceedings of International Symposium (H.L. McKim, Coordinator), Hanover, N.H., vol. 2, p. 157-163 (EXPER>TCELLS> HARVEST).

The growth and nutrient removal of forage grasses that received three years of wastewater application are reported in this study. The forages received wastewater at various application rates and schedules and grew in either a Windsor sandy loam or a Charlton silt loam soil. Plant and soil analyses were performed on representative samples during the study.

78-005: Selim, H.M. and I.K. Iskandar (1978) Nitrogen behavior in land treatment of wastewater: A simplified model. In State of Knowledge in Land Treatment of Wastewater, Proceedings of International Symposium (H.L. McKim, Coordinator), Hanover, N.H., vol. 1, p. 171-179 (MODEL>SELIM).

A simplified mathematical model is developed that describes transformations and transport of nitrogen under transient soil water flow conditions. Kinetic reactions are assumed to govern the nitrification and denitrification processes. A macroscopic approach is used to incorporate plant uptake of water as well as NO_3-N and NH_4-N from the soil solution. The sensitivity of the model to changes in rate of N transformation, N uptake by plants, and schedule and amounts of N application are also investigated. The model can be used as a tool to predict the fate of nitrogen in land treatment systems. The model is flexible and can be adapted to incorporate various nitrogen transformation mechanisms as well as layerings in the soil profile.

78-006: Bilello, M.A. and R.E. Bates (1978) Climatic survey at USACRREL in association with the land treatment project. CRREL Special Report 78-21, 39 p. (ADA 062 518) (EXPER>TCELLS>CLIMATE).

Six test cells at CRREL were used to study the effect of wastewater application on various soil types and vegetation. This paper reports basic information about the climate proximate to these test cells. This report describes the equipment used and its installation, and provides summarized results of the collected climatic data. Meteorological considerations for the operation of wastewater treatment systems are presented in reference to the operation of the CRREL test program.

78-007: Iskandar, I.K., D. Robinson, W. Willcockson and E. Keefauver (1978) Computer file for existing land application of wastewater systems: A user's guide. CRREL Special Report 78-22, 28 p. (ADA 062 658) (WDBASE>EXISYS).

These two computer programs, both written in BASIC, store and retrieve information on existing wastewater land treatment systems. These programs provide assistance to design engineers during the planning of new land treatment systems by making available the design criteria and performance characteristics of operating systems. The SEARCH program locates systems with specific design parameters, such as flow rate, waste type, application rate and mode, ground cover and length of operation. The printout from SEARCH includes a list of articles on similar systems in addition to the design parameters. The UPDATE program is used for the revision of information on file. Currently there are about 350 domestic and 75 foreign systems on file.

78-008: Jenkins, T.F. et al. (1978) Five-year performance of CRREL land treatment test cells. CRREL Special Report 78-26, 27 p. (ADA 086 172) (EXPER>TCELLS>WATERQ).

The performance of the six land treatment test cells is summarized over a five-year period from June 1973 through May 1978. The data presented include quality and volume of wastewater applied and percolate resulting from application of primary and secondary wastewater by spray irrigation. Mass loadings and removals are presented as well as crop production and nutrient uptake. Nutrient balance sheets are shown which demonstrate the percentage of nitrogen and phosphorus that is attributed to crop uptake and leachate over this period.

77-001: Iskandar, I.K., R.S. Sletten, T.F. Jenkins and D.C. Leggett (1977) Wastewater treatment alternative needed. Water and Wastes Engineering, vol. 14, no. 11, p. 82-87 (EXPER>TCELLS>WATERQ).

Wastewater application rate, effect of pre-application treatment, soil type and seasonal effects are considered in this land treatment of wastewater study by using prototype test cells.

77-002: Palazzo, A.J. (1977) Land application of wastewater: Forage growth and utilization of applied nitrogen, phosphorus and potassium. In Land as a Waste Management Alternative, Proceedings 1976 Cornell Agricultural Waste Management Conference (R.C. Loehr, ed.). Ann Arbor Michigan: Ann Arbor Science Publishers, Inc., p. 171-180 (EXPER>TCELLS>HARVEST).

This two-year study characterizes the effectiveness of a forage mixture in renovating wastewater when applied to land at several application rates. Nutritional changes through soil and plant analysis are determined to permit correction, where necessary, through proper management procedures.

77-003: Johnson, D.W. and D.W. Cole (1977) Anion mobility in soils: Relevance to nutrient transport from terrestrial to aquatic ecosystems. Ecological Research Series, EPA 600 3-77-068 (distributed by NTIS # PB-271 725), 28 p. (University of Washington) (EXPER>U.WASH).

This report reviews the current knowledge of soil anion adsorption reactions and their effects on leaching, and suggests a simple model, based on anion production and adsorption considerations, to predict and explain nutrient transport. The relationship of this approach to that based on cation production and adsorption is discussed.

76-001: Iskandar, I.K., R.S. Sletten, D.C. Leggett and T.F. Jenkins (1976) Wastewater renovation by a prototype slow infiltration land treatment system. CRREL Report 76-19, 54 p. (ADA 029 744) (EXPER>TCELLS>WATERQ).

The feasibility of a slow-infiltration land treatment system as an alternative to advanced waste treatment of wastewater was studied using six outdoor test cells. Wastewater was applied to forage grasses by spray irrigation. The parameters studied were wastewater and application rate, effect of pretreatment and soil type and seasonal effects on the treatment system.

76-002: Palazzo, A.J. (1976) The effects of wastewater application on the growth and chemical composition of forages. CRREL Report 76-39, 13 p. (ADA 032 774) (EXPER>TCELLS>HARVEST).

The data presented in this report are related to the capabilities of the vegetation in renovating land applications of wastewater. This information is useful when applied to the design and operation of a land treatment system.

Also included in the report are results that reflect on the management of a system for sustained plant performance and nitrogen removal.

75-001: Iskandar, I.K. (1975) Urban waste as a source of heavy metals in land treatment. In Proceedings, International Conference on Heavy Metals in the Environment, Toronto, Ontario, Canada, 27-31 October, 1975, p. 417-432 (EXPER>TCELLS>SOILCHEM).

Heavy metal accumulation in soils and forages of a slow infiltration land treatment system during a two-year period is discussed. Uptake of heavy metals by plants and soils is compared with the amount applied, soil type, and mode of wastewater application.

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