

PART F

FORMAT FOR THE USER'S CONTROL INPUT

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1.0 GENERAL INFORMATION AND CONVENTIONS

1.1 The User's Control Input

The User's Control Input (UCI) consists of text lines limited to 80 characters. A general feature of the UCI is that the lines are collected into groups. Groups may contain subordinate groups; that is, they may be nested. In every case, a group commences with a heading (such as RUN) and ends with a delimiter (such as END RUN).

The HSPF system will ignore any line in the UCI which contains three or more consecutive asterisks (***), just as a computer language compiler bypasses comments in a source program. Blank lines are also ignored. This feature can be used to insert headings and comments which make the text more intelligible to the reader, but are not required or read by the HSPF system itself.

The body of the User's Control Input consists of one or more major groups of text, called RUN input sets:

```
<RUN input set 1>
<RUN input set 2>
-----
-----
```

A RUN input set contains all the input needed to perform a single RUN. A RUN is a set of operations with a common START date-time and END date-time.

1.2 General Comments on Method of Documentation

The documentation of each portion of the UCI is divided into three sections: "layout", "details", and "explanation".

The "layout" section shows how the input is arranged. Text always appearing in the same form (e.g., RUN) is shown in upper case. Text which varies from job to job is shown by lower case symbols enclosed in angle brackets (<spa>). Lines containing illustrative text, not actually required by the system, have three consecutive asterisks, just as they might have in the UCI. Optional material, or that which is not always required, is enclosed in brackets []. The column numbers printed at the head of each layout show the starting location of each keyword and symbol.

The "details" section describes the input values required for each symbol appearing in the layout. The Fortran identifiers used to store the value(s) in the code are given, followed by the format. The field(s) specified in this format start in the column containing the < which immediately precedes the symbol in the layout. For example, < range >, which consists of the starting and ending operations that the current line applies to, starts in column 1 and ends in column 10. Where relevant, the Details section also indicates default values and minimum and maximum values for each item in the UCI.

The "explanation" section contains any necessary explanatory material which could not fit into the details section.

2.0 FORMAT OF A TSSMGR DATA SET (omitted)

Note: the TSSMGR module and all other TSS functionality is no longer documented or maintained; refer to Version 10 (or earlier) documentation for details.

3.0 SAMPLE TSSMGR INPUT SET (omitted)

4.0 FORMAT OF THE USERS CONTROL INPUT

Summary

The User's Control Input starts with a RUN heading and ends with an END RUN delimiter. The body of the text consists of several groups, called "blocks," which may appear in any sequence:

RUN

GLOBAL Block

Contains information of a global nature. It applies to every operation in the RUN.

FILES Block

Specifies disk files to be used by the run and their file unit numbers.

OPN SEQUENCE Block

Specifies the operations to be performed in the RUN, in the sequence they will be executed. It indicates any grouping (INGROUPS).

<Operation-type> Block

Deals with data pertaining to all the operations of the same <Operation-type>, for example, parameters and initial conditions for all Pervious Land-segments in a RUN. It is not concerned with relationships between operations, or with external sources or targets for time series. There is one <Operation-type> Block for each <operation-type> involved in the RUN.

[FTABLES Block]

A collection of function tables (FTABLES). A function table is used to document, in discrete numerical form, a functional relationship between two or more variables. FTABLES are used to specify the depth-volume-discharge relationship for RCHRES operations.

[EXT SOURCES Block]

Specifies time series which are input to the operations from external sources (WDM file, DSS file, or sequential (SEQ) files).

[NETWORK Block]

Specifies any time series which are passed between operations.

[EXT TARGETS Block]

Specifies those time series which are output from operations to external destinations (WDM or DSS file).

[SCHEMATIC Block]

Specifies structure of watershed, i.e., connections of land segments and stream reaches to each other. Operates in tandem with MASS-LINK block to simplify definition of complex watersheds.

[MASS-LINK Block]

Specifies groups of time series to combine with network connections defined in the SCHEMATIC block in order to specify mass flows in the watershed.

[MONTH-DATA Block]

Specifies monthly values of atmospheric deposition fluxes and concentrations (in rain) for water quality constituents.

[CATEGORIES Block]

Specifies the number of water categories to be simulated in the streams and reservoirs represented by RCHRES operations.

[PATHNAMES Block]

Associates DSS pathnames with data-set ID numbers for all DSS data sets in the EXT SOURCES and EXT TARGETS blocks.

[FORMATS Block]

Contains any user-supplied formats which may be required to read time series on external sequential (SEQ) files.

[SPEC-ACTIONS Block]

Specifies operation, variable location, type or name, date/time and action code in order to change a variable's value during a run.

END RUN

Usually, a User's Control Input will not include all of the above blocks. Their presence will be dictated by the operations performed in the RUN and the options which are selected.

4.1 GLOBAL Block

This block must always be present in a RUN input set.

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

GLOBAL

```
<----- run-info ----->
START <---s-date-time---> END<---e-date-time--->
RUN INTERP OUTPT LEVELS<lev><spa>
RESUME <res> RUN <run> UNITS <ufg>
END GLOBAL
```

Example

GLOBAL

```
Seven Mile River - Water quality run
START      1980/01/01 00:00  END      1987/12/31 12:00
RUN INTERP OUTPT LEVELS      4      3
RESUME      0 RUN      1 UNITS      1
END GLOBAL
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<run-info>	RUNINF(20)	A78	none	none	none
<s-date-time>	SYR,	I8,	none	1	32767
	SMO,	1X,I2,	1	1	12
	SDA,	1X,I2,	1	1	varies
	SHR,	1X,I2,	0	0	23
	SMI	1X,I2	0	0	59
<e-date-time>	EYR,	I8,	none	1	32767
	EMO,	1X,I2,	12	1	12
	EDA,	1X,I2,	varies	1	varies
	EHR,	1X,I2,	#24	0	24 #only if EMI is 0
	EMI	1X,I2	0	0	59
<lev>	OUTLEV	I5	0	0	10
<spa>	SPOUT	I5	2	0	10
<res>	RESMFG	I5	0	0	1
<run>	RUNFG	I5	0	0	1
<ufg>	EMFG	I5	1	1	2

Explanation

RUNINF stores the users title/comments regarding the RUN.

Users conventionally label the same point in time differently, depending whether they are looking forward or backward towards it. For example, if we say that a RUN starts on 1978/05 we mean that it commences at the start of May 1978. On the other hand, if we say it ends on 1978/05 we mean it terminates at the end of May 1978. Thus, HSPF has two separate conventions for the external labeling of time. When supplying values for a date/time field a user may omit any element in the field except the year, which must be supplied as a 4 digit figure. HSPF will substitute the defaults given above for any blank or zero values. The completed starting and ending date/time fields are translated into another format, which is the only one used to label intervals and time points internally. It has a resolution of 1 minute. Thus, time is recorded as a year/month/day/hour/minute set, to completely specify either a time interval or point. The date/time used by the internal clock uses the "contained within" principle. For example, the first minute in an hour is numbered 1 (not 0) and the last is numbered 60 (not 59). The same applies to the numbering of hours. Thus, the time conventionally labeled 11:15 is in the 12th hour of the day so is labeled 12:15 internally; the last minute of 1978 is labeled 1978/12/31 24:60. This convention is extended to the labeling of points by labeling it with the minute that immediately precedes it. Thus, midnight New Year's eve 1978/1979 is 1978/12/31 24:60, not 1979/01/01 00:00. This gives a system for uniquely labeling each point internally.

OUTLEV is a flag which governs the quantity of informative output produced by the Run Interpreter. A value of 0 results in minimal output; 10 results in very detailed output useful primarily for debugging the software. A value of 3 or 4 is appropriate for most runs. OUTLEV does not affect error or warning messages.

SPOUT is a flag that governs the quantity of output produced in the Run Interpreter Output file whenever a Special Action is performed during the simulation. A value of 1 results in minimal output, and a value of 10 results in maximum output.

RESMFG represents a feature that is not supported in this version of HSPF. It should be set to 0.

If RUNFG is 1, the system will both interpret the input and execute the RUN. If it is 0, only the interpretation will be done.

EMFG is the UCI units system flag for all simulation operations (i.e., PERLND, IMPLND and RCHRES operations). If EMFG is 1, all input values in the UCI file will be interpreted using the English units defined in the tables in this section (Part F) of this manual. If EMFG is 2, Metric units are assumed for UCI values.

4.2 FILES Block

```

*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****

```

Layout

FILES

```
<ftyp>  <un#>  <-----filename----->
```

```
. . . . .
```

(repeats until all files are specified)

```
. . . . .
```

END FILES

Example

FILES

```
<FTYP>  UNIT#  FILE NAME ***
```

```
WDM1      24  test.wdm
```

```
MESSU     21  test.mes
```

```
          61  test.dsp
```

```
          33  test.pls
```

END FILES

```
*****
```

Details

Symbol	Fortran Name(s)	Format	Comment
<ftyp>	FTYPE	A6	File type; valid values are: MESSU, WDM, WDM1, WDM2, WDM3, WDM4, DSS1, DSS2, DSS3, DSS4, DSS5, PLTGEN (for VAX only), and blank (" ").
<un#>	FUNIT	I5	File unit number; valid values are 1-99 (21-99 recommended).
<filename>	FNAME	A64	File name; complete path name or local name if in default/current directory.

Explanation

The FILES Block contains the names of input and output files used by the program during the run; this block associates the unit numbers specified in various parts of the UCI file with actual disk file names. It is designed to eliminate the need for a separate command file, such as a DOS batch (BAT) file or VAX command (COM) file, where the correspondence between file name and unit number is often performed for batch programs such as HSPF. Since the FILES Block requires that the program be able to locate the UCI file, HSPF prompts the user for its name. Alternatively, on DOS-based PCs, the command line for invoking HSPF may include the name of the UCI file. The syntax is as follows:

```
hspf uci-file-name <RET>
```

FTYPE is a keyword that identifies the type of file. There are twelve FTYPE's that HSPF recognizes, and FTYPE must be specified for these types of files. Note, however, that the WDM and WDM1 keywords are synonymous, and should not appear together in the same FILES block. For all other files, this field should be left blank. The FTYPE keyword should be left-justified in columns one through six. The valid FTYPE values are shown below:

<u>DESCRIPTION</u>	<u>FTYPE</u>
Run interpreter output	MESSU
Watershed Data Management	WDM, WDM1, WDM2, WDM3, WDM4
HEC Data Storage System files	DSS1, DSS2, DSS3, DSS4, DSS5
VAX (only) PLTGEN output file	PLTGEN
Other input and output files	(blank)

FUNIT is the file unit number of the file. This corresponds to the unit number of those files specified in other parts of the UCI file. FUNIT is an integer value that should be right-justified in columns 9 through 13; valid values are 1-99. Each value of FUNIT in the FILES Block should be unique, and the values 7 and 9 are reserved for internal scratch files. Preferably, values of 21 and greater should be used to avoid any conflicts.

FNAME is the name of the file. If the file is not in the current (default) directory, the complete path name should be specified. FNAME should be left-justified in columns 17 through 80.

The FILES Block is usually required. In particular, if a WDM or DSS file is needed by the run, it must be specified in the FILES Block, since the program does not have a default name for these files.

FILES Block

Similarly, for the operating modules (PERLND, IMPLND, RCHRES, DISPLY, PLTGEN, DURANL, and MUTSIN), and sequential (SEQ) time series input, the user must specify file unit numbers as the destination for printout (or source for MUTSIN or sequential time series input). Also, it is recommended that these files be explicitly assigned names in the FILES Block. However, if the user does not include an entry in the FILES block for one of these operations, a file is automatically opened by HSPF with the default name "hspfxx.dat", where xx is the unit number (except for the MESSU file, which defaults to "hspfecho.out").

4.3 OPN SEQUENCE Block

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

OPN SEQUENCE

```
      [ INGRP                INDELT <idt>]
        <-opn-id----->
          . . . . .
        <-opn-id----->
      [END INGRP  ]
        <-opn-id----->      INDELT <idt>
          . . . . .
        <-opn-id----->      INDELT <idt>
      [ INGRP                INDELT <idt>]
        <-opn-id----->
          . . . . .
      [END INGRP  ]
        . . . . .
```

END OPN SEQUENCE

Example

OPN SEQUENCE

```
      INGRP                INDELT 02:00
        PERLND             20
        PERLND             21
        PERLND             22
      END INGRP
        RCHRES             1    INDELT 12:00
```

END OPN SEQUENCE

Details

Symbol	Fortran Name(s)	Format	Comment
<idt>	HRMIN(2)	I2,1X,I2	Time interval (hour:min) used in the INPAD e.g., 00:05
<-opn-id->	OPTYP,OPTNO	A6,5X,I3	Type and number of this operation. e.g., RCHRES 100

Explanation

This block specifies the various operations to be performed in the RUN and, optionally, their grouping into INGROUPOs. The operations will be performed in the sequence specified in the block, apart from repetition implied by grouping. **A maximum of 200 operations can be specified in one run.**

Every <-opn-id-> consists of OPTYP and OPTNO. The OPTYP field must contain an identifier of up to 6 characters which corresponds to one of the operating module identifiers in the HSPF system. The OPTNO field contains an integer which distinguishes operations of the same type from one another. Every <-opn-id> (OPTYP plus OPTNO) must be unique.

The time intervals of the INGROUPOs (or the RUN) are specified in this block. These appear on the INGROUP lines, except where the user has not placed an operation in an INGROUP. In that case <idt> is specified alongside <-opn-id->.

4.3.1 Optimization of Operation Sequencing

The sequence of operations within the Operations Sequence block should be optimized to make most efficient use of the internal scratch pad (INPAD). Optimal use of the INPAD is accomplished by reducing the maximum number of time series (rows) on the INPAD. This increases the length of each row and the INSPAN, which reduces swapping between operations.

A time series occupies a row on the INPAD from the moment it is either read from an external source or is created by an operation until the moment it is used by the last operation requiring it. HSPF automatically optimizes the reading of data from external sources and writing of data to external targets.

Optimal sequencing of operations requires that an operation be executed as soon as all input timeseries produced by other operations have been created. For example, a DISPLY operation which displays outflow from a PERLND operation should immediately follow the PERLND operation. A RCHRES operation representing a section of stream should immediately follow any RCHRES operations representing reaches upstream and any PERLND operations which contribute local inflow.

For example, a watershed is represented by 4 PERLND operations, 5 RCHRES operations, 2 PLTGEN operations, 4 DISPLY operations, and 1 DURANL operation. These are defined as follows:

```

PERLND 1 - rain gage 1, land use of pasture
PERLND 2 - rain gage 1, land use of corn
PERLND 3 - rain gage 2, land use of pasture
PERLND 4 - rain gage 2, land use of corn
RCHRES 1 - local inflow from PERLND 1 and 2
RCHRES 2 - upstream inflow from RCHRES 1, local inflow from PERLND 1 and 2
RCHRES 3 - local inflow from PERLND 3 and 4
RCHRES 4 - upstream inflow from RCHRES 2 and 3, local inflow from
            PERLND 3 and 4
RCHRES 5 - upstream inflow from RCHRES 4, local inflow from PERLND 3 and 4
DISPLY 1 - outflow from RCHRES 5
DISPLY 2 - outflow from RCHRES 3
DISPLY 3 - unit flow from PERLND 2
DISPLY 4 - unit flow from PERLND 4
PLTGEN 1 - outflow from RCHRES 5, measured flow at bottom of RCHRES 5
PLTGEN 2 - outflow from RCHRES 1, area weighted sum of unit flow from
            PERLND 1 and 2
DURANL 1 - outflow from RCHRES 5

```

The optimum order for these operations is:

```

PERLND 1
PERLND 2
DISPLY 3
RCHRES 1
PLTGEN 2
RCHRES 2
PERLND 3
PERLND 4
DISPLY 4
RCHRES 3
DISPLY 2
RCHRES 4
RCHRES 5
DISPLY 1
DURANL 1
PLTGEN 1

```

4.4 <Operation-type> Block

```

*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****

```

Layout

<otyp>

General input

Section 1 input --

Section 2 input | Only supplied if the operating module contains sections
 . | and the section is active
 . |

Section N input --

END <otyp>

Details

Symbol	Fortran Name(s)	Format	Comment
<otyp>	OPTYP	A6	Type of operation covered in this block, e.g., RCHRES, PERLND

Explanation

This type of block deals with data which pertain to all operations of the same <Operation-type>, e.g., the parameters and initial conditions for all the Previous Land segments in a RUN. It is not concerned with relationships between operations or with external sources or targets for time series.

This type of block provides for general input and for input which is specific to individual sections of the operating module. The latter only apply to modules which are sectioned (PERLND, IMPLND, and RCHRES). The general input contains all of the information which simple (non-sectioned) modules require; for sectioned modules it contains input which is not specific to any one section.

The general organization of the <Operation-type> blocks is as follows:

The user supplies his input in a set of tables (e.g., ACTIVITY, Sect 4.4(1).1.1 below). Each table has a name (eg. ACTIVITY), called the "Table-type". A table starts with the heading <Table-type> and ends with the delimiter END <Table-type>. The body of the table consists of:

```
<range><-----values----->
```

where <range> is the range of operation-type numbers to which the <values> apply. If the second field in <range> is blank, the range is assumed to consist of a single operation. Thus, in the example in Sect 4.4(1).1.1, Previous Land-segments (PERLNDs) 1 through 7 have the same set of active sections, while PERLND 9 has a different set.

Thus, a table lists the values given to a specified set of variables (occupying only 1 line) for all the operations of a given type. The input was designed this way to minimize the quantity of data supplied when many operations have the same values for certain sets of input.

HSPF will only look for a given Table-type if the options already specified by the user require data contained within it. Thus, Table-type MON-INTERCEP (Sect 4.4(1).4.6) is relevant only if VCSFG in Table-type PWAT-PARM1 (4.4(1).4.1) is set to 1 for one or more PERLNDs. The system has been designed to ignore redundant information. Thus, if VCSFG is 0 and Table-type MON-INTERCEP is supplied, the table will be ignored.

On the other hand, if an expected value is not supplied, the system will attempt to use a default value. This situation can arise in one of three ways:

1. The entire table may be missing from the UCI.
2. The table may be present but not contain an entry (line) for the operation in question. The example in Sect 4.4(1).1.1 has no entry for PLS No. 8. Thus, all values in its active sections vector will have the default of 0.
3. A field may be left blank. In the example in Section 4.4(1).4.2, KVARY will acquire the default value 0.0 for PLS's 1 through 7.

When appropriate, the HSPF system will also check that a value supplied by the user falls within an allowable range. If it does not, an error message is generated.

Note that a table contains either integers or real values, but generally not both. For example, Table-type ACTIVITY (Sect 4.4(1).1.1) contains only integer flags, while Table-type PWAT-PARM2 (4.4(1).4.2) contains only real numbers. For tables containing real-valued data, the documentation gives separate defaults, minima and maxima for the English and Metric unit systems. The user specifies the units system for the UCI in the GLOBAL block.

4.4(1) PERLND Block

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

PERLND

```
  General input
[section ATEMP input]
[section SNOW input]
[section PWATER input]
[section SEDMNT input]
[section PSTEMP input]
[section PWTGAS input]
[section PQUAL input]
[section MSTLAY input]
[section PEST input]
[section NITR input]
[section PHOS input]
[section TRACER input]
```

END PERLND

Explanation

This block contains the data which are domestic to all the Pervious Land Segments in the RUN. The general input is always relevant: other input is only required if the module section concerned is active.

4.4(1).1 PERLND BLOCK -- General input

```
*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
Table-type ACTIVITY
[Table-type PRINT-INFO]
Table-type GEN-INFO
```

```
*****
```

Explanation

The exact format of each of the tables mentioned above is detailed in the documentation which follows.

Tables enclosed in brackets [] above are not always required; for example, because all the values can be defaulted.

4.4(1).1.1 Table-type ACTIVITY -- Active Sections Vector

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
ACTIVITY
<-range><-----a-s-vector----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END ACTIVITY
```

```
*****
Example
*****
```

```
ACTIVITY
  <PLS >           Active Sections          ***
  # - # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC***
  1   7   1   1   1
  9     0   0   0   1
END ACTIVITY
```

```
*****
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<a-s-vector>	ASVEC(12)	12I5	0	0	1

Explanation

The PERLND module is divided into 12 sections. The values supplied in this table specify which sections are active and which are not, for each operation involving the PERLND module. A value of 0 means inactive and 1 means active. Any meaningful subset of sections may be active.

4.4(1).1.2 Table-type PRINT-INFO -- Printout information for PERLND

```
*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
PRINT-INFO
<-range><-----print-flags-----><piv><pyr>
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END PRINT-INFO
```

```
*****
Example
*****
```

```
PRINT-INFO
  <PLS > ***** Print-flags ***** PIVL  PYR
  # - # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC *****
  1   7   2   4   6              4   3   2   10   12
END PRINT-INFO
```

```
*****
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<print-flags>	PFLAG(12)	12I5	4	2	6
<piv>	PIVL	I5	1	1	1440
<pyr>	PYREND	I5	9	1	12

Explanation

HSPF permits the user to vary the printout level (maximum frequency) for the various active sections of an operation. The meaning of each permissible value for PFLAG() is:

- 2 means every PIVL intervals
- 3 means every day
- 4 means every month
- 5 means every year
- 6 means never

In the example above, output from Pervious Land-segments 1 thru 7 will occur as follows:

Section	Maximum frequency
ATEMP	10 intervals
SNOW	month
PWATER	never
SEDMNT	--
thru	month (defaulted)
PEST	--
NITR	month
PHOS	day
TRACER	10 intervals

A value need only be supplied for PIVL if one or more sections have a printout level of 2. For those sections, printout will occur every PIVL intervals (that is, every PIVL*DELT minutes, where DELT is the number of minutes in the time step or the RUN or INGROUP). PIVL must be chosen such that there are an integer number of printout periods in a day.

HSPF will automatically provide printed output at all standard intervals greater than the specified interval. In the above example, output for section PHOS will be printed at the end of each day, month, and year.

PYREND is the calendar month which will terminate the year for printout purposes. Thus, the annual summary can reflect the situation over the past water year or the past calendar year, etc.

4.4(1).1.3 Table-type GEN-INFO -- Other general information for PERLND

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
GEN-INFO
<-range><---PLS-id----->          <unit-sys><-printu->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END GEN-INFO
```

```
*****
Example
*****
```

```
GEN-INFO
  <PLS >   PLS Name                Units   Printout ***
  # - #                                t-series Engr Metr ***
                                in  out      ***
    1      Yosemite Valley          1    1    23    24
    2      Kings river              1    1    23    24
END GEN-INFO
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<PLS-id>	LSID(5)	5A4	none	none	none
<unit-sys>	IUNITS,OUNITS	2I5	1	1	2
<printu>	PUNIT(2)	2I5	0	0	99

Explanation

Any string of up to 20 characters may be supplied as the identifier (LSID) for a PERLND.

The values supplied for <unit-sys> indicate the system of units for data in the input time series and output time series, respectively: 1 means English units, 2 means Metric units.

Note: All operations in the run must use the same units system for data in the UCI file; therefore, this system of units is specified by EMFG in the GLOBAL block.

The values supplied for PUNIT(*) indicate the destinations (files) of printout in English and metric units, respectively. A value of 0 means no printout is required in that unit system. A non-zero value means printout is required in that system, and the value is the unit number of the file to which printout is to be written. The unit number is associated with a filename in the FILES BLOCK.

Note that printout for each Impervious Land Segment can be obtained in either the English or Metric systems, or both (irrespective of the system used to supply the inputs).

4.4(1).2 PERLND BLOCK -- Section ATEMP input

```
*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

[Table-type ATEMP-DAT]

```
*****
```

Explanation

The exact format of the table mentioned above is detailed in the documentation which follows.

Tables enclosed in brackets [] above are not always required; for example, because all the values can be defaulted.

4.4(1).2.1 Table-type ATEMP-DAT -- Elevation difference between gage & PLS

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
ATEMP-DAT
<-range><el-diff-><-airtmp->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END ATEMP-DAT
```

```
*****
Example
*****
```

```
ATEMP-DAT
  <PLS >   El-diff   ***
  # - #     (ft)     ***
  1   7     150.
END ATEMP-DAT
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<el-diff>	ELDAT	F10.0	0.0	none	none	ft	Engl
			0.0	none	none	m	Metric
<airtmp>	AIRTMP	F10.0	60	-60	140	Deg F	Engl
			15	-50	60	Deg C	Metric

Explanation

ELDAT is the difference in elevation between the temperature gage and the PERLND; it is used to estimate the temperature over the segment by application of a lapse rate. ELDAT is positive if the segment is higher than the gage, and vice versa.

AIRTMP is the air temperature over the land segment at the start of the RUN.

4.4(1).3 PERLND BLOCK -- Section SNOW input

```
*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
[Table-type ICE-FLAG]
  Table-type SNOW-PARM1
[Table-type SNOW-PARM2]
[Table-type SNOW-INIT1]
[Table-type SNOW-INIT2]
```

Explanation

The exact format of each of the tables mentioned above is detailed in the documentation which follows.

Tables enclosed in brackets [] above are not always required; for example, because all the values can be defaulted.

4.4(1).3.1 Table-type ICE-FLAG -- governs simulation of ice formation in snow

```
*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
      ICE-FLAG
      <-range><ice>
      . . . . .
      (repeats until all operations of this type are covered)
      . . . . .
      END ICE-FLAG
```

```
*****
Example
*****
```

```
      ICE-FLAG
      <PLS > Ice-   ***
      # - # flag   ***
      1   7   1
      END ICE-FLAG
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<ice>	ICEFG	I5	0	0	1

Explanation

A value of 0 means ice formation in the snow pack will not be simulated; 1 means it will.

4.4(1).3.2 Table-type SNOW-PARM1 -- First group of SNOW parameters

1 2 3 4 5 6 7 8
123456789012345678901234567890123456789012345678901234567890

Layout

SNOW-PARM1
<-range><-----snowparm1----->
.
(repeats until all operations of this type are covered)
.
END SNOW-PARM1

Example

SNOW-PARM1
 <PLS > Latitude Mean- SHADE SNOWCF COVIND ***
 # - # elev ***
 1 7 39.5 3900. 0.3 1.2 10.
END SNOW-PARM1

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<snowparm1>	LAT	5F10.0	40.0	-90.0	90.0	degrees	Both
	MELEV		0.0 0.0	0.0 0.0	30000.0 10000.0	ft m	Engl Metric
	SHADE		0.0	0.0	1.0	none	Both
	SNOWCF		none	1.0	100.0	none	Both
	COVIND		none none	0.01 0.25	none none	in mm	Engl Metric

Explanation

LAT is the latitude of the pervious land segment (PLS). It is positive for the northern hemisphere, and negative for the southern hemisphere.

MELEV is the mean elevation of the PLS above sea level.

SHADE is the fraction of the PLS which is shaded from solar radiation, by trees for example.

SNOWCF is the factor by which the input precipitation data will be multiplied, if the simulation indicates it is snowfall, to account for poor catch efficiency of the gage under snow conditions.

COVIND is the maximum snowpack (water equivalent) at which the entire PLS will be covered with snow (see SNOW section in Functional Description).

4.4(1).3.3 Table-type SNOW-PARM2 -- Second group of SNOW parameters

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

SNOW-PARM2

<-range><-----snowparm2----->

.

(repeats until all operations of this type are covered)

.

END SNOW-PARM2

Example

SNOW-PARM2

<PLS >

-

RDCSN

TSNOW

SNOEVP

CCFACT

MWATER

MGMELT

1 7

0.2

33.

END SNOW-PARM2

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<snowparm2>	RDCSN	F10.0	0.15	0.01	1.0	none	Both
	TSNOW	F10.0	32.0	30.0	40.0	degF	Engl
			0.0	-1.0	5.0	degC	Metric
	SNOEVP	F10.0	0.1	0.0	1.0	none	Both
	CCFACT	F10.0	1.0	0.0	2.0	none	Both
	MWATER	F10.0	0.03	0.0	1.0	none	Both
	MGMELT	F10.0	0.01	0.0	1.0	in/day	Engl
			0.25	0.0	25.	mm/day	Metric

Explanation

RDCSN is the density of cold, new snow relative to water. This value applies to snow falling at air temperatures lower than or equal to 0 degrees F. At higher temperatures the density of snow is adjusted.

TSNOW is the air temperature below which precipitation will be snow, under saturated conditions. Under non-saturated conditions the temperature is adjusted slightly.

SNOEVP is a parameter which adapts the snow evaporation (sublimation) equation to field conditions.

CCFACT is a parameter which adapts the snow condensation/convection melt equation to field conditions.

MWATER is the maximum water content of the snow pack, in depth of water per depth of water.

MGMELT is the maximum rate of snowmelt by ground heat, in depth of water per day. This is the value which applies when the pack temperature is at the freezing point.

4.4(1).3.4 Table-type SNOW-INIT1 -- First group of initial values for SNOW

```

*****
          1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****

```

```
SNOW-INIT1
<-range><-----snowinit1----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END SNOW-INIT1
```

```
*****
Example
*****
```

```

SNOW-INIT1
  <PLS >
  # - # Pack-snow  Pack-ice  Pack-watr      RDENPF      DULL      PAKTMP***
  1   7      2.1      .02      .40
END SNOW-INIT1

```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<snowinit1>	Pack-snow	F10.0	0.0	0.0	none	in	Engl
			0.0	0.0	none	mm	Metric
	Pack-ice	F10.0	0.0	0.0	none	in	Engl
			0.0	0.0	none	mm	Metric
	Pack-watr	F10.0	0.0	0.0	none	in	Engl
			0.0	0.0	none	mm	Metric
RDENPF	F10.0	0.2	.01	1.0	none	Both	
DULL	F10.0	400.	0.0	800.	none	Both	
PAKTMP	F10.0	32.	none	32.	degF	Engl	
		0.0	none	0.0	degC	Metric	

Explanation

Pack-snow is the quantity of snow in the pack (water equivalent).

Pack-ice is the quantity of ice in the pack (water equivalent).

Pack-watr is the quantity of liquid water in the pack.

RDENPF is the density of the frozen contents (snow and ice) of the pack, relative to water.

DULL is an index to the dullness of the snow pack surface, from which albedo is estimated.

PAKTMP is the mean temperature of the frozen contents of the snow pack.

4.4(1).3.5 Table-type SNOW-INIT2 -- Second group of initial values for SNOW

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

SNOW-INIT2

<-range><-----snowinit2----->

.

(repeats until all operations of this type are covered)

.

END SNOW-INIT2

Example

SNOW-INIT2

<PLS >

```
# - #      COVINX      XLNMLT      SKYCLR***
1   7              0.50
```

END SNOW-INIT2

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<snowinit2>	COVINX	F10.0	0.01 0.25	0.01 0.25	none none	in mm	Engl Metric
	XLNMLT	F10.0	0.0 0.0	0.0 0.0	none none	in mm	Engl Metric
	SKYCLR	F10.0	1.0	.15	1.0	none	Both

Explanation

COVINX is the current snow pack depth (water equivalent) required to obtain complete areal coverage of the PLS. If the pack is less than this amount, areal cover is prorated (PACKF/COVINX).

XLNMLT is the current remaining possible increment to ice storage in the pack (see Functional Description). It is relevant if ice formation is simulated (ICEFG= 1).

SKYCLR is the fraction of sky which is assumed to be clear at the present time.

4.4(1).4 PERLND BLOCK -- Section PWATER input

```
*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
[Table-type PWAT-PARM1]
  Table-type PWAT-PARM2
[Table-type PWAT-PARM3]
  Table-type PWAT-PARM4
[Table-type PWAT-PARM5]
[Table-type MON-INTERCEP]  --
[Table-type MON-UZSN]      |
[Table-type MON-MANNING]   | only required if the relevant quantity
[Table-type MON-INTERFLW]  | varies through the year
[Table-type MON-IRC]       |
[Table-type MON-LZETPARM]  --
[Table-type PWAT-STATE1 ]
```

Explanation

The exact format of each of the tables mentioned above is detailed in the documentation which follows.

Tables enclosed in brackets [] above are not always required; for example, because all the values can be defaulted.

4.4(1).4.1 Table-type PWAT-PARM1 -- First group of PWATER parameters (flags)

1 2 3 4 5 6 7 8
1234567890123456789012345678901234567890123456789012345678901234567890

Layout

PWAT-PARM1
<-range><-----pwatparm1----->
.
(repeats until all operations of this type are covered)
.
END PWAT-PARM1

Example

PWAT-PARM1
<PLS > Flags ***
- # CSNO RTOP UZFG VCS VUZ VNN VIFW VIRC VLE IFFC ***
1 7 1 1
END PWAT-PARM1

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<pwatparm1>	CSNOFG	I5	0	0	1
	RTOPFG	I5	0	0	1
	UZFG	I5	0	0	1
	VCSFG	I5	0	0	1
	VUZFG	I5	0	0	1
	VNNFG	I5	0	0	1
	VIFWFG	I5	0	0	1
	VIRCFG	I5	0	0	1
	VLEFG	I5	0	0	1
	IFFCFG	I5	1	1	2

Explanation

If CSNOFG is 1, section PWATER assumes that snow accumulation and melt is being considered. It will, therefore, expect that the time series produced by section SNOW are available, either internally (produced in this RUN) or from external sources (e.g., produced in a previous RUN). If CSNOFG is 0, no such time series are expected. See the Functional Description for further information.

RTOPFG is a flag that selects the algorithm for computing overland flow. Two optional methods are provided. If RTOPFG is 1, routing of overland flow is done in the same way as in the predecessor models HSPX, ARM and NPS. A value of 0 results in a different algorithm (see Functional Description for details).

UZFG selects the method for computing inflow to the upper zone. If UZFG is 1, upper zone inflow is computed in the same way as in the predecessor models HSPX, ARM and NPS. A value of 0 results in the use of a different algorithm, which is less sensitive to changes in DELT (see functional description).

The flags beginning with "V" indicate whether or not certain parameters will be assumed to vary through the year on a monthly basis: 1 means they do vary, 0 means they do not. The quantities which can vary on a monthly basis are:

VCSFG	interception storage capacity
VUZFG	upper zone nominal storage
VNNFG	Manning's n for the overland flow plane
VIFWFG	interflow inflow parameter
VIRCFG	interflow recession constant
VLEFG	lower zone evapotranspiration (E-T) parameter

If any of these flags are on (1), monthly values for the parameter concerned must be supplied (see Table-types MON-xxx, documented later in this section).

If IFFCFG is 1, then the effect of frozen ground on infiltration rate is computed from the amount of ice in the snow pack (PACKI). CSNOFG must be turned on, and if section SNOW does not compute PACKI (because ICEFG is off or the section is inactive) PACKI must be supplied as an input time series. If IFFCFG is 2, then the infiltration adjustment factor is determined from the soil temperature in the lower layer/groundwater layer, which is either computed in section PSTEMP or must be supplied as an input time series. (See Table-type PWAT-PARM5 for more details.)

4.4(1).4.2 Table-type PWAT-PARM2 -- Second group of PWATER parameters

```
*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
PWAT-PARM2
<-range><-----pwatparm2----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END PWAT-PARM2
```

```
*****
Example
*****
```

```
PWAT-PARM2
<PLS > ***
# - # ***FOREST      LZSN      INFILT      LSUR      SLSUR      KVARV      AGWRC
1   7      0.2      8.0      0.7      400.      .001      .98
END PWAT-PARM2
```

```
*****
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<pwatparm2>	FOREST	F10.0	0.0	0.0	1.0	none	Both
	LZSN	F10.0	none none	.01 .25	100. 2500.	in mm	Engl Metric
	INFILT	F10.0	none none	0.0001 0.0025	100. 2500.	in/hr mm/hr	Engl Metric
	LSUR	F10.0	none none	1.0 0.3	none none	ft m	Engl Metric
	SLSUR	F10.0	none	.000001	10.	none	Both
	KVARY	F10.0	0.0 0.0	0.0 0.0	none none	1/in 1/mm	Engl Metric
	AGWRC	F10.0	none	0.001	0.999	1/day	Both

Explanation

FOREST is the fraction of the PLS which is covered by forest, and which will therefore continue to transpire in winter. This is only relevant if snow is being considered (i.e., CSNOFG = 1).

LZSN is the lower zone nominal storage.

INFILT is an index to the infiltration capacity of the soil.

LSUR is the length of the assumed overland flow plane.

SLSUR is the slope of the overland flow plane.

KVARY is a parameter which affects the behavior of groundwater recession flow, enabling it to be non-exponential in its decay with time.

AGWRC is the basic groundwater recession rate if KVARY is zero and there is no inflow to groundwater; AGWRC is defined as the rate of flow today divided by the rate of flow yesterday.

4.4(1).4.3 Table-type PWAT-PARM3 -- Third group of PWATER parameters

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
PWAT-PARM3
<-range><-----pwatparm3----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END PWAT-PARM3
```

```
*****
Example
*****
PWAT-PARM3
<PLS >***
# - #*** PETMAX      PETMIN      INFEXP      INFILD      DEEPFR      BASETP      AGWETP
1   7
9           39          33          3.0          1.5
END PWAT-PARM3
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<pwatparm3>	PETMAX	F10.0	40. 4.4	none none	none none	degF degC	Engl Metric
	PETMIN	F10.0	35. 1.7	none none	none none	degF degC	Engl Metric
	INFEXP	F10.0	2.0	0.0	10.0	none	Both
	INFILD	F10.0	2.0	1.0	2.0	none	Both
	DEEPFR	F10.0	0.0	0.0	1.0	none	Both
	BASETP	F10.0	0.0	0.0	1.0	none	Both
	AGWETP	F10.0	0.0	0.0	1.0	none	Both

Explanation

PETMAX is the air temperature below which E-T will arbitrarily be reduced below the value obtained from the input time series, and PETMIN is the temperature below which E-T will be zero regardless of the value in the input time series. These values are only used if snow is being considered (CSNOFG= 1).

INFEXP is the exponent in the infiltration equation, and INFILD is the ratio between the maximum and mean infiltration capacities over the PLS.

DEEPFR is the fraction of groundwater inflow which will enter deep (inactive) groundwater, and, thus, be lost from the system as it is defined in HSPF.

BASETP is the fraction of remaining potential E-T which can be satisfied from baseflow (groundwater outflow), if enough is available.

AGWETP is the fraction of remaining potential E-T which can be satisfied from active groundwater storage if enough is available.

4.4(1).4.4 Table-type PWAT-PARM4 -- Fourth group of PWATER parameters

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

PWAT-PARM4

<-range><-----pwatparm4----->

.

(repeats until all operations of this type are covered)

.

END PWAT-PARM4

Example

PWAT-PARM4

<PLS >

# - #	CEPSC	UZSN	NSUR	INTFW	IRC	LZETP***
1 7	0.1	1.3	0.1	3.	0.5	0.7

END PWAT-PARM4

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<pwatparm4>	CEPSC	F10.0	0.0	0.0	10.0	in	Engl
			0.0	0.0	250.	mm	Metric
	UZSN	F10.0	none	0.01	10.0	in	Engl
			none	0.25	250.	mm	Metric
	NSUR	F10.0	0.1	0.001	1.0	complex	Both
	INTFW	F10.0	none	0.0	none	none	Both
	IRC	F10.0	none	1.0E-30	0.999	1/day	Both
	LZETP	F10.0	0.0	0.0	0.999	none	Both

Explanation

Values in this table need only be supplied for those parameters which do not vary through the year. If they do vary (as specified in Table-type PWAT-PARM1), monthly values are supplied in the tables documented below (MON-xxx).

CEPSC is the interception storage capacity.

UZSN is the upper zone nominal storage.

NSUR is Manning's n for the assumed overland flow plane.

INTFW is the interflow inflow parameter.

IRC is the interflow recession parameter. Under zero inflow, this is the ratio of today's interflow outflow rate to yesterday's rate.

LZETP is the lower zone E-T parameter. It is an index to the density of deep-rooted vegetation.

4.4(1).4.5 Table-type PWAT-PARM5 -- Fifth group of PWATER parameters

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
PWAT-PARM5
<-range><---pwatparm5----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END PWAT-PARM5
```

```
*****
Example
*****
```

```
PWAT-PARM3
<PLS >***
# - #***      FZG      FZGL
1   7
9      0.9      0.1
END PWAT-PARM3
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<pwatparm5>	FZG	F10.0	1.0	0.0001	none	/in	Engl
		F10.0	0.0394	0.0001	none	/mm	Metr
	FZGL	F10.0	0.1	0.0001	1.0	none	Both

Explanation

FZG is the parameter that adjusts for the effect of ice in the snow pack on infiltration when IFFCFG is 1. It is not used if IFFCFG is 2.

FZGL is the lower limit of INFFAC as adjusted by ice in the snow pack when IFFCFG is 1. If IFFCFG is 2, FZGL is the value of INFFAC when the lower layer temperature is at or below freezing.

4.4(1).4.6 Table-type MON-INTERCEP -- Monthly interception storage capacity

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-INTERCEP
<-range><-----mon-icep----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-INTERCEP
```

```
*****
Example
*****
```

```
MON-INTERCEP
  <PLS >  Interception storage capacity at start of each month      ***
  # - #   JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC***
  1   7   .02  .03  .03  .04  .05  .08  .12  .15  .12  .05  .03  .01
END MON-INTERCEP
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-icep>	CEPSCM(12)	12F5.0	0.0 0.0	0.0 0.0	10. 250.	in mm	Engl Metric

Explanation

Monthly values of interception storage. Only required if VCSFG is 1 in Table-type PWAT-PARM1.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).4.7 Table-type MON-UZSN -- Monthly upper zone nominal storage

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-UZSN
<-range><-----mon-uzsn----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-UZSN
```

```
*****
Example
*****
```

```
MON-UZSN
<PLS > Upper zone storage at start of each month          ***
# - # JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC ***
1   7  .30  .35  .30  .45  .56  .57  .45  .67  .64  .54  .56  .40
END MON-UZSN
```

```
*****
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-uzsn>	UZSNM(12)	12F5.0	none none	.01 .25	10. 250.	in mm	Engl Metric

Explanation

Monthly values of upper zone nominal storage. This table is only required if VUZFG is 1 in Table-type PWAT-PARM1.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).4.8 Table-type MON-MANNING -- Monthly Manning's n values

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-MANNING
<-range><-----mon-Manning----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-MANNING
```

```
*****
Example
*****
```

```
MON-MANNING
<PLS > Manning's n at start of each month          ***
# - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
1   7   .23  .34  .34  .35  .28  .35  .37  .35  .28  .29  .30  .30
END MON-MANNING
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-Manning>	NSURM(12)	12F5.0	.10	.001	1.0	complex	Both

Explanation

Monthly values of Manning's constant for overland flow. This table is only required if VNNFG is 1 in Table-type PWAT-PARML.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).4.9 Table-type MON-INTERFLW -- monthly interflow inflow parameters

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-INTERFLW
<-range><-----mon-interflw----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-INTERFLW
```

```
*****
Example
*****
```

```
MON-INTERFLW
  <PLS > Interflow inflow parameter for start of each month      ***
  # - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
  1   7  2.0  3.3  3.6  3.8  4.2  5.6  5.6  7.6  7.5  5.6  4.6  3.4
END MON-INTERFLW
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-interflw>	INTFWM(12)	12F5.0	none	0.0	none	none	Both

Explanation

Monthly values of the interflow inflow parameter. This table is only required if VIFWFG is 1 in Table-type PWAT-PARML.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).4.10 Table-type MON-IRC -- Monthly interflow recession constants

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-IRC
<-range><-----mon-irc----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-IRC
```

```
*****
Example
*****
```

```
MON-IRC
<PLS > Interflow recession constant at start of each month      ***
# - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC***
1   7   .35  .40  .40  .40  .40  .43  .45  .45  .50  .45  .45  .40
END MON-IRC
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-irc>	IRCM(12)	12F5.0	none	1.0E-30	0.999	/day	Both

Explanation

Monthly values of the interflow recession parameter. This table is only required if VIRCFG is 1 in Table-type PWAT-PARML.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).4.11 Table-type MON-LZETPARM -- Monthly lower zone E-T parameter

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-LZETPARM
<-range><-----mon-lzetparm----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-LZETPARM
```

```
*****
Example
*****
```

```
MON-LZETPARM
  <PLS > Lower zone evapotranspiration parm at start of each month ***
  # - # JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC***
  1   7 .30 .30 .35 .35 .40 .40 .45 .45 .45 .45 .42 .38
END MON-LZETPARM
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-lzetparm>	LZETPM(12)	12F5.0	0.0	0.0	0.999	none	Both

Explanation

Monthly values of the lower zone ET parameter. This table is only required if VLEFG is 1 in Table-type PWAT-PARM1.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).4.12 Table-type PWAT-STATE1 -- PWATER initial state variables

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
PWAT-STATE1
<-range><-----pwat-statel----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END PWAT-STATE1
```

```
*****
Example
*****
```

```
PWAT-STATE1
<PLS > PWATER state variables***
# - #***  CEPS      SURS      UZS      IFWS      LZS      AGWS      GWVS
1   7      0.05     0.10     0.25     0.01     8.2      2.0      .025
END PWAT-STATE1
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<pwat-statel>	CEPS	7F10.0	0.0	0.0	100	inches	Engl
			0.0	0.0	2500	mm	Metric
	SURS		0.0	0.0	100	inches	Engl
			0.0	0.0	2500	mm	Metric
	UZS		.001	.001	100	inches	Engl
			.025	.025	2500	mm	Metric
	IFWS		0.0	0.0	100	inches	Engl
			0.0	0.0	2500	mm	Metric
	LZS		.001	.001	100	inches	Engl
			.025	.025	2500	mm	Metric
	AGWS		0.0	0.0	100	inches	Engl
			0.0	0.0	2500	mm	Metric
	GWVS		0.0	0.0	100	inches	Engl
			0.0	0.0	2500	mm	Metric

Explanation

This table is used to specify the initial water storages in the soil.

CEPS is the initial interception storage.

SURS is the initial surface (overland flow) storage.

UZS is the initial upper zone storage.

IFWS is the initial interflow storage.

LZS is the initial lower zone storage.

AGWS is the initial active groundwater storage.

GWVS is the initial index to groundwater slope; it is a measure of antecedent active groundwater inflow.

4.4(1).5 PERLND BLOCK -- Section SEDMNT input

```
*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
[Table-type SED-PARM1]      Tables in brackets [] are
Table-type SED-PARM2      not always required.
Table-type SED-PARM3
[Table-type MON-COVER]
[Table-type MON-NVSI]
[Table-type SED-STOR]
```

```
*****
```

Explanation

The exact format of each of the tables mentioned above is detailed in the documentation which follows.

4.4(1).5.1 Table-type SED-PARM1 -- First group of SEDMNT parameters

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

```
SED-PARM1
<-range><--sed-parm1-->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END SED-PARM1
```

Example

```
SED-PARM1
<PLS >***
# - # CRV VSIV SDOP***
1 7 0 1 0
END SED-PARM1
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<sed-parm1>	CRVFG	3I5	0	0	1
	VSIVFG		0	0	2
	SDOPFG		0	0	1

Explanation

If CRVFG is 1, erosion-related cover may vary throughout the year. Values are supplied in Table-type MON-COVER.

If VSIVFG is 1, the rate of net vertical sediment input may vary throughout the year. If VSIVFG is 2, the vertical sediment input is added to the detached sediment storage only on days when no rainfall occurred during the previous day. Values are supplied in Table-type MON-NVSI.

SDOPFG is a flag that determines the algorithm used to simulate removal of sediment from the land surface. If SDOPFG is 1, sediment removal will be simulated with the algorithm used in the predecessor models ARM and NPS. If it is 0, a different algorithm will be used (see the Functional Description for details).

4.4(1).5.2 Table-type SED-PARM2 -- Second group of SEDMNT parameters

1 2 3 4 5 6 7 8
123456789012345678901234567890123456789012345678901234567890

Layout

SED-PARM2
<-range><-----sed-parm2----->
.
(repeats until all operations of this type are covered)
.
END SED-PARM2

Example

SED-PARM2
 <PLS >***
 # - # SMPF KRER JRER AFFIX COVER NVSI***
 1 7 0.9 0.08 1.90 0.01 0.5 -0.100
END SED-PARM2

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<sedparm2>	SMPF	6F10.0	1.0	0.001	1.0	none	Both
	KRER		0.0	0.0	none	complex	Both
	JRER		none	none	none	complex	Both
	AFFIX		0.0	0.0	1.0	/day	Both
	COVER		0.0	0.0	1.0	none	Both
	NVSI		0.0	none	none	lb/ac/day	Engl
			0.0	none	none	kg/ha/day	Metric

Explanation

SMPF is a "supporting management practice factor." It is used to simulate the reduction in erosion achieved by use of erosion control practices.

KRER is the coefficient in the soil detachment equation.

JRER is the exponent in the soil detachment equation.

AFFIX is the fraction by which detached sediment storage decreases each day as a result of soil compaction.

COVER is the fraction of land surface which is shielded from rainfall erosion (not considering snow cover, which is handled by the program).

NVSI is the rate at which sediment enters detached storage from the atmosphere. A negative value can be supplied, for example, to simulate removal by human activity or wind.

If monthly values for COVER and NVSI are being supplied, values supplied for these variables in this table are not relevant.

4.4(1).5.3 Table-type SED-PARM3 -- Third group of SEDMNT parameters

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
SED-PARM3
<-range><-----sed-parm3----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END SED-PARM3
```

```
*****
Example
*****
```

```
SED-PARM3
<PLS >***
# - #      KSER      JSER      KGER      JGER***
1   7      0.08      1.7      0.06      1.4
END SED-PARM3
```

```
*****
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<sedparm3>	KSER	4F10.0	0.0	0.0	none	complex	Both
	JSER		none	none	none	complex	Both
	KGER		0.0	0.0	none	complex	Both
	JGER		none	none	none	complex	Both

Explanation

KSER and JSER are the coefficient and exponent in the detached sediment washoff equation.

KGER and JGER are the coefficient and exponent in the matrix soil scour equation, which simulates gully erosion.

4.4(1).5.4 Table-type MON-COVER -- Monthly erosion-related cover values

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-COVER
<-range><-----mon-cover----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-COVER
```

```
*****
Example
*****
```

```
MON-COVER
<PLS > Monthly values for erosion related cover ***
# - # JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC***
1   7 0.0 .12 .12 .24 .24 .56 .67 .56 .34 .34 .23 .12
END MON-COVER
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-cover>	COVERM(12)	12F5.0	0.0	0.0	1.0	none	Both

Explanation

Monthly values of the COVER parameter. This table is only required if CRVFG is 1 in Table-type SED-PARML.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).5.5 Table-type MON-NVSI -- Monthly net vertical sediment input

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-NVSI
<-range><-----mon-nvsi----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-NVSI
```

```
*****
Example
*****
```

```
MON-NSVI
<PLS > Monthly net vertical sediment input***
# - # JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC***
1   7 -.01 -.02 -.03 -.04 -.05 -.03 -.02 -.01 0.0 .01 .03 .01
END MON-NVSI
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-nvsi>	NVSIM(12)	12F5.0	0.0 0.0	none none	none none	lb/ac/day kg/ha/day	Engl Metric

Explanation

Monthly values of the net vertical sediment input. This table is only required if VSIVFG is greater than 0 in Table-type SED-PARML.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).5.6 Table-type SED-STOR -- Initial storage of detached sediment

1 2 3 4 5 6 7 8
123456789012345678901234567890123456789012345678901234567890

Layout

SED-STOR
<-range><----->
.
(repeats until all operations of this type are covered)
.
END SED-STOR

Example

SED-STOR
 <PLS > Detached sediment storage (tons/acre) ***
 # - # ***
 1 7 0.2
END SED-STOR

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<sed-stor>	DETS	F10.0	0.0 0.0	0.0 0.0	none none	tons/ac tonnes/ha	Engl Metric

Explanation

DETS is the initial storage of detached sediment.

4.4(1).6 PERLND BLOCK -- Section PSTEMP input

```
*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
[Table-type PSTEMP-PARM1]
  Table-type PSTEMP-PARM2      Tables in brackets [] are
[Table-type MON-ASLT]          not always required
[Table-type MON-BSLT]
[Table-type MON-ULTP1]
[Table-type MON-ULTP2]
[Table-type MON-LGTP1]
[Table-type MON-LGTP2]
[Table-type PSTEMP-TEMPS]
```

```
*****
```

Explanation

The exact format of each of the tables mentioned above is detailed in the documentation which follows.

4.4(1).6.1 Table-type PSTEMP-PARM1 -- Flags for section PSTEMP

1 2 3 4 5 6 7 8
123456789012345678901234567890123456789012345678901234567890

Layout

PSTEMP-PARM1
<-range><---pstemp-parm1--->
.
(repeats until all operations of this type are covered)
.
END PSTEMP-PARM1

Example

PSTEMP-PARM1
<PLS > Flags for section PSTEMP***
- # SLTV ULTV LGTV TSOP***
1 7 0 0 0 1
END PSTEMP-PARM1

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<pstemp-parm1>	SLTVFG	4I5	0	0	1
	ULTVFG		0	0	1
	LGTVFG		0	0	1
	TSOPFG		0	0	2

Explanation

If SLTVFG is 1, parameters for estimating surface layer temperature can vary throughout the year. Thus, Table-types MON-ASLT and MON-BSLT will be expected.

ULTVFG serves the same purpose for upper layer temperature calculations. Tables MON-ULTP1 and MON-ULTP2 will be expected if ULTVFG is 1. LGTVFG serves the same purpose for the lower layer and active groundwater layer temperature calculations. Table-types MON-LGTP1 and MON-LGTP2 will be expected if LGTVFG is 1.

TSOPFG governs the methods used to estimate subsurface soil temperatures. If TSOPFG is 0, they are computed using a mean departure from air temperature, together with smoothing factors. If TSOPFG is 2, the method is identical, except that the lower layer/groundwater layer temperature is calculated from the upper layer soil temperature, instead of directly from the air temperature. If TSOPFG is 1, upper layer soil temperature is estimated by regression on air temperature (like surface temperature). The lower layer/ground-water layer temperature is supplied directly by the user (a different value may be specified for each month).

4.4(1).6.2 Table-type PSTEMP-PARM2 -- Second group of PSTEMP parameters

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

PSTEMP-PARM2

<-range><-----pstemp-param2----->

.
(repeats until all operations of this type are covered)

.
END PSTEMP-PARM2

Example

PSTEMP-PARM2

<PLS >***

#	-	#	ASLT	BSLT	ULTP1	ULTP2	LGTP1	LGTP2***
1		7	24.	.5	24.	.5	40.	0.0

END PSTEMP-PARM2

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<pstemp-parm2>	ASLT	6F10.0	32.	0.0	100.	deg F	Engl
			0.	-18.	38.	deg C	Metric
	BSLT		1.0	0.001	2.0	deg F/F	Engl
			1.0	0.001	2.0	deg C/C	Metric

Definition of remaining quantities depends on soil temperature option flag
(TSOPFG in Table-type PSTEMP-PARM1)

TSOPFG = 0 or 2:

ULTP1	none	none	none	none	Both
ULTP2	none	none	none	F deg	Engl
	none	none	none	C deg	Metric
LGTP1	none	none	none	none	Both
LGTP2	none	none	none	F deg	Engl
	none	none	none	C deg	Metric

TSOPFG = 1:

ULTP1	none	none	none	Deg F	Engl
	none	none	none	Deg C	Metric
ULTP2	none	none	none	Deg F/F	Engl
	none	none	none	Deg C/C	Metric
LGTP1	none	none	none	Deg F	Engl
	none	none	none	Deg C	Metric
LGTP2	not used				

Explanation

ASLT is the surface layer temperature when the air temperature is 32 degrees F (0 degrees C). It is the intercept of the surface layer temperature regression equation.

BSLT is the slope of the surface layer temperature regression equation.

If TSOPFG = 0 then:

ULTP1 is the smoothing factor in the upper layer temperature calculation.

ULTP2 is the mean difference between upper layer soil temperature and air temperature.

LGTP1 and LGTP2 are the smoothing factor and mean departure from air temperature for calculating lower layer/groundwater soil temperature.

If TSOPFG = 1 then:

ULTP1 and ULTP2 are the intercept and slope in the upper layer soil temperature regression equation (like ASLT and BSLT for the surface layer). LGTP1 is the lower layer/groundwater layer soil temperature. LGTP2 is not used.

If TSOPFG = 2 then:

ULTP1 is the smoothing factor in the upper layer temperature calculation.

ULTP2 is the mean difference between upper layer soil temperature and air temperature.

LGTP1 and LGTP2 are the smoothing factor and mean departure from the upper layer soil temperature for calculating lower layer/groundwater soil temperature.

If monthly values are being supplied for any of these quantities (in Table-type MON-xxx), the value appearing in this table is not relevant.

4.4(1).6.3 Table-type MON-ASLT -- Monthly values for ASLT

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-ASLT
<-range><-----mon-aslt----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-ASLT
```

```
*****
Example
*****
```

```
MON-ASLT
  <PLS > Value of ASLT at start of each month (deg F)***
  # - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC***
  1   7  37.  38.  39.  40.  41.  42.  43.  44.  45.  44.  41.  40.
END MON-ASLT
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-aslt>	ASLTM(12)	12F5.0	32. 0.	0. -18.	100. 38.	deg F deg C	Engl Metric

Explanation

This table is only required if SLTVFG is 1 in Table-type PSTEMP-PARM1.

The input monthly values apply to the first day of the month; values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).6.4 Table-type MON-BSLT -- Monthly values for BSLT

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-BSLT
<-range><-----mon-bslt----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-BSLT
```

```
*****
Example
*****
```

```
MON-BSLT
<PLS > Value of BSLT at start of each month (deg F/F)***
# - # JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC***
1   7  .3  .3  .3  .4  .4  .5  .5  .5  .4  .4  .4  .3
END MON-BSLT
```

```
*****
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-bslt>	BSLTM(12)	12F5.0	1.0 1.0	0.001 0.001	2.0 2.0	deg F/F deg C/C	Engl Metric

Explanation

This table is only required if SLTVFG is 1 in Table-type PSTEMP-PARM1.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).6.5 Table-type MON-ULTP1 -- Monthly values for ULTP1

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-ULTP1
<-range><-----mon-ultp1----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-ULTP1
```

```
*****
Example
*****
```

```
MON-ULTP1
  <PLS > Value of ULTP1 at start of each month (TSOPFG=1)          ***
  # - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC***
  1   7  37.  38.  39.  40.  42.  44.  47.  44.  42.  39.  39.  39.
END MON-ULTP1
```

```
*****
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<mon-ultp1>	ULTP1M(12)	12F5.0	see notes for Table-type PSTEMP-PARM2		

Explanation

This table is only required if ULTVFG is 1 in Table-type PSTEMP-PARM1.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).6.6 Table-type MON-ULTP2 -- Monthly values for ULTP2

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-ULTP2
<-range><-----mon-ultp2----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-ULTP2
```

```
*****
Example
*****
```

```
MON-ULTP2
<PLS > Value of ULTP2 at start of each month (TSOPFG=1)          ***
# - # JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC***
1   7   .3   .3   .4   .5   .5   .5   .6   .6   .5   .4   .4   .3
END MON-ULTP2
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<mon-ultp2>	ULTP2M(12)	12F5.0	see notes for Table-type PSTEMP-PARM2		

Explanation

This table is only required if ULTVFG is 1 in Table-type PSTEMP-PARM1.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).6.7 Table-type MON-LGTP1 -- Monthly values for LGTP1

1 2 3 4 5 6 7 8
123456789012345678901234567890123456789012345678901234567890

Layout

MON-LGTP1
<-range><-----mon-lgtp1----->
.
(repeats until all operations of this type are covered)
.
END MON-LGTP1

Example

MON-LGTP1
 <PLS > Value of LGTP1 at start of each month (TSOPFG=1) ***
 # - # JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC***
 1 7 35. 38. 41. 43. 51. 45. 46. 45. 39. 37. 35. 35.
END MON-LGTP1

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<mon-lgtp1>	LGTP1M(12)	12F5.0	see notes for Table-type PSTEMP-PARM2		

Explanation

This table is only required if LGTVFG is 1 in Table-type PSTEMP-PARM1.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).6.8 Table-type MON-LGTP2 -- Monthly values for LGTP2

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-LGTP2
<-range><-----mon-lgtp2----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-LGTP2
```

```
*****
Example
*****
```

```
MON-LGTP2
<PLS > Value for LGTP2 at start of each month (F deg) (TSOPFG=0) ***
# - # JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC***
1   7 2.0 2.0 2.0 2.0 1.0 1.0 1.0 0.0 0.0 0.0 1.0 2.0
END MON-LGTP2
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-lgtp2>	LGTP2M(12)	12F5.0	none none	none none	none none	F deg C deg	Engl Metric

Explanation

This table is only required if LGTVFG is 1 in Table-type PSTEMP-PARM1, and TSOPFG is 0 or 2.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).6.9 Table-type PSTEMP-TEMPS -- Initial temperatures

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
PSTEMP-TEMPS
<-range><-----pstemp-temps----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END PSTEMP-TEMPS
```

Example

```
PSTEMP-TEMPS
  <PLS > Initial temperatures***
  # - #      AIRTC      SLTMP      ULTMP      LGTMP***
  1   7       48.       48.       48.       48.
END PSTEMP-TEMPS
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<pstemp-temps>	AIRTC	4F10.0	60.	-20.	120.	deg F	Engl
			16.	-29.	49.	deg C	Metric
	SLTMP		60.	-20.	120.	deg F	Engl
			16.	-29.	49.	deg C	Metric
	ULTMP		60.	-20.	120.	deg F	Engl
			16.	-29.	49.	deg C	Metric
	LGTMP		60.	-20.	120.	deg F	Engl
			16.	-29.	49.	deg C	Metric

Explanation

These are the initial temperatures:

```
AIRTC - air temperature
SLTMP - surface layer soil temperature
ULTMP - upper layer soil temperature
LGTMP - lower layer/groundwater layer soil temperature
```

4.4(1).7 PERLND BLOCK -- Section PWTGAS input

```
*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
[Table-type PWT-PARM1]
[Table-type PWT-PARM2]
[Table-type MON-IFWDOX]
[Table-type MON-IFWCO2]
[Table-type MON-GRNDDOX]
[Table-type MON-GRNDCO2]
[Table-type PWT-TEMPS]
[Table-type PWT-GASES]
```

Tables in brackets [] are not
always required

Explanation

The exact format of each of the tables mentioned above is detailed in the documentation which follows.

4.4(1).7.1 Table-type PWT-PARM1 -- Flags for section PWTGAS

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
PWT-PARM1
<-range><----pwt-parm1----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END PWT-PARM1
```

Example

```
PWT-PARM1
<PLS > Flags for section PWTGAS***
# - # IDV ICV GDV GVC***
1   7   0   0   1   0
END PWT-PARM1
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<pwt-parm1>	IDVFG	4I5	0	0	1
	ICVFG		0	0	1
	GDVFG		0	0	1
	GCVFG		0	0	1

Explanation

Each of these flags indicate whether or not a parameter is allowed to vary throughout the year, and thus, whether or not the corresponding table of monthly values will be expected:

FLAG	PARAMETER	TABLE FOR MONTHLY VALUES
IDVFG	Interflow dissolved oxygen concentration	MON-IFWDOX
ICVFG	Interflow CO2 concentration	MON-IFWCO2
GDVFG	Groundwater dissolved oxygen concentration	MON-GRNDDOX
GCVFG	Groundwater CO2 concentration	MON-GRNDCO2

4.4(1).7.2 Table-type PWT-PARM2 -- Second group of PWTGAS parameters

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
PWT-PARM2
<-range><-----pwt-parm2----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END PWT-PARM2
```

Example

```
PWT-PARM2
<PLS > Second group of PWTGAS parameters ***
# - #      ELEV      IDOXP      ICO2P      ADOXP      ACO2P***
1   7      1281.      8.2       0.2       8.2       0.3
END PWT-PARM2
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<pwt-parm2>	ELEV	5F10.0	0.0	-1000.	30000.	ft	Engl
			0.0	-300.	9100.	m	Metric
	IDOXP		0.0	0.0	20.	mg/l	Both
	ICO2P		0.0	0.0	1.0	mg C/l	Both
	ADOXP		0.0	0.0	20.	mg/l	Both
	ACO2P		0.0	0.0	1.0	mg C/l	Both

Explanation

ELEV is the elevation of the PLS above sea level; it is used to adjust the saturation concentrations of dissolved gases in surface outflow.

IDOXP is the concentration of dissolved oxygen in interflow outflow.

ICO2P is the concentration of dissolved CO2 in interflow outflow.

ADOXP is the concentration of dissolved oxygen in active groundwater outflow.

ACO2P is the concentration of dissolved CO2 in active groundwater outflow.

4.4(1).7.3 Table-type MON-IFWDOX -- Monthly interflow dissolved oxygen concentration

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-IFWDOX
<-range><-----mon-ifwdox----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-IFWDOX
```

```
*****
Example
*****
```

```
MON-IFWDOX
  <PLS > Value at start of each month for interflow DO concentration***
  # - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC***
  1   7  4.5  4.7  5.7  6.5  7.6  7.6  7.4  6.3  4.3  5.3  4.3  3.5
END MON-IFWDOX
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-ifwdox>	IDOXPM(12)	12F5.0	0.0	0.0	20.0	mg/l	Both

Explanation

This table is only required if IDVFG is 1 in Table-type PWT-PARML.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).7.4 Table-type MON-IFWCO2 -- Monthly interflow CO2 concentration

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-IFWCO2
<-range><-----mon-ifwco2----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-IFWCO2
```

```
*****
Example
*****
```

```
MON-IFWCO2
<PLS > Value at start of each month for interflow CO2 concentration***
# - # JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC***
1   7 .123 .171 .142 .145 .157 .178 .122 .123 .143 .145 .176 .145
END MON-IFWCO2
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-ifwco2>	ICO2PM(12)	12F5.0	0.0	0.0	1.0	mg C/l	Both

Explanation

This table is only required if ICVFG is 1 in Table-type PWT-PARM1.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).7.5 Table-type MON-GRNDDOX -- Monthly groundwater dissolved oxygen concentration

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-GRNDDOX
<-range><-----mon-grnddox----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-GRNDDOX
```

```
*****
Example
*****
```

```
MON-GRNDDOX
  <PLS > Value at start of each month for groundwater DO concentration***
  # - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC***
  1   7  4.5  4.7  4.9  4.9  4.9  4.9  5.0  5.6  5.7  5.8  5.4  5.1
END MON-GRNDDOX
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-grnddox>	ADOXPM(12)	12F5.0	0.0	0.0	20.0	mg/l	Both

Explanation

This table is only required if GDVFG is 1 in Table-type PWT-PARML.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).7.6 Table-type MON-GRNDCO2 -- Monthly groundwater CO2 concentration

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-GRNDCO2
<-range><-----mon-grndco2----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-GRNDCO2
```

```
*****
Example
*****
```

```
MON-GRNDCO2
<PLS > Value at start of each month for groundwater CO2 concentration***
# - # JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC***
1   7 .23 .22 .22 .23 .24 .25 .24 .23 .22 .22 .22 .22
END MON-GRNDCO2
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-grndco2>	ACO2PM(12)	12F5.0	0.0	0.0	1.0	mg C/l	Both

Explanation

This table is only required if GCVFG is 1 in Table-type PWT-PARML.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).7.7 Table-type PWT-TEMPS -- Initial water temperatures

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
PWT-TEMPS
<-range><-----pwt-temps----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END PWT-TEMPS
```

```
*****
Example
*****
```

```
PWT-TEMPS
  <PLS >   Initial water temperatures***
    # - #   SOTMP      IOTMP      AOTMP***
    1   7     47.       47.       53.
END PWT-TEMPS
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<pwt-temps>	SOTMP	3F10.0	60.	32.	100.	deg F	Engl
			16.	0.	38.	deg C	Metric
	IOTMP		60.	32.	100.	deg F	Engl
			16.	0.	38.	deg C	Metric
	AOTMP		60.	32.	100.	deg F	Engl
			16.	0.	38.	deg C	Metric

Explanation

These are the initial values of outflow water temperatures:

SOTMP is surface outflow temperature.
 IOTMP is interflow outflow temperature.
 AOTMP is active groundwater outflow temperature.

4.4(1).7.8 Table-type PWT-GASES -- Initial dissolved oxygen and CO2 concentrations

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
PWT-GASES
<-range><-----pwt-gases----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END PWT-GASES
```

```
*****
Example
*****
```

```
PWT-GASES
  <PLS >          Initial DO and CO2 concentrations***
  # - #          SODOX          SOCO2          IODOX          IOCO2          AODOX          AOCO2***
  1   7           8.9           .122           7.8           .132           3.5           .132
END PWT-GASES
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<pwt-gases>	SODOX	6F10.0	0.0	0.0	20.	mg/l	Both
	SOCO2		0.0	0.0	1.0	mg C/l	Both
	IODOX		0.0	0.0	20.	mg/l	Both
	IOCO2		0.0	0.0	1.0	mg C/l	Both
	AODOX		0.0	0.0	20.	mg/l	Both
	AOCO2		0.0	0.0	1.0	mg C/l	Both

Explanation

These are the initial concentrations of dissolved gases in outflow:

SODOX is DO concentration in surface outflow.
 SOCO2 is CO2 concentration in surface outflow.
 IODOX is DO concentration in interflow outflow.
 IOCO2 is CO2 concentration in interflow outflow.
 AODOX is DO concentration in active groundwater outflow.
 AOCO2 is CO2 concentration in active groundwater outflow.

4.4(1).8 PERLND BLOCK -- Section PQUAL input

```
*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
[Table-type NQUALS]
[Table-type PQL-AD-FLAGS]

Table-type QUAL-PROPS      ---
[Table-type QUAL-INPUT]   |
[Table-type MON-POTFW]    |
[Table-type MON-POTFS]    | repeat for each
[Table-type MON-ACCUM]    | quality constituent
[Table-type MON-SQOLIM]   |
[Table-type MON-IFLW-CONC]|
[Table-type MON-GRND-CONC]|
                        ---
```

```
*****
```

Explanation

The exact format of each of the tables mentioned above is detailed in the documentation which follows.

Tables enclosed in brackets [] are not always required; for example, because all the values can be defaulted.

4.4(1).8.1 Table-type NQUALS -- Total number of quality constituents simulated

1 2 3 4 5 6 7 8
123456789012345678901234567890123456789012345678901234567890

Layout

NQUALS
<-range><nql>
.
(repeats until all operations of this type are covered)
.
END NQUALS

Example

NQUALS
 <PLS > ***
 # - #NQUAL***
 1 7 8
END NQUALS

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<nql>	NQUAL	I5	1	1	10

Explanation

The total number of quality constituents simulated in Section PQUAL is indicated in this table. The set of tables below Table-type PQL-AD-FLAGS is repeated for each quality constituent.

4.4(1).8.2 Table-type PQL-AD-FLAGS -- Atmospheric deposition flags for PQUAL

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
PQL-AD-FLAGS
<-range> <f><c> <f><c> <f><c> <f><c> <f><c> <f><c> <f><c> <f><c> <f><c> <f><c>
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END PQL-AD-FLAGS
```

```
*****
Example
*****
```

```
PQL-AD-FLAGS
<PLS >                      Atmospheric deposition flags ***
***      QUAL1  QUAL2  QUAL3  QUAL4  QUAL5  QUAL6  QUAL7  QUAL8  QUAL9  QAL10
#*** # <F><C> <F><C> <F><C> <F><C> <F><C> <F><C> <F><C> <F><C> <F><C>
1      7  -1 10  -1 -1  11 12  13 -1   0  0   0 11   0 -1   0  0           -1  0
END PQL-AD-FLAGS
```

```
*****
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<f><c>	PQADFG(*)	(1X,2I3)	0	-1	none

Explanation

PQADFG is an array of flags indicating the source of atmospheric deposition data. The QUAL ID number is determined by the order in which the QUALS are input in the tables below. Each QUAL has two flags. The first is for dry or total deposition flux, and the second is for wet deposition concentration. The flag values indicate:

- 0 No deposition of this type is simulated
- 1 Deposition of this type is input as time series PQADFX or PQADCN
- >0 Deposition of this type is input in the MONTH-DATA table with the corresponding table ID number.
refer to the MONTH-DATA Block (Section 4.11)

It is an error to specify a non-zero flag value for a non-QUALOF.

4.4(1).8.3 Table-type QUAL-PROPS -- Identifiers and flags for a quality constituent

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

QUAL-PROPS

<-range><-qualid---> <qt><-----flags----->

.

(repeats until all operations of this type are covered)

.

END QUAL-PROPS

Example

QUAL-PROPS

<PLS > Identifiers and Flags***

```
# - #*** qualid      QTID  QSD  VPFW  VPFS  QSO  VQO  QIFW  VIQC  QAGW  VAQC
1   7      BOD        kg    0    0    0    1    1    1    0    1    1
```

END QUAL-PROPS

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<qualid>	QUALID	3A4	none	none	none
<qt>	QTYID	A4	none	none	none
<flags>	QSDFG	9I5	0	0	1
	VPFWFG		0	0	2
	VPFSFG		0	0	1
	QSOFG		0	0	1
	VQOFG		0	0	1
	QIFWFG		0	0	1
	VIQCFG		0	0	4
	QAGWFG		0	0	1
	VAQCFG		0	0	4

Explanation

QUALID is a string of up to 10 characters which identifies the quality constituent.

QTYID is a string of up to 4 characters which identifies the units associated with this constituent (e.g., kg, or lb). These are the units referred to as "qty" in subsequent tables (e.g., Table-type QUAL-INPUT).

If QSDFG is 1 then:

1. This constituent is a QUALSD; it is assumed to be sediment-associated.
2. If VPFWFG is 1 or greater, the washoff potency factor may vary throughout the year. Table-type MON-POTFW is expected. If VPFWFG is 2, the daily factors are not computed by interpolation between the monthly values.
3. If VPFSFG is 1, the scour potency factor may vary throughout the year. Table-type MON-POTFS is expected.

If QSOFG is 1 then:

1. This constituent is a QUALOF; it is assumed to be directly associated with overland flow.
2. If VQOFG is 1 then the rate of accumulation and the limiting storage of the QUALOF may vary throughout the year. Table-types MON-ACCUM and MON-SQOLIM are expected for this QUAL.

If QIFWFG is 1 then:

1. This constituent is a QUALIF; it is assumed to be associated with interflow.
2. If VIQCFG is 1 or greater, the concentration of this constituent in interflow outflow may vary throughout the year. Table-type MON-IFLW-CONC is expected. If VIQCFG is 2 or 4, the daily values are obtained directly from the monthly values; no interpolation between monthly values is performed. If VIQCFG is 3 or 4, the units of the input concentrations are mg/l; note: this option requires that the "qty" units be pounds (English system) or kilograms (Metric system).

If QAGWFG is 1 then:

1. This constituent is a QUALGW (groundwater associated).
2. If VAQCFG is 1 or greater, the concentration of this constituent in groundwater outflow may vary throughout the year. Table-type MON-GRND-CONC is expected. If VAQCFG is 2 or 4, the daily values are obtained directly from the monthly values; no interpolation between monthly values is performed. If VAQCFG is 3 or 4, the units of the input concentrations are mg/l; note: this option requires that the "qty" units be pounds (English system) or kilograms (Metric system).

4.4(1).8.4 Table-type QUAL-INPUT -- Nonseasonal PQUAL parameters

```
*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
QUAL-INPUT
<-range><-----qual-input----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END QUAL-INPUT
```

```
*****
Example
*****
```

```
QUAL-INPUT
  <PLS > Storage on surface and nonseasonal parameters***
  # - #      SQO   POTFW   POTFS   ACQOP   SQOLIM   WSQOP   IOQC   AOQC***
  1   7      1.21   17.2    1.1    0.02     2.0    1.70   15.2   17.1
END QUAL-INPUT
```

```
*****
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<qual-input>	SQO	8F8.0	0.0	0.0	none	qty/ac	Engl
			0.0	0.0	none	qty/ha	Metric
	POTFW		0.0	0.0	none	qty/ton	Engl
			0.0	0.0	none	qty/tonne	Metric
	POTFS		0.0	0.0	none	qty/ton	Engl
			0.0	0.0	none	qty/tonne	Metric
	ACQOP		0.0	0.0	none	qty/ac/day	Engl
			0.0	0.0	none	qty/ha/day	Metric
	SQOLIM		.000001	.000001	none	qty/ac	Engl
			.000002	.000002	none	qty/ha	Metric
	WSQOP		1.64	0.01	none	in/hr	Engl
			41.7	0.25	none	mm/hr	Metric
	IOQC		0.0	0.0	none	qty/ft3	Engl
			0.0	0.0	none	qty/l	Metric
	AOQC		0.0	0.0	none	qty/ft3	Engl
			0.0	0.0	none	qty/l	Metric

Explanation

The following variables are applicable only if the constituent is a QUALSD:

1. POTFW is the washoff potency factor.
2. POTFS is the scour potency factor.

A potency factor is the ratio of constituent yield to sediment (washoff or scour) outflow.

The following variables are applicable only if the constituent is a QUALOF:

1. SQO is the initial storage of QUALOF on the surface of the PLS.
2. ACQOP is the rate of accumulation of QUALOF.
3. SQOLIM is the maximum storage of QUALOF.
4. WSQOP is the rate of surface runoff which will remove 90 percent of stored QUALOF per hour.

IOQC is the concentration of the constituent in interflow outflow; it is meaningful only if this QUAL is a QUALIF. AOQC is the concentration of the constituent in active groundwater outflow; it is meaningful only if this QUAL is a QUALGW.

If monthly values are being supplied for any of these quantities, the value in this table is not relevant; instead, the system expects and uses values supplied in Table-type MON-xxx.

4.4(1).8.5 Table-type MON-POTFW -- Monthly washoff potency factor

```
*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-POTFW
<-range><-----mon-potfw----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-POTFW
```

```
*****
Example
*****
```

```
MON-POTFW
<PLS > Value at start of each month for washoff potency factor (lb/ton)***
# - # JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC***
1   7  1.2  2.4  3.6  5.8 10.2 20.2 25.2 30.8 40.2 10.1  2.5  1.7
END MON-POTFW
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-potfw>	POTFWM(12)	12F5.0	0.0 0.0	0.0 0.0	none none	qty/ton qty /tonne	Engl Metric

Explanation

This table is only required if VPFWFG is greater than 0 in Table-type QUAL-PROPS.

If VPFWFG is 1 or 3, the input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values. If VPFWFG is 2 or 4, the input monthly values apply directly to all days of the month.

4.4(1).8.6 Table-type MON-POTFS -- Monthly scour potency factor

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-POTFS
<-range><-----mon-potfs----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-POTFS
```

```
*****
Example
*****
```

```
MON-POTFS
<PLS > Value at start of each month for scour potency factor (lb/ton)***
# - # JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC***
1   7 0.9 0.9 0.9 0.8 0.8 1.1 1.1 1.3 1.3 1.0 0.9 0.9
END MON-POTFS
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-potfs>	POTFSM(12)	12F5.0	0.0 0.0	0.0 0.0	none none	qty/ton qty /tonne	Engl Metric

Explanation

This table is only required if VPFSFG is 1 in Table-type QUAL-PROPS.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).8.7 Table-type MON-ACCUM -- Monthly accumulation rates of QUALOF

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-ACCUM
<-range><-----mon-accum----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-ACCUM
```

```
*****
Example
*****
```

```
MON-ACCUM
<PLS > Value at start of month for accum rate of QUALOF (lb/ac.day)***
# - # JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC***
1   7  0.0  0.0  0.01 0.02 0.02 0.04 0.05 0.04 0.02 0.01  0.0  0.0
END MON-ACCUM
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-accum>	ACQOPM(12)	12F5.0	0.0 0.0	0.0 0.0	none none	qty/ac/day qty/ha/day	Engl Metric

Explanation

This table is only required if VQOFG is 1 in Table-type QUAL-PROPS.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).8.8 Table-type MON-SQOLIM -- Monthly limiting storage of QUALOF

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-SQOLIM
<-range><-----mon-sqolim----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-SQOLIM
```

```
*****
Example
*****
```

```
MON-SQOLIM
  <PLS > Value at start of month for limiting storage of QUALOF (lb/acre)***
  # - # JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC***
  1   7  10  12  14  18  20  25  30  26  20  13  10   7
END MON-SQOLIM
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-sqolim>	SQOLIM(12)	12F5.0	1.E-6 2.E-6	1.E-6 2.E-6	none none	qty/ac qty/ha	Engl Metric

Explanation

This table is only required if VQOFG is 1 in Table-type QUAL-PROPS.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).8.9 Table-type MON-IFLW-CONC -- Monthly concentration of QUAL
in interflow

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-IFLW-CONC
<-range><-----mon-iflw-conc----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-IFLW-CONC
```

```
*****
Example
*****
```

```
MON-IFLW-CONC
<PLS > Conc of QUAL in interflow outflow for each month (lb/ft3)***
# - # JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC***
1   7.0012.0010.0005 0.0 0.0.0002 .005 .002 .001.0016.0014.0012
END MON-IFLW-CONC
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system	
<mon-iflw-conc>	IOQCM(12)	12F5.0	0.0	0.0	none	qty/ft3	Engl	
			0.0	0.0	none	qty/l	Metric	
If VIQCFG = 3 or 4 in								
Table-type QUAL-PROPS:			0.0	0.0	none	mg/l	Both	

Explanation

This table is only required if VIQCFG is greater than 0 in Table-type QUAL-PROPS.

If VIQCFG is 1 or 3, the input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values. If VIQCFG is 2 or 4, the input monthly values apply directly to all days of the month.

4.4(1).8.10 Table-type MON-GRND-CONC -- Monthly concentration of QUAL in active groundwater

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-GRND-CONC
<-range><-----mon-grnd-conc----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-GRND-CONC
```

```
*****
Example
*****
```

```
MON-GRND-CONC
  <PLS > Value at start of month for conc of QUAL in groundwater (lb/ft3)**
  # - # JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC***
  1   7.0013.0014.0012.0012.0012.001 .001 .001 .0011.0012.0012.0013
END MON-GRND-CONC
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-grnd-conc>AOQCM(12)		12F5.0	0.0	0.0	none	qty/ft3	Engl
			0.0	0.0	none	qty/l	Metric
If VAQCFG = 3 or 4 in Table-type QUAL-PROPS:			0.0	0.0	none	mg/l	Both

Explanation

This table is only required if VAQCFG is greater than 0 in Table-type QUAL-PROPS.

If VAQCFG is 1 or 3, the input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values. If VAQCFG is 2 or 4, the input monthly values apply directly to all days of the month.

4.4(1).9 PERLND BLOCK -- Section MSTLAY input

1 2 3 4 5 6 7 8
123456789012345678901234567890123456789012345678901234567890

Layout

```

Table-type VUZFG          | only if Section
Table-type UZSN-LZSN      | PWATER is
Table-type MON-UZSN if VUZFG= 1 | inactive

```

Table-type MST-PARM

Table-type MST-TOPSTOR

Table-type MST-TOPFLX

Table-type MST-SUBSTOR

Table-type MST-SUBFLX

Explanation

The exact format of each of the tables mentioned above, except MON-UZSN, is detailed in the documentation which follows. MON-UZSN is documented under the input for Section PWATER (4.4(1).4).

Note that if all the fields in a table have default values, the table can be omitted from the User's Control Input. Then, the defaults will be used.

Table-types MST-TOPSTOR through MST-SUBFLX should usually not be supplied. See the documentation of those tables for further details.

4.4(1).9.1 Table-type VUZFG -- Variable upper zone flag

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
VUZFG
<-range><vuz>
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END VUZFG
```

```
*****
Example
*****
```

```
VUZFG
  <PLS >VUZFG***
  # - #      ***
  1   7      1
END VUZFG
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<vuz>	VUZFG	I5	0	0	1

Explanation

VUZFG is a flag which indicates whether or not the upper zone nominal storage varies throughout the year or not. A value of zero means it does not vary, a value of 1 means it does. If it does vary, the system will expect a table of type MON-UZSN in the User's Control Input.

Note that Table VUZFG is only required if Section PWATER is inactive. If that section is active VUZFG would have already been provided in the input for PWATER (Table-type PWAT-PARM1).

4.4(1).9.2 Table-type UZSN-LZSN -- Values of UZSN, LZSN and initial surface storage

1 2 3 4 5 6 7 8
123456789012345678901234567890123456789012345678901234567890

Layout

UZSN-LZSN
<-range><-uzsn-><-lzsns-><-surs->
.
(repeats until all operations of this type are covered)
.
END UZSN-LZSN

Example

UZSN-LZSN
 <PLS > UZSN LZSN SURS ***
 # - # in in in ***
 1 7 1.0 6.0 .02
END UZSN-LZSN

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<uzsn>	UZSN	F8.0	none	0.01	10.0	in	Engl
			none	0.25	250.	mm	Metric
<lzsns>	LZSN	F8.0	none	0.01	100.	in	Engl
			none	0.25	2500.	mm	Metric
<surs>	SURS	F8.0	.001	.001	100.	in	Engl
			.025	.025	2500.	mm	Metric

Explanation

This table is only required if Section PWATER is inactive; otherwise, the data would have already been supplied in the input for Section PWATER.

UZSN is the nominal upper zone storage. The value supplied here is irrelevant if VUZFG has been set to 1; in that case monthly values for UZSN are supplied in Table-type MON-UZSN.

LZSN is the nominal lower zone storage.

SURS is the initial surface detention storage.

4.4(1).9.3 Table-type MST-PARM -- Factors used to adjust solute leaching rates

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MST-PARM
<-range><-----leach-parms----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MST-PARM
```

```
*****
Example
*****
```

```
MST-PARM
  <PLS >      SLMPF      ULPF      LLPF***
  # - #              ***
  1   7          0.5      2.0      2.0
END MST-PARM
```

```
*****
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<leach-parms>	SLMPF	3F10.0	1.0	.001	1.0	none	Both
	ULPF		1.0	1.0	10.0	none	Both
	LLPF		1.0	1.0	10.0	none	Both

Explanation

These are the factors that are used to adjust solute percolation rates. SLMPF affects percolation from the surface layer storage to the upper layer principal storage. ULPF affects percolation from the upper layer principal storage to the lower layer storage. LLPF affects percolation from the lower layer storage to the active and inactive groundwater.

4.4(1).9.4 Table-type MST-TOPSTOR -- Initial moisture storage in each topsoil layer

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

```
MST-TOPSTOR
<-range><-----topstor----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MST-TOPSTOR
```

Example

```
MST-TOPSTOR
  <PLS >      Topsoil storages (lb/ac)***
  # - #      SMSTM      UMSTM      IMSTM***
  1   7      100000     400000     300000
END MST-TOPSTOR
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<topstor>	SMSTM	3F10.0	0.0	0.0	none	lb/ac	Engl
			0.0	0.0	none	kg/ha	Metric
	UMSTM		0.0	0.0	none	lb/ac	Engl
			0.0	0.0	none	kg/ha	Metric
	IMSTM		0.0	0.0	none	lb/ac	Engl
			0.0	0.0	none	kg/ha	Metric

Explanation

This table is used to specify the initial moisture content in the surface, upper principal and upper transitory (interflow) storages, respectively.

Note that the values given in this table only affect the water storages for the start of the first interval in the run; there is no carry-over of the values beyond the starting instant. Therefore, in most runs, this table need not be supplied; the default zero values will not cause any problems.

4.4(1).9.5 Table-type MST-TOPFLX -- Initial fractional fluxes in topsoil layers

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

MST-TOPFLX

<-range><-----top-flux----->

.

(repeats until all operations of this type are covered)

.

END MST-TOPFLX

Example

MST-TOPFLX

<PLS > Fractional fluxes in topsoil layers (/ivl) ***

#	-	#	FSO	FSP	FII	FUP	FIO***
1		7	.07	.03			

END MST-TOPFLX

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<top-flux>	FSO,FSP,FII, FUP,FIO	5F10.0	0.0	0.0	1.0	/ivl	Both

Explanation

These are the initial values of the fractional fluxes of soluble chemicals through the topsoil layers of a PLS.

Note that the values supplied in this table apply at the instant that the run starts. The program computes new values each time step and there is no carry-over of values from one time step to the next. Therefore, in most runs, you can omit this table; the default zero values will not cause any problems.

4.4(1).9.6 Table-type MST-SUBSTOR -- Initial moisture storage in subsurface layers

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

MST-SUBSTOR

<-range><-----substor----->

.

(repeats until all operations of this type are covered)

.

END MST-SUBSTOR

Example

MST-SUBSTOR

<PLS >Subsoil moisture (kg/ha)***

- # LMSTM AMSTM ***

1 7 800000 1000000

END MST-SUBSTOR

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<substor>	LMSTM,AMSTM	2F10.0	0.0	0.0	none	lb/ac	Engl
			0.0	0.0	none	kg/ha	Metric

Explanation

These are the initial moisture storages in the lower layer and active groundwater layers, respectively.

Usually, this table should be omitted and the default values used. The comments made on this subject in the explanation for Table-type MST-TOPSTOR are also applicable here.

4.4(1).9.7 Table-type MST-SUBFLX -- Initial fractional fluxes in subsurface layers

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

```
MST-SUBFLX
<-range><-----subflux----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MST-SUBFLX
```

Example

```
MST-SUBFLX
  <PLS >Subsurface fractional fluxes (/ivl) ***
    # - #      FLP      FLDP      FAO      ***
    1   7      0.1      0.05
END MST-SUBFLX
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<subflux>	FLP,FLDP,FAO	3F10.0	0.0	0.0	1.0	/ivl	Both

Explanation

These are the initial fractional fluxes of soluble chemicals through the subsoil layers.

Usually, this table should be omitted and the default values taken. The comments on this subject in the explanation for Table-type MST-TOPFLX are applicable here.

4.4(1).10 PERLND BLOCK -- Section PEST input

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

[Table-type PEST-FLAGS]

[Table-type PEST-AD-FLAGS]

Table-type SOIL-DATA

Table-type PEST-ID

Table-type PEST-THETA

Table-type PEST-FIRSTPM for surface layer

Table-type PEST-FIRSTPM for upper layer

Table-type PEST-FIRSTPM for lower layer

Table-type PEST-FIRSTPM for groundwater layer

if
ADOPFG
=1

Table-type PEST-CMAX

Table-type PEST-SVALPM for surface layer

Table-type PEST-SVALPM for upper layer

Table-type PEST-SVALPM for lower layer

Table-type PEST-SVALPM for groundwater layer

if
ADOPFG
=2

Table-type PEST-CMAX

Table-type PEST-NONSVPM for surface layer

Table-type PEST-NONSVPM for upper layer

Table-type PEST-NONSVPM for lower layer

Table-type PEST NONSVPM for groundwater layer

if
ADOPFG
=3

repeat for
each
pesticide

Table-type PEST-DEGRAD

Table-type PEST-STOR1 for surface layer storage

Table-type PEST-STOR1 for upper layer principal storage

Table-type PEST-STOR2 for upper layer transitory storage

Table-type PEST-STOR1 for lower layer storage

Table-type PEST-STOR1 for groundwater layer storage

```
*****
```

Explanation

The exact format of each of the tables mentioned above is detailed in the documentation which follows.

The comments given alongside the table names above indicate under what circumstances a table is expected.

Note that if all the fields in a table have default values, the table can be omitted from the User's Control Input. Then, the defaults will be adopted. However, any tables that are repeated for multiple soil layers should generally not be omitted because the "nth" occurrence of one of these tables refers to the corresponding "nth" layer. If a table for layer *i* is omitted, the next occurrence of the table (intended for layer *i*+1) will be applied to layer *i*, and unintended results may occur.

ADOPFG is the adsorption/desorption option flag. It is described in the documentation for Table-type PEST-FLAGS (Sect. 4.4(1).10.1) below.

4.4(1).10.1 Table-type PEST-FLAGS -- Flags for pesticide simulation

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

PEST-FLAGS

<-range><nps><----itmax----><----adopt---->

.

(repeats until all operations of this type are covered)

.

END PEST-FLAGS

Example

PEST-FLAGS

<PLS > NPST|Max iterations|Adsorp option ***

- # |Pst1 Pst2 Pst3|Pst1 Pst2 Pst3***

1 7 2 20 20 1 3

END PEST-FLAGS

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<nps>	NPST	I5	1	1	3
<itmax>	ITMXPS(*)	3I5	30	1	100
<adopt>	ADOPFG(*)	3I5	2	1	3

Explanation

NPST is the number of pesticides being simulated in the PERLND. NPST is limited to 3.

ITMXPS is the maximum number of iterations that will be made in trying to solve for adsorbed and dissolved equilibrium using the Freundlich isotherm. A separate value may be supplied for each pesticide being simulated. If the Freundlich method is not being used, these values have no effect.

ADOPFG(*) are flags which indicate which method will be used to simulate adsorption/desorption for each pesticide:

- 1 - first-order kinetics
- 2 - single-value Freundlich method
- 3 - non-single value Freundlich method

4.4(1).10.2 Table-type PEST-AD-FLAGS -- Atmospheric deposition flags for pesticides

```
*****
1           2           3           4           5           6           7           8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

PEST-AD-FLAGS

```
<-range> <f><c> <f><c> <f><c> <f><c> <f><c> <f><c> <f><c> <f><c> <f><c>
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END PEST-AD-FLAGS
```

Example

PEST-AD-FLAGS

```
<PLS >           Atmospheric deposition flags ***
***      PESTICIDE #1           PESTICIDE #2           PESTICIDE #3
***      CRY  ADSB  SOLN      CRY  ADSB  SOLN      CRY  ADSB  SOLN
#*** # <F><C> <F><C> <F><C> <F><C> <F><C> <F><C> <F><C> <F><C> <F><C>
1      7  -1 10  -1 -1  11 12  13 -1  10  0    11    -1  0  0  -1  0
END PEST-AD-FLAGS
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<f><c>	PEADFG(*)	(1X,2I3)	0	-1	none

Explanation

PEADFG is an array of flags indicating the source of pesticide atmospheric deposition data. Each pesticide has three forms: crystalline, adsorbed, and solution. Each form has two flags. The first is for dry or total deposition flux (<f>), and the second is for wet deposition concentration (<c>). The flag values indicate:

- 0 No deposition of this type is simulated
- 1 Deposition of this type is input as time series PEADFX or PEADCN
- >0 Deposition of this type is input in the MONTH-DATA table with the corresponding table ID number. (Refer to Section 4.11 for details)

4.4(1).10.3 Table-type SOIL-DATA -- Soil layer depths and bulk densities

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

SOIL-DATA

<-range><-----depths-----><-----bulkdens----->

.

(repeats until all operations of this type are covered)

.

END SOIL-DATA

Example

SOIL-DATA

<PLS >		Depths (ins)				Bulk density (lb/ft3)				***
#	- #	Surface	Upper	Lower	Groundw	Surface	Upper	Lower	Groundw	***
1	7	.12	6.0	40.0	80.	80.			120.	

END SOIL-DATA

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<depths>	none	4F8.0	none	.001	1000	in	Engl
			none	.0025	2500	cm	Metric
<bulkdens>	none	4F8.0	103	50	150	lb/ft3	Engl
			1.65	0.80	2.40	g/cm3	Metric

Explanation

The first four values are the depths (thicknesses) of the surface, upper, lower and groundwater layers, respectively; the second group of four values are the corresponding bulk densities of the soil in those layers.

The depth and bulk density are multiplied together by the program to obtain the mass of soil in each layer. This is used to compute the concentrations of adsorbed chemicals.

4.4(1).10.4 Table-type PEST-ID -- Name of pesticide

1 2 3 4 5 6 7 8
1234567890123456789012345678901234567890123456789012345678901234567890

Layout

PEST-ID
<-range><-----pestid----->
.
(repeats until all operations of this type are covered)
.
END PEST-ID

Example

PEST-ID
 <PLS > Pesticide***
 # - # ***
 1 7 Atrazine
END PEST-ID

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<pestid>	PESTID(*)	5A4	none	none	none

Explanation

This table specifies the name of the pesticide to which the data in the following tables apply.

4.4(1).10.5 Table-type PEST-THETA -- Pesticide first-order reaction
temperature correction parameters

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

PEST-THETA

<-range><-----theta----->

.

(repeats until all operations of this type are covered)

.

END PEST-THETA

Example

PEST-THETA

<PLS > Temperature parms ***

- # THDSPS THADPS ***

1 7 1.07

END PEST-THETA

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<theta>	THDSPS,THADPS	2F10.0	1.05	1.00	2.00	none	Both

Explanation

These parameters are used to adjust the desorption and adsorption rate parameters (respectively), using a modified Arrhenius equation:

$$\text{Rate at } T = (\text{Rate at } 35 \text{ deg C}) * (\text{theta})^{*(T-35)}$$

This table is only required if first-order kinetics are used to simulate adsorption/desorption (ADOPFG=1 in Table-type PEST-FLAGS).

4.4(1).10.6 Table-type PEST-FIRSTPM -- Pesticide first-order parameters

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

PEST-FIRSTPM

<-range><----firstparm----->

.

(repeats until all operations of this type are covered)

.

END PEST-FIRSTPM

Example

PEST-FIRSTPM

<PLS >First-order parms (/day)***

- # KDSPS KADPS ***

1 7 .07 .04

END PEST-FIRSTPM

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<firstparm>	KDSPS,KADPS	2F10.0	0.0	0.0	none	/day	Both

Explanation

KDSPS and KADPS are the desorption and adsorption rates at 35 deg C.

This table is only required if ADOPFG=1 (first-order kinetics) for this pesticide.

4.4(1).10.7 Table-type PEST-CMAX -- Maximum solubility of pesticide

```
*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

PEST-CMAX

<-range><--cmax-->

.

(repeats until all operations of this type are covered)

.

END PEST-CMAX

Example

PEST-CMAX

<PLS > CMAX***

- # (ppm)***

1 7 25.0

END PEST-CMAX

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<cmax>	CMAX	F10.0	0.0	0.0	none	ppm	Both

Explanation

CMAX is the maximum solubility of the pesticide in water.

This table is only required if ADOPFG= 2 or 3 for this pesticide (Freundlich method of simulating adsorption/desorption).

4.4(1).10.8 Table-type PEST-SVALPM -- Pesticide parameters for single-value
Freundlich method

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

PEST-SVALPM

<-range><-----svalpm----->

.

(repeats until all operations of this type are covered)

.

END PEST-SVALPM

Example

PEST-SVALPM

<PLS > XFIX K1 N1***

- # (ppm) ***

1 7 20. 4.0 1.5

END PEST-SVALPM

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<svalpm>	XFIX	3F10.0	0.0	0.0	none	ppm	Both
	K1		0.0	0.0	none	l/kg	Both
	N1		none	1.0	none	none	Both

Explanation

XFIX is the maximum concentration (on the soil) of pesticide which is permanently fixed to the soil. K1 and N1 are the coefficient and exponent parameters for the Freundlich adsorption/desorption equation:

$$X = K1 * C^{(1/N1)} + XFIX$$

This table is only used if ADOPFG= 2 for this pesticide (single-value Freundlich method). Then, the system expects it to appear four times for this pesticide; first, for the surface layer, second for the upper layer, third for the lower layer, and fourth for the active groundwater layer.

4.4(1).10.9 Table-type PEST-NONSVPM -- Pesticide parameters for non-single value Freundlich method

```

*****
          1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****

```

```

PEST-NONSVPM
<-range><-----nonsvpm----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END PEST-NONSVPM

```

Example

```

PEST-NONSVPM
  <PLS >      XFIX      K1      N1      N2***
  # - #      (ppm)      ***
  1   7      15.      5.0      1.5      1.7
END PEST-NONSVPM

```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<nonsvpm>	XFIX	4F10.0	0.0	0.0	none	ppm	Both
	K1		0.0	0.0	none	l/kg	Both
	N1		none	1.0	none	none	Both
	N2		none	1.0	none	none	Both

Explanation

XFIX is the maximum concentration (on the soil) of pesticide which is permanently fixed in the soil. K1 and N1 are the coefficient and exponent parameters for the Freundlich curve used for adsorption. N2 is the exponent parameter for the auxiliary ("desorption") curve.

This table is only used if ADOPFG= 3 for this pesticide (non-single value Freundlich method).

4.4(1).10.10 Table-type PEST-DEGRAD -- Pesticide degradation rates

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
PEST-DEGRAD
<-range><-----degrad----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END PEST-DEGRAD
```

```
*****
Example
*****
```

```
PEST-DEGRAD
  <PLS >   Pesticide degradation rates (/day)   ***
  # - #   Surface    Upper    Lower    Groundw***
  1   7     .05      .02      .01
END PEST-DEGRAD
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<degrad>	SDGCON,UDGCON, LDGCON,ADGCON	4F10.0	0.0	0.0	1.0	/day	Both

Explanation

These are the degradation rates of the pesticide in the surface, upper, lower and groundwater layers, respectively. These rates are not adjusted for temperature.

4.4(1).10.11 Table-type PEST-STOR1 -- Initial pesticide storage in surface,
upper, lower or groundwater layer

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

PEST-STOR1

<-range><-cryst--><---ads--><---soln-->

.

(repeats until all operations of this type are covered)

.

END PEST-STOR1

Example

PEST-STOR1

<PLS >Initial pesticide in surface layer (lb/ac)***

- # Cryst Ads Soln ***

1 7 10.0 25.0 50.0

END PEST-STOR1

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<cryst>,<ads>,<soln>	PSCY,PSAD, PSSU	3F10.0	0.0 0.0	0.0 0.0	none none	lb/ac kg/ha	Engl Metric

Explanation

PSCY is the pesticide in crystalline form, PSAD is the pesticide in adsorbed form and PSSU is the pesticide in solution.

The values given in this table apply to one of the following four soil storages: surface, upper principal, lower or groundwater. The table should appear four times, once for each layer.

4.4(1).10.12 Table-type PEST-STOR2 -- Initial pesticide stored in upper layer
transitory (interflow) storage

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

```
PEST-STOR2
<-range><--ips--->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END PEST-STOR2
```

Example

```
PEST-STOR2
  <PLS > Interflow      ***
  # - #   storage(kg/ha)***
  1   7     20.0
END PEST-STOR2
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<ips>	IPS	F10.0	0.0 0.0	0.0 0.0	none none	lb/ac kg/ha	Engl Metric

Explanation

IPS is the initial storage of pesticide in the upper layer transitory (interflow) storage. Since only dissolved pesticide is modeled in that storage, only one value is needed (no crystalline or adsorbed material).

4.4(1).11 PERLND BLOCK -- Section NITR input

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
Table-type SOIL-DATA  if section PEST is inactive
Table-type NIT-FLAGS
Table-type NIT-AD-FLAGS
Table-type NIT-FSTGEN
Table-type NIT-FSTPM  for surface layer
Table-type NIT-FSTPM  for upper layer
Table-type NIT-FSTPM  for lower layer
Table-type NIT-FSTPM  for groundwater layer
Table-type NIT-ORGPM  for surface layer
Table-type NIT-ORGPM  for upper layer
Table-type NIT-ORGPM  for lower layer
Table-type NIT-ORGPM  for groundwater layer
Table-type NIT-AMVOLAT  ---- if AMVOFG= 1

Table-type NIT-CMAX
Table-type NIT-SVALPM  for surface layer
Table-type NIT-SVALPM  for upper layer
Table-type NIT-SVALPM  for lower layer
Table-type NIT-SVALPM  for groundwater layer

Table-type NIT-UPTAKE  ----- if VNUTFG= 0
Table-type MON-NITUPT  for surface layer
Table-type MON-NITUPT  for upper layer
Table-type MON-NITUPT  for lower layer
Table-type MON-NITUPT  for groundwater layer

Table-type SOIL-DATA2
Table-type CROP-DATES

Table-type NIT-YIELD
Table-type MON-NUPT-FR1
Table-type MON-NUPT-FR2  for surface layer
Table-type MON-NUPT-FR2  for upper layer
Table-type MON-NUPT-FR2  for lower layer
Table-type MON-NUPT-FR2  for groundwater layer
```

```

Table-type NIT-UPIMCSAT
Table-type NIT-UPIMKMAX  ---- if VNUTFG= 0
Table-type MON-NITUPNI   |
Table-type MON-NITUPAM   | if VNUTFG= 1   | if NUPTFG= 2 or -2
Table-type MON-NITIMNI   |
Table-type MON-NITIMAM   |

```

Note: The preceding group of tables each repeat four times, once for each soil layer, if NUPTFG= 2, but appear only once for all soil layers if NUPTFG= -2

```

Table-type NIT-BGPLRET   | if VPRNFG= 0
Table-type MON-NPRETBG   |
Table-type MON-NPRETBG   | for surface layer
Table-type MON-NPRETBG   | for upper layer
Table-type MON-NPRETBG   | for lower layer   | if VPRNFG=1
Table-type MON-NPRETBG   | for groundwater layer
Table-type MON-NPRETFBG

```

```

Table-type NIT-AGUTF     ----- if VNUTFG= 0
Table-type MON-NITAGUTF   | for surface layer
Table-type MON-NITAGUTF   | for upper layer
Table-type MON-NITAGUTF   | for lower layer   | if VNUTFG= 1
Table-type MON-NITAGUTF   | for groundwater layer | if ALPNFG=1

```

```

Table-type NIT-AGPLRET   ----- if VPRNFG= 0
Table-type MON-NPRETAG    |
Table-type MON-NPRETLI    | for surface layer
Table-type MON-NPRETLI    | for upper layer   | if VPRNFG= 1
Table-type MON-NPRETFLI

```

```

Table-type NIT-STOR1     for surface layer storage
Table-type NIT-STOR1     for upper layer principal storage
Table-type NIT-STOR2     for upper layer transitory storage, above ground plant
                        and litter storage
Table-type NIT-STOR1     for lower layer storage
Table-type NIT-STOR1     for groundwater layer storage

```

Explanation

The exact format of each of the tables mentioned above, except SOIL-DATA, is detailed in the documentation which follows. SOIL-DATA is documented under the input for Section PEST (4.4(1).10).

This section is complex, and has many possible tables. Users are cautioned to carefully observe the options selected and the tables that are required. The comments given alongside the table names in the above list indicate under what circumstances a table is expected. The flags that determine the expected/required tables are described below as well as under the table where they are input (Table-type NIT-FLAGS in Sect. 4.4(1).11.1, below).

AMVOFG is the ammonia volatilization flag.

FORAFG is the ammonium adsorption/desorption method flag.

VNUTFG is the variable nitrogen plant uptake flag.

NUPTFG is the plant uptake method flag.

ALPNFG is the "above-ground plant N and litter compartment" flag.

VPRNFG is the variable plant return flag.

Note that if all the fields in a table have default values, the table can be omitted from the User's Control Input. Then, the defaults will be adopted. However, any tables that are repeated for multiple soil layers should generally not be omitted because the "nth" occurrence of one of these tables refers to the corresponding "nth" layer. If a table for layer i is omitted, the next occurrence of the table (intended for layer i+1) will be applied to layer i, and unintended results may occur.

4.4(1).11.1 Table-type NIT-FLAGS -- Flags for nitrogen simulation

1 2 3 4 5 6 7 8
1234567890123456789012345678901234567890123456789012345678901234567890

Layout

NIT-FLAGS
<-range><-----nitflags----->
.
(repeats until all operations of this type are covered)
.
END NIT-FLAGS

Example

NIT-FLAGS
<PLS > Nitrogen flags ***
x - x VNUT FORA ITMX BNUM CNUM NUPT FIXN AMVO ALPN VNPR ***
1 7 1 3 1 2 1 1
END NIT-FLAGS

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<nitflags>	VNUTFG	10I5	0	0	1
	FORAFG		0	0	1
	ITMAXA		30	1	100
	BNUMN		none	1	1000
	CNUMN		none	1	1000
	NUPTFG		0	-2	2
	FIXNFG		0	0	1
	AMVOFG		0	0	1
	ALPNFG		0	0	1
	VNPRFG		0	0	1

Explanation

If VNUTFG = 1, the first-order plant uptake parameters for nitrogen are allowed to vary throughout the year and four tables of type MON-NITUPT (or MON-NITUPNI and MON-NITUPAM if saturation kinetics are being simulated) are expected in the User's Control Input. The first appearance is for the surface layer, 2nd for upper layer, 3rd for the lower layer, and 4th for the groundwater layer. If VNUTFG = 0, the uptake rates do not vary through the year and a value for each layer is specified in a single table (Table-type NIT-UPTAKE if first-order kinetics are being simulated or NIT-UPIMKMAX if saturation kinetics are being simulated).

FORAFG indicates which method is to be used to simulate adsorption and desorption of ammonium:

- 0 first-order kinetics
- 1 single-value Freundlich method

ITMAXA is the maximum number of iterations that will be attempted in solving the Freundlich equation; applicable only if FORAFG= 1.

BNUMN is the number of time steps that will elapse between recalculation of biochemical reaction fluxes. For example, if BNUMN = 10 and the simulation time step is 5 minutes, then these fluxes will be recalculated every 50 minutes. All reactions except adsorption/desorption fall into this category. CNUMN is the corresponding number for the chemical (adsorption/desorption) reactions.

NUPTFG indicated which method is to be used to simulate plant uptake of nitrogen:

- 0 first-order kinetics
- 1 yield-based algorithm
- 2 saturation (Michaelis-Menton) kinetics
- 2 same as for 2, but with parameters constant over all soil layers

If FIXNFG is 1, nitrogen fixation is simulated. For this option, NUTPTFG must also be 1. If FIXNFG is zero, or if NUTPTFG is not 1, then N fixation is turned off.

If AMVOFG is 1, ammonia volatilization is simulated.

If ALPNFG is 1, above-ground and litter compartments for plant nitrogen are simulated.

If VNPRFG is 1, then the parameters for describing the return of plant nitrogen to the soil are allowed to vary monthly.

4.4(1).11.2 Table-type NIT-AD-FLAGS -- Atmospheric Deposition Flags for Nitrogen Species

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

NIT-AD-FLAGS

<-range> <f><c> <f><c> <f><c> <f><c> <f><c> <f><c>

.

(repeats until all operations of this type are covered)

.

END NIT-AD-FLAGS

Example

NIT-AD-FLAGS

<PLS > Atmospheric deposition flags ***

*** NITRATE AMMONIA ORGANIC N

*** SURF UPPR SURF UPPR SURF UPPR

#*** # <F><C> <F><C> <F><C> <F><C> <F><C> <F><C>

1 7 -1 10 -1 -1 11 12 13 -1 10 0 11

END NIT-AD-FLAGS

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<f><c>	NIADFG(*)	(1X,2I3)	0	-1	none

Explanation

NIADFG is an array of flags indicating the source of atmospheric deposition data. Each species can be deposited into either the surface or upper soil layers. Each species/layer combination has two flags. The first is for dry or total deposition flux, and the second is for wet deposition concentration. The flag values indicate:

- 0 No deposition of this type is simulated
- 1 Deposition of this type is input as time series NIADFX or NIADCN
- >0 Deposition of this type is input in the MONTH-DATA table with the corresponding table ID number. (Refer to Section 4.11 for details)

4.4(1).11.3 Table-type NIT-FSTGEN -- Nitrogen first-order general parameters

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
NIT-FSTGEN
<-range><upt-fact><-----temp-parms----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END NIT-FSTGEN
```

```
*****
Example
*****
```

```
NIT-FSTGEN
  <PLS > Upt-facts<----- Temp-parms (theta) -----> ***
  # - #  NO3  NH4  PLN KDSA KADA KIMN  KAM KDNI  KNI KIMA ***
  1   7   .5   .5 1.07 1.08
END NIT-FSTGEN
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<upt-fact>	NO3UTF	2F5.0	1.0	0.001	1.0	none	Both
	NH4UTF		0.0	0.0	1.0	none	Both
<temp-parms>	THPLN	8F5.0	1.07	1.0	2.0	none	Both
	THKDSA		1.05	1.0	2.0	none	Both
	THKADA		1.05	1.0	2.0	none	Both
	THKIMN		1.07	1.0	2.0	none	Both
	THKAM		1.07	1.0	2.0	none	Both
	THKDNI		1.07	1.0	2.0	none	Both
	THKNI		1.05	1.0	2.0	none	Both
	THKIMA		1.07	1.0	2.0	none	Both

Explanation

These general parameters apply to nitrogen reactions in all the layers; thus, this table only appears once (or not at all, if defaults are used).

NO3UTF and NH4UTF designate which fraction of nitrogen uptake comes from nitrate and ammonium, respectively. Their sum must be unity; otherwise an error message is generated. They are used only if first-order or yield-based plant uptake is being used (NUPTFG = 0 or 1 in Table-type NIT-FLAGS).

The remaining fields specify the temperature coefficients (theta) for the various reactions:

THPLN	Plant uptake (not relevant if NUPTFG = 1)
THKDSA	Ammonium desorption (only relevant if FORAFG = 0)
THKADA	Ammonium adsorption (only relevant if FORAFG = 0)
THKIMN	Nitrate immobilization
THKAM	Organic N ammonification
THKDNI	NO3 denitrification
THKNI	Nitrification
THKIMA	Ammonium immobilization

4.4(1).11.4 Table-type NIT-FSTPM -- Nitrogen first-order reaction parameters for the surface, upper, lower or active groundwater layer

```
*****
1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789 0123456789012345678901234567890
*****
```

Layout

NIT-FSTPM

<-range><-----fstparms----->

.

(repeats until all operations of this type are covered)

.

END NIT-FSTPM

Example

NIT-FSTPM

<PLS >*** Nitrogen first-order parameters for lower layer (/day)

#	-	***	KDSAM	KADAM	KIMNI	KAM	KDNI	KNI	KIMAM
1	7		.05	.03		.02		.05	

END NIT-FSTPM

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<fstparms>	KDSAM,KADAM, KIMNI,KAM,KDNI, KNI,KIMAM	7F10.0	0.0	0.0	none	/day	Both

Explanation

These are the first-order reaction rate parameters for a layer of soil:

KDSAM Ammonium desorption (only relevant if FORAFG = 0)
 KADAM Ammonium adsorption (only relevant if FORAFG = 0)
 KIMNI Nitrate immobilization (only relevant if NUPTFG = 0 or 1)
 KAM Organic N ammonification
 KDNI Denitrification of NO₃
 KNI Nitrification
 KIMAM Ammonium immobilization (only relevant if NUPTFG = 0 or 1)

HSPF expects this table to appear four times in the User's Control Input; first for the surface layer, second for the upper layer, third for the lower layer, and fourth for the active groundwater layer. If one or more occurrences of the table are missing, all reaction parameters for the affected layer(s) will be defaulted to zero.

4.4(1).11.5 Table-type NIT-ORGPM -- Organic nitrogen transformation parameters for the surface, upper, lower, or groundwater layer

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
NIT-ORGPM
<-range><-----orgpm----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END NIT-ORGPM
```

```
*****
Example
*****
```

```
NIT-ORGPM
  <PLS >      KLON      KRON      KONLR      THNLR ***
  # - #                /day                ***
  1   3      250.      200.      .02      1.07
END NIT-ORGPM
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<orgpm>	KLON	4F10.0	1.0E20	0.0	1.0E20	none	Both
	KRON		1.0E20	0.0	1.0E20	none	Both
	KONLR		0.0	0.0	none	/day	Both
	THNLR		1.07	1.0	2.0	none	Both

Explanation

This table is only required in order to simulate detailed organic nitrogen transformations and transport (designed primarily for forests). The table is supplied four times - once for each soil layer. If one or more occurrences of the table are missing, all parameters for the affected layer(s) will be defaulted.

KLON is the particulate/soluble partitioning coefficient for labile organic N. KRON is the particulate/soluble partitioning coefficient for refractory organic N. KONLR is the first-order conversion rate of labile to refractory particulate organic N and THNLR is the associated temperature correction coefficient.

4.4(1).11.6 Table-type NIT-AMVOLAT -- Ammonia volatilization parameters

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
NIT-AMVOLAT
<-range><-----amvopm----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END NIT-AMVOLAT
```

```
*****
Example
*****
```

```
NIT-AMVOLAT
<PLS >      SKVOL      UKVOL      LKVOL      AKVOL      THVOL      TRFVOL ***
x - x      (/day)      (/day)      (/day)      (/day)      (-)      (deg C) ***
1   3        0.4        0.2        0.1        0.0        1.07      20.0
END NIT-AMVOLAT
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<amvopm>	SKVOL,UKVOL,	6F10.0	0.0	0.0	none	/day	Both
	LKVOL,AKVOL						
	THVOL		1.07	1.0	2.0	none	Both
	TRFVOL		20.0	0.0	35.0	deg C	Both

Explanation

SKVOL, UKVOL, LKVOL, and AKVOL are the ammonia volatilization rates in the surface, upper, lower, and groundwater layers, respectively. THVOL is the temperature correction coefficient. TRFVOL is the reference temperature for the correction.

This table is only used if volatilization of ammonia is simulated (AMVOFG = 1 in Table-type NIT-FLAGS).

4.4(1).11.7 Table-type NIT-CMAX -- Maximum solubility of ammonium

```
*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

NIT-CMAX

<-range><--cmax-->

.

(repeats until all operations of this type are covered)

.

END NIT-CMAX

Example

NIT-CMAX

<PLS > CMAX***

- # (ppm)***

1 5 15.0

END NIT-CMAX

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<cmax>	CMAX	F10.0	0.0	0.0	none	ppm	Both

Explanation

CMAX is the maximum solubility of ammonium in water. This table only appears once, and is only required if FORAFG = 1 (adsorption/desorption is simulated using single-value Freundlich method).

4.4(1).11.8 Table-type NIT-SVALPM -- Nitrogen single value Freundlich
adsorption/desorption parameters

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

NIT-SVALPM

<-range><-----svalpm----->

.

(repeats until all operations of this type are covered)

.

END NIT-SVALPM

Example

NIT-SVALPM

<PLS > XFIX K1 N1***

- # (ppm) ***

1 3 10.0 5.0 1.2

END NIT-SVALPM

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<svalpm>	XFIX	3F10.0	0.0	0.0	none	ppm	Both
	K1		0.0	0.0	none	l/kg	Both
	N1		none	1.0	none	none	Both

Explanation

This table is only required if FORAFG = 1; that is, adsorption and desorption of ammonium is simulated using the single-value Freundlich method.

This table is exactly analogous to Table-type PEST-SVALPM.

4.4(1).11.9 Table-type NIT-UPTAKE -- Nitrogen plant uptake rate parameters

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
NIT-UPTAKE
<-range><-----uptake----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END NIT-UPTAKE
```

```
*****
Example
*****
```

```
NIT-UPTAKE
  <PLS >Nitrogen plant uptake rates (/day)      ***
  # - #   Surface   Upper    Lower   Groundw***
  1   2     0.01     0.02     0.01
END NIT-UPTAKE
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<uptake>	SKPLN,UKPLN, LKPLN,AKPLN	4F10.0	0.0	0.0	none	/day	Both

Explanation

SKPLN, UKPLN, LKPLN and AKPLN are the plant nitrogen uptake reaction rate parameters for the surface, upper, lower, and active groundwater layers, respectively. This table is required when first-order plant uptake is being used, and uptake parameters do not vary monthly (NUPTFG = 0 and VNUTFG = 0 in Table-type NIT-FLAGS).

4.4(1).11.10 Table-type MON-NITUPT -- Monthly plant uptake parameters for nitrogen, for the surface, upper, lower or groundwater layer

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-NITUPT
<-range><-----mon-uptake----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-NITUPT
```

```
*****
Example
*****
```

```
MON-NITUPT
  <PLS > Plant uptake parms for nitrogen in upper layer (/day)      ***
  # - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC***
  1   4                .01  .03  .05  .05  .03  .01
END MON-NITUPT
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-uptake>	KPLNM(*)	12F5.0	0.0	0.0	none	/day	Both

Explanation

This table is required if first-order plant uptake is being used and the plant uptake parameters vary throughout the year (NUPTFG = 0 and VNUTFG = 1 in Table-type NIT-FLAGS). The entire table is supplied four times; first for the surface layer, second for the upper layer, third for the lower layer, and fourth for the active groundwater layer. If omitted, default values will be supplied. For example, if the third and fourth occurrences of the table are omitted, the parameters for the lower and groundwater layers will default to zero.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).11.11 Table-type SOIL-DATA2 -- Wilting points for yield-based plant uptake

```
*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
SOIL-DATA2
<-range><----wiltpt----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END SOIL-DATA2
```

```
*****
Example
*****
```

```
SOIL-DATA2
  <PLS > Wilting points for each soil layer      ***
  # - #   SURFACE   UPPER   LOWER   ACT GW   ***
  1   7       .02     .01     .01     .015
END SOIL-DATA2
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<wiltpt>	SWILTP,UWILTP LWILTP,AWILTP	4F10.0	0.0	0.0	none	none	Both

Explanation

The wilting point, which is input as a fraction (volume-basis) is used to determine when the soil is too dry for plant uptake to occur when the yield-based method of plant uptake is being used (NUPTFG = 1 in Table-type NIT-FLAGS and/or PUPTFG = 1 in Table-type PHOS-FLAGS). This table should only be entered once for the NITR and PHOS sections.

4.4(1).11.12 Table-type CROP-DATES -- Planting and harvesting dates for yield-based plant uptake

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

CROP-DATES

<-range><ncr> <m><d> <m><d> <m><d> <m><d> <m><d> <m><d>

.

(repeats until all operations of this type are covered)

.

END CROP-DATES

Example

CROP-DATES

<PLS >

CROP 1

CROP 2

CROP 3

- # NCRP

PM PD HM HD

PM PD HM HD

PM PD HM HD

1 2

4 15 8 20

9 5 9 29

END CROP-DATES

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<ncr>	NCRP	I5	1	1	3
<m>	CRPDAT(*)	2I3	1	1	12
<d>			1	1	31

Explanation

NCRP is the number of crops per year.

CRPDAT is the month and day of planting and harvesting for each crop. Crop seasons cannot overlap, but a season may wrap around the end of the calendar year.

Cropping dates are required only when the yield-based method of plant uptake is being used (NUPTFG = 1 in Table-type NIT-FLAGS and/or PUPTFG = 1 in Table-type PHOS-FLAGS). This table should only be entered once for the NITR and PHOS sections.

4.4(1).11.13 Table-type NIT-YIELD -- Yield-based nitrogen plant uptake parameters

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
NIT-YIELD
<-range><-target-><-maxrat->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END NIT-YIELD
```

```
*****
Example
*****
```

```
NIT-YIELD
  <PLS >    NUPTGT    NMXRAT ***
  # - #    (LB/AC)      ***
  1      100.00      1.5
END NIT-YIELD
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<-target->	NUPTGT	F10.0	0.0	0.0	none	lb/ac	Engl
			0.0	0.0	none	kg/ha	Metric
<-maxrat->	NMXRAT	F10.0	1.0	1.0	none	none	Both

Explanation

NUPTGT is the total annual target for plant uptake of nitrogen for all soil layers and all crops during the calendar year.

NMXRAT is the ratio of the maximum uptake rate to the optimum (target) rate when the crop is making up a deficit in nitrogen uptake.

This table is required only when yield-based plant uptake is being used (i.e., NUPTFG = 1 in Table-type NIT-FLAGS).

4.4(1).11.14 Table-type MON-NUPT-FR1 -- Monthly fractions for yield-based plant uptake of nitrogen

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-NUPT-FR1
<-range><-----mon-nuptfr----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-NUPT-FR1
```

```
*****
Example
*****
```

```
MON-NUPT-FR1
<PLS > Monthly fractions for plant uptake target      ***
# - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
1      .1   .2   .2   .1   .2
2      .1   .1   .05  .05  .1   .1   .1   .05  .05  .1   .1   .1
END MON-NUPT-FR1
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-nuptfr>	NUPTFM(*)	12F5.0	0.0	0.0	1.0	none	Both

Explanation

These are the fractions of the total annual nitrogen plant uptake target (NUPTGT in Table-type NIT-YIELD) applied to each month. The fractions across the year must sum to unity; otherwise, an error message is generated. This table is only required when yield-based plant uptake of nitrogen is being used (NUPTFG = 1 in Table-type NIT-FLAGS).

4.4(1).11.15 Table-type MON-NUPT-FR2 -- Monthly fractions for yield-based plant uptake of nitrogen from a soil layer

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-NUPT-FR2
<-range><-----mon-layfr----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-NUPT-FR2
```

```
*****
Example
*****
```

```
MON-NUPT-FR2
  <PLS > Monthly fractions for plant uptake target from surface ***
  # - # JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC ***
  2      .15 .15 .15 .1 .1 .1 .1 .1 .15 .12 .12 .1
END MON-NUPT-FR2
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-layfr>	SNUPTM(*),UNUPTM(*) LNUPTM(*),ANUPTM(*)	12F5.0	0.0	0.0	1.0	none	Both

Explanation

These are the fractions of the monthly nitrogen plant uptake target (NUPTGT in Table-type NIT-YIELD times NUPTFM in Table-type MON-NUPT-FR1) applied to each soil layer: surface, upper, lower, and active groundwater. The fractions across the four layers (NOT across the 12 months, as for MON-NUPT-FR1) must sum to unity; otherwise an error message is generated. This table is only required when yield-based plant uptake of nitrogen is being used (NUPTFG = 1 in Table-type NIT-FLAGS). Then, the system expects it to appear four times: first, for the surface layer, second for the upper layer, etc. If one or more occurrences of the table are missing, all parameters for the affected layer(s) will be defaulted to zero.

4.4(1).11.16 Table-type NIT-UPIMCSAT -- Half saturation constants for nitrogen uptake and immobilization when using saturation kinetics method (for surface, upper, lower, or groundwater layer)

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

```
NIT-UPIMCSAT
<-range><-----csatpm----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END NIT-UPIMCSAT
```

Example

```
NIT-UPIMCSAT
  <PLS >      CSUNI      CSUAM      CSINI      CSIAM ***
  x - x      (ug/l)      (ug/l)      (ug/l)      (ug/l) ***
  1   3        40.        15.        4.0        1.5
END NIT-UPIMCSAT
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<csatpm>	CSUNI,CSUAM CSINI,CSIAM	4F10.0	0.0	0.0	none	ug/l	Both

Explanation

CSUNI and CSUAM are the nitrate and ammonia half saturation constants for uptake. CSINI and CSIAM are the nitrate and ammonia half saturation constants for immobilization.

This table is only required if nitrogen uptake and immobilization are being simulated using the saturation kinetics method (NUPTFG = 2 or -2 in Table-type NIT-FLAGS). If NUPTFG = 2, HSPF expects this table to appear four times in the User's Control Input, once for each soil layer. If one or more occurrences of the table are missing, all parameters for the affected layer(s) will be defaulted to zero. If NUPTFG = -2, HSPF expects one occurrence of this table, and uses the same parameters for all four soil layers.

4.4(1).11.17 Table-type NIT-UPIMKMAX -- Maximum rate constants for nitrogen uptake and immobilization when using saturation kinetics method (for surface, upper, lower, or groundwater layer)

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

```
NIT-UPIMKMAX
<-range><-----kmaxpm----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END NIT-UPIMKMAX
```

Example

```
NIT-UPIMKMAX
  <PLS > Maximum plant uptake and immobilization rates (mg/l/day) ***
    x - x      KUPNI      KUPAM      KIMNI      KIMAM      ***
    1   3        1.0        0.6        .05        .02
END NIT-UPIMKMAX
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<kmaxpm>	KUPNI,KUPAM KIMNI,KIMAM	4F10.0	0.0	0.0	none	mg/l/day	Both

Explanation

KUPNI and KUPAM are the nitrate and ammonia maximum uptake rates. KIMNI and KIMAM are the nitrate and ammonia maximum immobilization rates.

This table is only required if nitrogen uptake and immobilization are being simulated using the saturation kinetics method (NUPTFG = 2 or -2 in Table-type NIT-FLAGS). If NUPTFG = 2, HSPF expects this table to appear four times in the User's Control Input, once for each soil layer. If one or more occurrences of the table are missing, all parameters for the affected layer(s) will be defaulted to zero. If NUPTFG = -2, HSPF expects one occurrence of this table, and uses the same parameters for all four soil layers.

4.4(1).11.18 Table-type MON-NITUPNI -- Monthly nitrate uptake maximum rates when using saturation kinetics method (for the surface, upper, lower or groundwater layer)

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

```
MON-NITUPNI
<-range><-----mon-upnimp----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-NITUPNI
```

Example

```
MON-NITUPNI
<PLS > Maximum plant uptake rate for nitrate (mg/l/day)      ***
x - x  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
1   4   .05  .25  .75  1.2  2.0  2.5  2.5  2.5  2.0  1.2  .75  .25
END MON-NITUPNI
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-upnimp>	KUNIM(*)	12F5.0	0.0	0.0	none	mg/l/day	Both

Explanation

This table contains the maximum nitrate uptake rates when using the saturation kinetics method. The table is required if saturation kinetics are being simulated for uptake and the rates vary monthly (NUPTFG = 2 or -2 and VNUTFG = 1 in Table-type NIT-FLAGS). If NUPTFG = 2, HSPF expects this table to appear four times in the User's Control Input, once for each soil layer. If one or more occurrences of the table are missing, all parameters for the affected layer(s) will be defaulted to zero. If NUPTFG = -2, HSPF expects one occurrence of this table, and uses the same parameters for all four soil layers.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).11.19 Table-type MON-NITUPAM -- Monthly ammonia uptake maximum rates when using saturation kinetics method (for the surface, upper, lower or groundwater layer)

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

```
MON-NITUPAM
<-range><-----mon-upampm----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-NITUPAM
```

Example

```
MON-NITUPAM
<PLS > Max ammonia uptake rate in upper layer (mg/l/day)      ***
# - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
1   4   .03  .06  .12  .30  .45  .60  .60  .45  .30  .15  .08
END MON-NITUPAM
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-upampm>	KUAMM(*)	12F5.0	0.0	0.0	none	mg/l/day	Both

Explanation

This table contains the maximum ammonia uptake rates when using the saturation kinetics method. The table is required if saturation kinetics are being simulated for uptake and the rates vary monthly (NUPTFG = 2 or -2 and VNUTFG = 1 in Table-type NIT-FLAGS). If NUPTFG = 2, HSPF expects this table to appear four times in the User's Control Input, once for each soil layer. If one or more occurrences of the table are missing, all parameters for the affected layer(s) will be defaulted to zero. If NUPTFG = -2, HSPF expects one occurrence of this table, and uses the same parameters for all four soil layers.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).11.20 Table-type MON-NITIMNI -- Monthly nitrate immobilization rates when using saturation kinetics method (for the surface, upper, lower or groundwater layer)

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

MON-NITIMNI

<-range><-----mon-immipm----->

.
(repeats until all operations of this type are covered)

.
END MON-NITIMNI

Example

MON-NITIMNI

<PLS > Nitrate immobilization rate in upper layer (mg/l/day) ***

#	-	#	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	***
1		4	.01	.01	.02	.02	.03	.04	.04	.04	.03	.03	.02	.01	

END MON-NITIMNI

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-immipm>	KINIM(*)	12F5.0	0.0	0.0	none	mg/l/day	Both

Explanation

This table contains the maximum nitrate immobilization rates when using the saturation kinetics method. The table is required if saturation kinetics are being simulated for immobilization, and the rates vary monthly (NUPTFG = 2 or -2 and VNUTFG = 1 in Table-type NIT-FLAGS). If NUPTFG = 2, HSPF expects this table to appear four times in the User's Control Input, once for each soil layer. If one or more occurrences of the table are missing, all parameters for the affected layer(s) will be defaulted to zero. If NUPTFG = -2, HSPF expects one occurrence of this table, and uses the same parameters for all four soil layers.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).11.21 Table-type MON-NITIMAM -- Monthly ammonia immobilization rates when using saturation kinetics method (for the surface, upper, lower or groundwater layer)

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

MON-NITIMAM

<-range><-----mon-imampm----->

.
(repeats until all operations of this type are covered)

.
END MON-NITIMAM

Example

MON-NITIMAM

<PLS > Ammonia immobilization rate in upper layer (mg/l/day) ***

#	-	#	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	***
1		4	.01	.01	.01	.02	.02	.02	.03	.03	.02	.02	.02	.01	

END MON-NITIMAM

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-imampm>	KIAMM(*)	12F5.0	0.0	0.0	none	mg/l/day	Both

Explanation

This table contains the maximum ammonia immobilization rates when using the saturation kinetics method. The table is required if saturation kinetics are being simulated for immobilization, and the rates vary monthly (NUPTFG = 2 or -2 and VNUTFG = 1 in Table-type NIT-FLAGS). If NUPTFG = 2, HSPF expects this table to appear four times in the User's Control Input, once for each soil layer. If one or more occurrences of the table are missing, all parameters for the affected layer(s) will be defaulted to zero. If NUPTFG = -2, HSPF expects one occurrence of this table, and uses the same parameters for all four soil layers.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).11.22 Table-type NIT-BGPLRET -- Below-ground plant nitrogen return rates.

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
NIT-BGPLRET
<-range><-----plrepm----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END NIT-BGPLRET
```

```
*****
Example
*****
```

```
NIT-BGPLRET
  Below-ground plant return rates and refractory fraction ***
  <PLS>    SKPRBN    UKPRBN    LKPRBN    AKPRBN    BGNPRF ***
  x - x    (/day)   (/day)   (/day)   (/day)
  1   3      .02      .01      .01      0.0      0.1
END NIT-BGPLRET
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<plrepm>	SKPRBN	F10.0	0.0	0.0	none	/day	Both
	UKPRBN	F10.0	0.0	0.0	none	/day	Both
	LKPRBN	F10.0	0.0	0.0	none	/day	Both
	AKPRBN	F10.0	0.0	0.0	none	/day	Both
	BGNPRF	F10.0	0.0	0.0	none	none	Both

Explanation

SKPRBN, UKPRBN, LKPRBN, and AKPRBN are the first-order return rates of below-ground plant N to organic N storage in the four layers. BGNPRF is the fraction of plant N return that becomes particulate refractory organic N. (The rest becomes particulate labile organic N.)

This table is only used when plant return rates are constant (VPRNFG = 0 in Table-type NIT-FLAGS).

4.4(1).11.23 Table-type MON-NPRETBG -- Monthly below-ground plant N return rates for the surface, upper, lower or groundwater layer

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-NPRETBG
<-range><-----mon-plrepm----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-NPRETBG
```

```
*****
Example
*****
```

```
MON-NPRETBG
<PLS > Return rates for below-ground plant N in upper layer (/day) ***
# - # JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC ***
1   4           .01 .03 .05 .05 .03 .01
END MON-NPRETBG
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-plrepm>	KRBNM(*)	12F5.0	0.0	0.0	none	/day	Both

Explanation

This table contains the first-order return rates of below-ground plant N to organic N. The table is used if the plant N return parameters vary throughout the year (VPLRFG = 1 in Table-type NIT-FLAGS). The entire table is supplied four times; first for the surface layer, second for the upper layer, third for the lower layer, and fourth for the active groundwater layer. If omitted, default values will be supplied. For example, if the third and fourth occurrences of the table are omitted, the parameters for the lower and groundwater layers will default to zero.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).11.24 Table-type MON-NPRETFBG -- Monthly refractory fractions for
below-ground plant N return

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-NPRETFBG
<-range><-----mon-plrefr----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-NPRETFBG
```

```
*****
Example
*****
```

```
MON-NPRETFBG
  <PLS > Monthly refractory fractions for below-ground plant N return ***
  x - x  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
  1   4   .02  .02  .03  .04  .04  .05  .05  .05  .04  .04  .03  .03
END MON-NPRETFBG
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-plrefr>	BNPRFM(*)	12F5.0	0.0	0.0	1.0	none	Both

Explanation

This table contains the fractions of below-ground plant N return which become particulate refractory organic N. (The rest becomes particulate labile organic N.) The table is used only if the plant N return parameters vary throughout the year (VPLRFG = 1 in Table-type NIT-FLAGS).

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).11.25 Table-type NIT-AGUTF -- Above-ground plant uptake fractions

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
NIT-AGUTF
<-range><-----agutf----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END NIT-AGUTF
```

```
*****
Example
*****
```

```
NIT-AGUTF
<PLS > Above-ground plant uptake fractions ***
x - x   SANUTF   UANUTF   LANUTF   AANUTF ***
1   3       0.8     0.8     0.7     0.7
END NIT-AGUTF
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<agutf>	SANUTF,UANUTF, LANUTF,AANUTF	4F10.0	0.0	0.0	1.0	none	Both

Explanation

SANUTF, UANUTF, LANUTF and AANUTF are the above-ground plant uptake fractions for the surface, upper, lower, and active groundwater layers, respectively. This table is used only when the above-ground compartment is being simulated and uptake parameters do not vary monthly (ALPNFG = 1 and VNUTFG = 0 in Table-type NIT-FLAGS).

4.4(1).11.26 Table-type MON-NITAGUTF -- Monthly above-ground plant uptake fractions for nitrogen, for the surface, upper, lower or groundwater layer

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-NITAGUTF
<-range><-----mon-agutf----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-NITAGUTF
```

```
*****
Example
*****
```

```
MON-NITAGUTF
  <PLS >  Monthly above-ground fractions for plant uptake          ***
  x - x   JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC ***
  1   4   .70  .70  .70  .75  .75  .80  .80  .80  .75  .75  .70  .70
END MON-NITAGUTF
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-agutf>	ANUFM(*)	12F5.0	0.0	0.0	1.0	none	Both

Explanation

This table contains the fractions of plant uptake which go to above-ground plant N storage. The table is used only if the above-ground compartment is being simulated and the plant uptake parameters vary throughout the year (ALPNFG = 1 and VNUTFG = 1 in Table-type NIT-FLAGS). The table is supplied four times; first for the surface layer, second for the upper layer, third for the lower layer, and fourth for the active groundwater layer. If omitted, default values will be supplied. For example, if the third and fourth occurrences of the table are omitted, the parameters for the lower and groundwater layers will default to zero.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).11.27 Table-type NIT-AGPLRET -- Above-ground plant nitrogen return rates.

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
NIT-AGPLRET
<-range><-----plrepm----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END NIT-AGPLRET
```

```
*****
Example
*****
```

```
NIT-AGPLRET
  Above-ground plant return rates and refractory fraction
  <PLS>    AGKPRN    SKPRLN    UKPRLN    LINPRF
  x - x    (/day)    (/day)    (/day)
  1   3      .01      .02      .01      0.1
END NIT-AGPLRET
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<plrepm>	AGKPRN	F10.0	0.0	0.0	none	/day	Both
	SKPRLN	F10.0	0.0	0.0	none	/day	Both
	UKPRLN	F10.0	0.0	0.0	none	/day	Both
	LINPRF	F10.0	0.0	0.0	none	none	Both

Explanation

AGKPRN is the first-order return rate of above-ground plant N to litter N. SKPRLN and UKPRLN are the first-order return rates of litter N to organic N storage in the surface and upper soil layers, respectively. LINPRF is the fraction of litter N return that becomes particulate refractory organic N. (The rest becomes particulate labile organic N.)

This table is only used when the above-ground and litter compartments are being simulated for nitrogen, and plant return rates are constant (i.e., ALPNFG = 1 and VPRNFG = 0 in Table-type NIT-FLAGS).

4.4(1).11.28 Table-type MON-NPRETAG -- Monthly above-ground plant N return rates to litter N

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-NPRETAG
<-range><-----mon-plrepm----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-NPRETAG
```

```
*****
Example
*****
```

```
MON-NPRETAG
  <PLS > Return rates for above-ground plant N to litter N (/day) ***
  # - # JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC ***
  1   4           .01 .03 .05 .05 .03 .01
END MON-NPRETAG
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-plrepm>	KRANM(*)	12F5.0	0.0	0.0	none	/day	Both

Explanation

This table contains the first-order return rate of above-ground plant N to litter N. The table is used only when the above-ground compartment is being simulated and the plant N return parameters vary throughout the year (i.e., ALPNFG = 1 and VPLRFG = 1 in Table-type NIT-FLAGS).

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).11.29 Table-type MON-NPRETLI -- Monthly litter plant N return rates for the surface or upper layer

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-NPRETLI
<-range><-----mon-plrepm----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-NPRETLI
```

```
*****
Example
*****
```

```
MON-NPRETLI
  <PLS > Return rates for litter plant N to upper layer (/day)      ***
  # - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC***
  1   4                .01  .03  .05  .05  .03  .01
END MON-NPRETLI
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-plrepm>	KRLNM(*)	12F5.0	0.0	0.0	none	/day	Both

Explanation

This table contains the return rates of litter plant N to particulate labile organic N in the surface or upper layer. The table is required if the plant N return parameters vary throughout the year (VPLRFG = 1 in Table-type NIT-FLAGS). The entire table is supplied two times; first for the surface layer and second for the upper layer. If omitted, default values will be supplied. For example, if the second occurrence of the table is omitted, the parameters for the upper layer will default to zero.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).11.30 Table-type MON-NPRETFLI -- Monthly refractory fractions for
litter N return

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-NPRETFLI
<-range><-----mon-plrefr----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-NPRETFLI
```

```
*****
Example
*****
```

```
MON-NPRETFLI
  <PLS > Monthly refractory fractions for litter N return      ***
  x - x  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
  1   4   .02  .02  .03  .04  .04  .05  .05  .05  .04  .04  .03  .03
END MON-NPRETFLI
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-plrefr>	LNPRFM(*)	12F5.0	0.0	0.0	1.0	none	Both

Explanation

This table contains the fractions of litter N return which become particulate refractory organic N. (The rest becomes particulate labile organic N.) The table is used only if the litter compartment is being simulated and the plant N return parameters vary throughout the year (ALPNFG = 1 and VPLRFG = 1 in Table-type NIT-FLAGS).

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).11.31 Table-type NIT-STOR1 -- Initial storage of nitrogen in the surface, upper, lower, or groundwater layer

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
NIT-STOR1
<-range><-----nit-stor1----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END NIT-STOR1
```

```
*****
Example
*****
```

```
NIT-STOR1
  <PLS > Initial storage of N (lb/ac)
  x - x      LORGN      AMAD      AMSU      NO3      PLTN      RORGN ***
  1   4
END NIT-STOR1
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<nit-stor1>	LORGN,AMAD,AMSU,	6F10.0	0.0	0.0	none	lb/ac	Engl
	NO3,PLTN,RORGN		0.0	0.0	none	kg/ha	Metric

Explanation

This table is similar in organization to Table-type PEST-STOR1. It specifies the initial storage of N in one of the four major soil layers. The values in the table are:

```
LORGN  Labile organic nitrogen
AMAD   Adsorbed ammonium
AMSU   Solution ammonium
NO3    Nitrate
PLTN   Nitrogen stored in plants
RORGN  Refractory organic nitrogen
```


4.4(1).11.32 Table-type NIT-STOR2 -- Initial storage of nitrogen in upper layer transitory (interflow) storage

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
NIT-STOR2
<-range><-----nit-stor2----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END NIT-STOR2
```

```
*****
Example
*****
```

```
NIT-STOR2
<PLS > Initial N in interflow, above-ground, and litter storage (lb/ac) ***
  x - x      IAMSU      INO3      ISLON      ISRON      AGPLTN      LITTRN      ***
  1   2
      100.      10.
END NIT-STOR2
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<nit-stor2>	IAMSU,INO3,ISLON,	6F10.0	0.0	0.0	none	lb/ac	Engl
	ISRON,AGPLTN,LITTRN		0.0	0.0	none	kg/ha	Metric

Explanation

This table specifies the initial storage of N in the upper layer transitory (interflow) storage. If the above-ground and litter compartments are being simulated (ALPNFG = 1 in Table-type NIT-FLAGS), then the initial storage for these compartments is also specified.

```
IAMSU   Solution ammonium
INO3    Nitrate
ISLON   Solution labile organic nitrogen
ISRON   Solution refractory organic nitrogen
AGPLTN  Above-ground plant nitrogen (only relevant if ALPNFG = 1)
LITTRN  Litter nitrogen (only relevant if ALPNFG = 1)
```

4.4(1).12 PERLND BLOCK -- Section PHOS input

```
*****
      1      2      3      4      5      6      7      8
1234567890123456789012345678901234567890123456789 0123456789012345678901234567890
*****
Layout
*****
```

```
Table-type SOIL-DATA  if sections PEST and NITR are inactive
Table-type PHOS-FLAGS
Table-type PHOS-AD-FLAGS
Table-type PHOS-FSTGEN
Table-type PHOS-FSTPM  for surface layer
Table-type PHOS-FSTPM  for upper layer
Table-type PHOS-FSTPM  for lower layer
Table-type PHOS-FSTPM  for groundwater layer
```

```

Table-type PHOS-CMAX
Table-type PHOS-SVALPM for surface layer  | if          (single value
Table-type PHOS-SVALPM for upper layer   | FORPFG=    Freundlich
Table-type PHOS-SVALPM for lower layer    | 1          method)
Table-type PHOS-SVALPM for groundwater layer |

```

```

Table-type PHOS-UPTAKE  ----- if VPUTFG= 0
Table-type MON-PHOSUPT for surface layer  | if VPUTFG= 1  | if PUPTFG= 0
Table-type MON-PHOSUPT for upper layer   |
Table-type MON-PHOSUPT for lower layer    |
Table-type MON-PHOSUPT for groundwater layer |

```

```

Table-type SOIL-DATA2  | if NITR is inactive
Table-type CROP-DATES  | or NUPTFG= 0
Table-type PHOS-YIELD
Table-type MON-PUPT-FR1
Table-type MON-PUPT-FR2 for surface layer
Table-type MON-PUPT-FR2 for upper layer
Table-type MON-PUPT-FR2 for lower layer
Table-type MON-PUPT-FR2 for groundwater layer

```

```

Table-type PHOS-STOR1  for surface layer storage
Table-type PHOS-STOR1  for upper layer principal storage
Table-type PHOS-STOR2  for upper layer transitory storage
Table-type PHOS-STOR1  for lower layer storage
Table-type PHOS-STOR1  for groundwater layer storage

```

Explanation:

The exact format of each of the tables mentioned above, except for SOIL-DATA, SOIL-DATA2 and CROP-DATES, is detailed in the documentation which follows. SOIL-DATA is documented under the input for Section PEST (4.4(1).10). SOIL-DATA2 and CROP-DATES are documented under the input for Section NITR (4.4(1).11).

The comments given alongside the table names above indicate under what circumstances a table is expected. Note that if all the fields in a table have default values, the table can be omitted from the User's Control Input. Then, the defaults will be adopted. However, any tables that are repeated for multiple soil layers should generally not be omitted because the "nth" occurrence of one of these tables refers to the corresponding "nth" layer. If a table for layer i is omitted, the next occurrence of the table (intended for layer i+1) will be applied to layer i, and unintended results may occur.

NUPTFG and PUPTFG are the plant uptake method flag for nitrogen and phosphorus, respectively. VPUTFG and FORPFG are the phosphorus plant uptake flag and the phosphate adsorption/desorption method flag, respectively. NUPTFG is described under Table-type NIT-FLAGS (Sect. 4.4(1).11.1) above. The others are described under Table-type PHOS-FLAGS (Sect. 4.4(1).12.1) below.

4.4(1).12.1 Table-type PHOS-FLAGS -- Flags governing simulation of phosphorus

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
PHOS-FLAGS
<-range><-----phosflags----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END PHOS-FLAGS
```

```
*****
Example
*****
```

```
PHOS-FLAGS
  <PLS > VPUT FORP ITMX BNUM CNUM PUPT ***
  # - #
  1   4   1           10   10   1
END PHOS-FLAGS
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<phosflags>	VPUTFG	5I5	0	0	1
	FORPFG		0	0	1
	ITMAXP		30	1	100
	BNUMP		none	1	1000
	CNUMP		none	1	1000
	PUPTFG		0	0	1

Explanation

If VPUTFG = 1, the first-order plant uptake parameters for phosphorus are allowed to vary throughout the year and four tables of type MON-PHOSUPT are expected in the User's Control Input. The first appearance is for the surface layer, 2nd for upper layer, 3rd for the lower layer, and 4th for the groundwater layer. If VPUTFG = 0, the uptake rates do not vary through the year and a value for each layer is specified in a single table (Table-type PHOS-UPTAKE).

FORPFG indicates which method is to be used to simulate adsorption and desorption of phosphate:

- 0 first-order kinetics
- 1 single-value Freundlich method

ITMAXP is the maximum number of iterations that will be attempted in solving the Freundlich equation; applicable only if FORPFG= 1.

BNUMP is the number of time steps that will elapse between recalculation of biochemical reaction fluxes. For example, if BNUMP = 10 and the simulation time step is 5 minutes, then these fluxes will be recalculated every 50 minutes. All reactions except adsorption/desorption fall into this category. CNUMP is the corresponding number for the chemical (adsorption/desorption) reactions.

PUPTFG indicated which method is to be used to simulate plant uptake of phosphorus:

- 0 first-order kinetics
- 1 yield-based algorithm

4.4(1).12.2 Table-type PHOS-AD-FLAGS -- Atmospheric deposition flags for PHOS

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
PHOS-AD-FLAGS
<-range> <f><c> <f><c> <f><c> <f><c>
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END PHOS-AD-FLAGS
```

```
*****
Example
*****
```

```
PHOS-AD-FLAGS
<PLS > Atmospheric deposition flags ***
***      PHOSPHATE      ORGANIC P
***      SURF      UPPR      SURF      UPPR
#*** # <F><C> <F><C> <F><C> <F><C>
1      7  -1 10  -1 -1      11 12  13 -1
END PHOS-AD-FLAGS
```

```
*****
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<f><c>	PHADFG(*)	(1X,2I3)	0	-1	none

Explanation

PHADFG is an array of flags indicating the source of atmospheric deposition data. Each species can be deposited into either the surface or upper soil layers. Each species/layer combination has two flags. The first is for dry or total deposition flux, and the second is for wet deposition concentration. The flag values indicate:

- 0 No deposition of this type is simulated
- 1 Deposition of this type is input as time series PHADFX or PHADCN
- >0 Deposition of this type is input in the MONTH-DATA table with the corresponding table ID number. (Refer to Section 4.11 for details)

4.4(1).12.3 Table-type PHOS-FSTGEN -- Temperature correction parameters for phosphorus reactions

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

PHOS-FSTGEN

<-range><-----theta----->

.

(repeats until all operations of this type are covered)

.

END PHOS-FSTGEN

Example

PHOS-FSTGEN

<PLS > Temperature correction parameters (theta) ***

- # THPLP THKDSP THKADP THKIMP THKMP***

1 1.07 1.05

END PHOS-FSTGEN

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<theta>	THPLP	5F10.0	1.07	1.0	2.0	none	Both
	THKDSP		1.05	1.0	2.0	none	Both
	THKADP		1.05	1.0	2.0	none	Both
	THKIMP		1.07	1.0	2.0	none	Both
	THKMP		1.07	1.0	2.0	none	Both

Explanation

This table is analogous to Table-type NIT-FSTGEN, except for the first two values in that table. The temperature correction parameters supplied in this table (and the reactions they affect) are:

```
THPLP    Plant uptake (only relevant if PUPTFG=0 in Table PHOS-FLAGS)
THKDSP    Phosphate desorption (only relevant if FORPFG=0 in Table PHOS-FLAGS)
THKADP    Phosphate adsorption (only relevant if FORPFG=0 in Table PHOS-FLAGS)
THKIMP    Phosphate immobilization
THKMP     Organic P mineralization
```

4.4(1).12.4 Table-type PHOS-FSTPM -- Phosphorus first-order reaction parameters

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
PHOS-FSTPM
<-range><-----phos-fstpm----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END PHOS-FSTPM
```

```
*****
Example
*****
```

```
PHOS-FSTPM
  <PLS > Phosphorus first-order parameters for surface layer (/day) ***
    # - #      KDSP      KADP      KIMP      KMP      ***
    1   5
END PHOS-FSTPM
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<phos-fstpm>	KDSP,KADP, KIMP,KMP	4F10.0	0.0	0.0	none	/day	Both

Explanation

This table is analogous to Table-type NIT-FSTPM. The reaction rate parameters supplied in this table are:

```
KDSP  Phosphate desorption (only used if FORPFG=0 in Table-type PHOS-FLAGS)
KADP  Phosphate adsorption (only used if FORPFG=0 in Table-type PHOS-FLAGS)
KIMP  Phosphate immobilization
KMP   Organic P mineralization
```


4.4(1).12.5 Table-type PHOS-CMAX -- Maximum solubility of phosphate

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

PHOS-CMAX

<-range><--cmax-->

.

(repeats until all operations of this type are covered)

.

END PHOS-CMAX

Example

PHOS-CMAX

<PLS > CMAX***

- # (ppm)***

1 2 5.0

END PHOS-CMAX

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<cmax>	CMAX	F10.0	0.0	0.0	none	ppm	Both

Explanation

This table is exactly analogous to Table-type NIT-CMAX.

CMAX is the maximum solubility of phosphate in water. This table only appears once, and is only required if FORPFG = 1 in Table-type PHOS-FLAGS (adsorption/desorption is simulated using single-value Freundlich method).

4.4(1).12.6 Table-type PHOS-SVALPM -- Phosphorus single value Freundlich
adsorption/desorption parameters

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

PHOS-SVALPM

<-range><-----svalpm----->

.

(repeats until all operations of this type are covered)

.

END PHOS-SVALPM

Example

PHOS-SVALPM

<PLS > Parameters for Freundlich method (lower layer) ***

```
# - #      XFIX      K1      N1      ***
1      30.      5.0      1.5
```

END PHOS-SVALPM

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<svalpm>	XFIX	3F10.0	0.0	0.0	none	ppm	Both
	K1		0.0	0.0	none		Both
	N1		none	1.0	none		Both

Explanation

This table is exactly analogous to Table-type NIT-SVALPM. It is only used if
FORPFG= 1 in Table-type PHOS-FLAGS.

4.4(1).12.7 Table-type PHOS-UPTAKE -- Phosphorus plant uptake parameters

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

PHOS-UPTAKE

<-range><-----phos-uptake----->

.

(repeats until all operations of this type are covered)

.

END PHOS-UPTAKE

Example

PHOS-UPTAKE

<PLS > Phosphorus plant uptake parms (/day) ***

- # SKPLP UKPLP LKPLP AKPLP***

1 .005 .03 .05 .01

END PHOS-UPTAKE

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<phos-uptake>	SKPLP,UKPLP, LKPLP,AKPLP	4F10.0	0.0	0.0	none	/day	Both

Explanation

This table is exactly analogous to Table-type NIT-UPTAKE.

SKPLP, UKPLP, LKPLP and AKPLP are the plant phosphorus uptake reaction rate parameters for the surface, upper, lower, and active groundwater layers, respectively. This table is required when first-order plant uptake is being used, and uptake parameters do not vary monthly (PUPTFG = 0 and VPUTFG = 0 in Table-type PHOS-FLAGS).

4.4(1).12.8 Table-type MON-PHOSUPT -- Monthly plant uptake parameters for phosphorus, for the surface, upper, lower or groundwater layer

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

MON-PHOSUPT

<-range><-----mon-phosupt----->

.

(repeats until all operations of this type are covered)

.

END MON-PHOSUPT

Example

MON-PHOSUPT

<PLS > Monthly phosphorus uptake parameters for surface layer (/day)***

- # JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

1 2 .01 .03 .07 .07 .04 .01

END MON-PHOSUPT

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-phosupt>	KPLPM(*)	12F5.0	0.0	0.0	none	/day	Both

Explanation

This table is exactly analogous to Table-type MON-NITUPT.

This table is required if first-order plant uptake is being used and the plant uptake parameters vary throughout the year (PUPTFG = 0 and VPUTFG = 1 in Table-type PHOS-FLAGS). The entire table is supplied four times; first for the surface layer, second for the upper layer, third for the lower layer, and fourth for the active groundwater layer. If omitted, default values will be supplied. For example, if the third and fourth occurrences of the table are omitted, the parameters for the lower and groundwater layers will default to zero.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(1).12.9 Table-type PHOS-YIELD -- Yield-based phosphorus plant uptake parameters

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

PHOS-YIELD

<-range><-target-><-maxrat->

.

(repeats until all operations of this type are covered)

.

END PHOS-YIELD

Example

PHOS-YIELD

<PLS > PUPTGT PMXRAT ***

- # (LB/AC) ***

1 100.00 1.5

END PHOS-YIELD

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<-target->	PUPTGT	F10.0	0.0	0.0	none	lb/ac	Engl
			0.0	0.0	none	kg/ha	Metric
<-maxrat->	PMXRAT	F10.0	1.0	1.0	2.0	none	Both

Explanation

This table is exactly analogous to Table-type NIT-YIELD.

PUPTGT is the total annual target for plant uptake of phosphorus for all soil layers and all crops during the calendar year.

PMXRAT is the ratio of the maximum uptake rate to the optimum (target) rate when the crop is making up a deficit in phosphorus uptake.

This table is required only when yield-based plant uptake is being used (i.e., PUPTFG = 1 in Table-type PHOS-FLAGS).

4.4(1).12.10 Table-type MON-PUPT-FR1 -- Monthly fractions for yield-based plant uptake of phosphorus

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-PUPT-FR1
<-range><-----mon-puptfr----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-PUPT-FR1
```

```
*****
Example
*****
```

```
MON-PUPT-FR1
<PLS > Monthly fractions for plant uptake target      ***
# - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC  ***
1      .1   .1   .05  .05  .1   .1   .1   .05  .05  .1   .1   .1
2      .1   .1   .05  .05  .1   .1   .1   .05  .05  .1   .1   .1
END MON-PUPT-FR1
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-puptfr>	PUPTFM(*)	12F5.0	0.0	0.0	1.0	none	Both

Explanation

This table is exactly analogous to Table-type MON-NUPT-FR1.

These are the fractions of the total annual phosphorus plant uptake target (PUPTGT in Table-type PHOS-YIELD) applied to each month. The fractions across the year must sum to unity; otherwise, an error message is generated. This table is only required when yield-based plant uptake of phosphorus is being used (PUPTFG = 1 in Table-type PHOS-FLAGS).

4.4(1).12.11 Table-type MON-PUPT-FR2 -- Monthly fractions for yield-based plant uptake of phosphorus from a soil layer

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

MON-PUPT-FR2

<-range><-----mon-layfr----->

.
(repeats until all operations of this type are covered)

END MON-PUPT-FR2

Example

MON-PUPT-FR2

<PLS > Monthly fractions for plant uptake target from surface ***

#	-	#	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	***
2			.15	.15	.15	.1	.1	.1	.1	.1	.15	.12	.12	.1	

END MON-PUPT-FR2

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-layfr>	SPUPTM(*),UPUPTM(*), LPUPTM(*),APUPTM(*)	12F5.0	0.0	0.0	1.0	none	Both

Explanation

This table is exactly analogous to Table-type MON-NUPT-FR2. Refer to that table for details.

4.4(1).12.12 Table-type PHOS-STOR1 -- Initial phosphorus storage in the surface, upper, lower or groundwater layer

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

PHOS-STOR1

<-range><-----phos-stor1----->

.

(repeats until all operations of this type are covered)

.

END PHOS-STOR1

Example

PHOS-STOR1

<PLS >Initial phosphorus in upper layer (lb/ac) ***

- # ORGP P4AD P4SU PLTP ***

1 3 50. 2000. 200.

END PHOS-STOR1

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<phos-stor1>	ORGP,P4AD,	4F10.0	0.0	0.0	none	lb/ac	Engl
	P4SU,PLTP		0.0	0.0	none	kg/ha	Metric

Explanation

This table is analogous to Table-type NIT-STOR1. It specifies the initial storage of P in one of the four major soil layers. The values in the table are:

ORGP Organic phosphorus
P4AD Adsorbed phosphate
P4SU Solution phosphate
PLTP Phosphorus stored in plants

4.4(1).12.13 Table-type PHOS-STOR2 -- Initial storage of phosphate in upper layer transitory (interflow) storage

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

PHOS-STOR2

<-range><--phos-->

.

(repeats until all operations of this type are covered)

.

END PHOS-STOR2

Example

PHOS-STOR2

<PLS >Phosphate in interflow (kg/ha) ***

- # IP4SU ***

1 6 100.

END PHOS-STOR2

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<phos>	IP4SU	F10.0	0.0 0.0	0.0 0.0	none none	lb/ac kg/ha	Engl Metric

Explanation

This table is analogous to Table-type NIT-STOR2. It specifies the initial storage of solution phosphate in the upper layer transitory (interflow) storage.

4.4(1).13 PERLND BLOCK -- Section TRACER input

```
*****
      1      2      3      4      5      6      7      8
1234567890123456789012345678901234567890123456789 0123456789012345678901234567890
*****
Layout
*****
```

```
Table-type TRAC-ID
[Table-type TRAC-AD-FLAGS]
[Table-type TRAC-TOPSTOR]
[Table-type TRAC-SUBSTOR]
```

Explanation

The exact format of each of the tables mentioned above is detailed in the documentation which follows.

Note: if all the fields in a table have default values, the table can be omitted from the User's Control Input. Then, the defaults will be adopted.

4.4(1).13.1 Table-type TRAC-ID -- Name of conservative substance (tracer)

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
TRAC-ID
<-range><-----trac-id----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END TRAC-ID
```

```
*****
Example
*****
```

```
TRAC-ID
  <PLS >Name of tracer      ***
  # - #                      ***
  1  10 Chloride
END TRAC-ID
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<trac-id>	TRACID(*)	5A4	none	none	none

Explanation

Any 20 character string can be supplied as the name of the tracer substance.

4.4(1).13.2 Table-type TRAC-AD-FLAGS -- Atmospheric deposition flags for TRACER

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

TRAC-AD-FLAGS

<-range> <f><c> <f><c>

.

(repeats until all operations of this type are covered)

.

END TRAC-AD-FLAGS

Example

TRAC-AD-FLAGS

<PLS > Atmospheric deposition flags ***

*** SURF UPPR

#*** # <F><C> <F><C>

1 7 -1 10 -1 -1

END TRAC-AD-FLAGS

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
--------	--------------------	--------	-----	-----	-----

<f><c>	TRADFG(*)	(1X,2I3)	0	-1	none
--------	-----------	----------	---	----	------

Explanation

TRADFG is an array of flags indicating the source of atmospheric deposition data. The tracer substance can be deposited into either the surface or upper soil layers. Each layer has two flags. The first is for dry or total deposition flux, and the second is for wet deposition concentration. The flag values indicate:

- 0 No deposition of this type is simulated
- 1 Deposition of this type is input as time series TRADFX or TRADCN
- >0 Deposition of this type is input in the MONTH-DATA table with the corresponding table ID number. (Refer to Section 4.11 for details)

4.4(1).13.3 Table-type TRAC-TOPSTOR -- Initial quantity of tracer in topsoil storages

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

```
TRAC-TOPSTOR
<-range><-----trac-topstor----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END TRAC-TOPSTOR
```

Example

```
TRAC-TOPSTOR
  <PLS >Initial storage of chloride in topsoil (kg/ha)  ***
  # - #      STRSU      UTRSU      ITRSU      ***
  1              200.
END TRAC-TOPSTOR
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<trac-topstor>	STRSU,UTRSU,	3F10.0	0.0	0.0	none	lb/ac	Engl
	ITRSU		0.0	0.0	none	kg/ha	Metric

Explanation

This table specifies the initial storage of tracer (conservative) in the surface, upper principal, and upper transitory (interflow) storages.

4.4(1).13.4 Table-type TRAC-SUBSTOR -- Initial quantity of tracer in lower and active groundwater storages

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

TRAC-SUBSTOR

<-range><---trac-substor--->

.

(repeats until all operations of this type are covered)

.

END TRAC-SUBSTOR

Example

TRAC-SUBSTOR

<PLS >Initial storage of chloride in subsoil layers (lb/ac) ***

- # LTRSU ATRSU ***

1 300. 500.

END TRAC-SUBSTOR

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<trac-substor>	LTRSU,ATRSU	2F10.0	0.0	0.0	none	lb/ac	Engl
			0.0	0.0	none	kg/ha	Metric

Explanation

This table specifies the initial storage of conservative (tracer) material in the lower and active groundwater layers.

4.4(2) IMPLND Block

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
IMPLND
  General input
  [section ATEMP input]
  [section SNOW input]
  [section IWATER input]
  [section SOLIDS input]
  [section IWTGAS input]
  [section IQUAL input]
END IMPLND
```

Explanation

This block contains the data which are domestic to all the Impervious Land-segments in the RUN. The General input is always relevant: other input is only required if the module section concerned is active.

4.4(2).1 IMPLND BLOCK -- General input

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789 012345678901234567890
*****
Layout
*****
```

```
Table-type ACTIVITY
[Table-type PRINT-INFO]
Table-type GEN-INFO
```

Explanation

The exact format of each of the tables mentioned above is detailed in the documentation which follows.

Tables enclosed in brackets [] above are not always required; for example, because all the values can be defaulted.

4.4(2).1.1 Table-type ACTIVITY -- Active Sections Vector

```
*****
          1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
ACTIVITY
<-range><-----a-s-vector----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END ACTIVITY
```

```
*****
Example
*****
```

```
ACTIVITY
<ILS >           Active Sections ***
# - # ATMP SNOW IWAT  SLD  IWG IQAL ***
1   7   1   1   1
9     0   0   0   1
END ACTIVITY
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<a-s-vector>	AIRTFG, SNOWFG, IWATFG, SLDFG, IWGFG, IQALFG	6I5	0	0	1

Explanation

The IMPLND module is divided into 6 sections. The values supplied in this table specify which sections are active and which are not, for each operation involving the IMPLND module. A value of 0 means inactive and 1 means active. Any meaningful subset of sections may be active.

4.4(2).1.2 Table-type PRINT-INFO -- Printout information for IMPLND

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
PRINT-INFO
<-range><-----print-flags-----><piv><pyr>
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END PRINT-INFO
```

```
*****
Example
*****
```

```
PRINT-INFO
<ILS > ***** Print-flags ***** PIVL  PYR
# - # ATMP SNOW IWAT  SLD  IWG IQAL *****
1   7   2   4   6                10  12
END PRINT-INFO
```

```
*****
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<print-flags>	PFLAG(6)	6I5	4	2	6
<piv>	PIVL	I5	1	1	1440
<pyr>	PYREND	I5	9	1	12

Explanation

HSPF permits the user to vary the printout level (maximum frequency) for the various active sections of an operation. The meaning of each permissible value for PFLAG() is:

2 means every PIVL intervals
 3 means every day
 4 means every month
 5 means every year
 6 means never

In the example above, output from Impervious Land-segments 1 thru 7 will occur as follows:

Section	Maximum frequency
ATEMP	10 intervals
SNOW	month
IWATER	never
SOLIDS	--
thru	month (defaulted)
IQUAL	--

A value need only be supplied for PIVL if one or more sections have a printout level of 2. For those sections, printout will occur every PIVL intervals (that is, every $PDEL T = PIVL * DEL T$ minutes). PIVL must be chosen such that there are an integer number of PDEL T periods in a day.

HSPF will automatically provide printed output at all standard intervals greater than the specified minimum interval. In the above example, output for section ATEMP will be printed at the end of each 10 intervals, day, month and year.

PYREND is the calendar month which will terminate the year for printout purposes. Thus, the annual summary can reflect the situation over the past water year or the past calendar year, etc.

4.4(2).1.3 Table-type GEN-INFO -- Other general information for IMPLND

```
*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
GEN-INFO
<-range><---ILS-id----->      <unitsyst><-prntu->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END GEN-INFO
```

```
*****
Example
*****
```

```
GEN-INFO
  <ILS >      Name      UnitSysts  Printout  ***
  # - #      t-series  Engl Metr  ***
              in  out      ***

  1      Chicago loop
  2      Astrodome      1      23
END GEN-INFO
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<ILS-id>	LSID(5)	5A4	none	none	none
<unit-syst>	IUNITS,OUNITS	2I5	1	1	2
<prntu>	PUNIT(2)	2I5	0	0	99

Explanation

Any string of up to 20 characters may be supplied as the identifier for an IMPLND.

The values supplied for IUNITS and OUNITS indicate the system of units for input and output time series, respectively. 1 means English units, 2 means Metric units.

IMPLND -- General Input

Note: All operations in the run must use the same units system for data in the UCI file; therefore, this system of units is specified by EMFG in the GLOBAL block.

The values supplied for PUNIT(*) indicate the destinations (files) of printout in English and metric units, respectively. A value of 0 means no printout is required in that unit system. A non-zero value means printout is required in that system and is the unit number of the file to which printout is to be written. The unit number is associated with a filename in the FILES BLOCK.

Note that printout for each Impervious Land Segment can be obtained in either the English or Metric systems, or both (irrespective of the system used to supply the inputs).

4.4(2).2 IMPLND BLOCK -- SECTION ATEMP INPUT

Section ATEMP is common to the PERLND and IMPLND modules. See Section 4.4(1).2 for documentation.

4.4(2).3 IMPLND BLOCK -- SECTION SNOW INPUT

Section SNOW is common to the PERLND and IMPLND modules. See Section 4.4(1).3 for documentation.

4.4(2).4 IMPLND BLOCK -- Section IWATER input

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789 0123456789012345678901234567890
*****
```

Layout

[Table-type IWAT-PARM1]

Table-type IWAT-PARM2

[Table-type IWAT-PARM3]

[Table-type MON-RETN]

[Table-type MON-MANNING]

| only required if the relevant quantity
| varies through the year

[Table-type IWAT-STATE1]

Explanation

The exact format of each of the tables mentioned above is detailed in the documentation which follows.

Tables enclosed in brackets [] above are not always required; for example, because all the values can be defaulted.

4.4(2).4.1 Table-type IWAT-PARM1 -- First group of IWATER parameters (flags)

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

IWAT-PARM1

<-range><-----iwatparm1----->

.

(repeats until all operations of this type are covered)

.

END IWAT-PARM1

Example

IWAT-PARM1

<ILS > Flags ***

- # CSNO RTOP VRS VNN RTLI ***

1 7 1 1

END IWAT-PARM1

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<iwatparm1>	CSNOFG,RTOPFG, VRSFG,VNNFG, RTLIFG	5I5	0	0	1

Explanation

If CSNOFG is 1, section IWATER assumes that snow accumulation and melt is being considered. It will, therefore, expect that the time series produced by section SNOW are available, either internally (produced in this RUN) or from external sources (produced in a previous RUN). If CSNOFG is 0, no such time series are expected. See the functional description for further information.

RTOPFG is a flag that selects the algorithm for computing overland flow. Two optional methods are provided. If RTOPFG is 1, routing of overland flow is done in the same way as in the NPS Model. A value of 0 results in a different algorithm. (See the functional description for details).

The flags beginning with "V" indicate whether or not certain parameters will be assumed to vary through the year: 1 means they do vary, 0 means they do not. The quantities concerned are:

VRSFG	retention storage capacity
VNNFG	Manning's n for the overland flow plane

If either of these flags are on, monthly values for the parameter concerned must be supplied (see Table-types MON-RETN and MON-MANNING).

If RTLIFG is 1, any lateral surface inflow to the ILS will be subject to retention storage; if it is 0, lateral inflow is not subject to retention storage.

4.4(2).4.2 Table-type IWAT-PARM2 -- Second group of IWATER parameters

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
IWAT-PARM2
<-range><-----iwatparm2----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END IWAT-PARM2
```

```
*****
Example
*****
```

```
IWAT-PARM2
<ILS >          ***
# - #           LSUR      SLSUR      NSUR      RETSC      ***
1   7           400.      .001
END IWAT-PARM2
```

```
*****
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<iwatparm2>	LSUR	F10.0	none	1.0	none	ft	Engl
			none	0.3	none	m	Metric
	SLSUR	F10.0	none	.000001	10.	none	Both
	NSUR	F10.0	0.1	0.001	1.0		Both
	RETSC	F10.0	0.0	0.0	10.0	in	Engl
			0.0	0.0	250.	mm	Metric

Explanation

LSUR is the length of the assumed overland flow plane, and SLSUR is the slope.

NSUR is Manning's n for the overland flow plane.

RETSC is the retention (interception) storage capacity of the surface.

4.4(2).4.3 Table-type IWAT-PARM3 -- Third group of IWATER parameters

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

IWAT-PARM3

<-range><----iwatparm3----->

.

(repeats until all operations of this type are covered)

.

END IWAT-PARM3

Example

IWAT-PARM3

<ILS >***

- #*** PETMAX PETMIN

1 7

9 39 33

END IWAT-PARM3

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<iwatparm3>	PETMAX	F10.0	40.	none	none	degF	Engl
			4.4	none	none	degC	Metric
	PETMIN	F10.0	35.	none	none	degF	Engl
			1.7	none	none	degC	Metric

Explanation

PETMAX is the air temperature below which E-T will arbitrarily be reduced below the value obtained from the input time series.

PETMIN is the temperature below which E-T will be zero regardless of the value in the input time series. These values are only used if snow is being considered (i.e., CSNOFG= 1 in Table-type IWAT-PARM1).

4.4(2).4.4 Table-type MON-RETN -- Monthly retention storage capacity

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-RETN
<-range><-----mon-retn----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-RETN
```

```
*****
Example
*****
```

```
MON-RETN
<ILS > Retention storage capacity at start of each month      ***
# - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC***
1   7   .02  .03  .03  .04  .05  .08  .12  .15  .12  .05  .03  .01
END MON-RETN
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-retn>	RETSCM(12)	12F5.0	0.0 0.0	0.0 0.0	10. 250.	in mm	Engl Metric

Explanation

This table is only required if VRSFG = 1 in Table-type IWAT-PARML.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(2).4.5 Table-type MON-MANNING -- Monthly Manning's n values

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

MON-MANNING

<-range><-----mon-Manning----->

.

(repeats until all operations of this type are covered)

.

END MON-MANNING

Example

MON-MANNING

<ILS > Manning's n at start of each month

# - #	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1 7	.23	.34	.34	.35	.28	.35	.37	.35	.28	.29	.30	.30

END MON-MANNING

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-Manning>	NSURM(12)	12F5.0	0.1	.001	1.0	complex	Both

Explanation

This table is only required if VNNFG = 1 in Table-type IWAT-PARM1.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(2).4.6 Table-type IWAT-STATE1 -- IWATER initial state variables

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

IWAT-STATE1

<-range><----iwat-statel--->

.

(repeats until all operations of this type are covered)

.

END IWAT-STATE1

Example

IWAT-STATE1

<ILS > IWATER state variables***

- #*** RETS SURS

1 7 0.05 0.10

END IWAT-STATE1

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<iwat-statel>	RETS	2F10.0	.001	.001	100	inches	Engl
			.025	.025	2500	mm	Metric
	SURS		.001	.001	100	inches	Engl
			.025	.025	2500	mm	Metric

Explanation

This table is used to specify the initial water storages.

RETS is the initial retention storage.

SURS is the initial surface (overland flow) storage.

4.4(2).5 IMPLND BLOCK -- Section SOLIDS input

```
*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

[Table-type SLD-PARM1]

Table-type SLD-PARM2

[Table-type MON-SACCUM]

[Table-type MON-REMOV]

[Table-type SLD-STOR]

Explanation

The exact format of each of the tables mentioned above is detailed in the documentation which follows.

Tables enclosed in brackets [] above are not always required; for example, because all the values can be defaulted.

4.4(2).5.1 Table-type SLD-PARM1 -- First group of SOLIDS parameters

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

SLD-PARM1

<-range><--sld-parm1-->

.

(repeats until all operations of this type are covered)

.

END SLD-PARM1

Example

SLD-PARM1

<ILS > ***

- # VASD VRSD SDOP***

1 7 0 1 0

END SLD-PARM1

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<sld-parm1>	VASDFG	3I5	0	0	1
	VRSDFG		0	0	1
	SDOPFG		0	0	1

Explanation

If VASDFG is 1, the accumulation rate of solids is allowed to vary throughout the year and Table-type MON-SACCUM is expected. If the flag is zero, the accumulation rate is constant, and is specified in Table-type SLD-PARM2. The corresponding flag for the unit removal rate is VRSDFG.

SDOPFG is a flag that determines the algorithm used to simulate removal of sediment from the land surface. If SDOPFG is 1, sediment removal will be simulated with the algorithm used in the NPS model. If it is 0, a different algorithm will be used. (See the functional description for details).

4.4(2).5.2 Table-type SLD-PARM2 -- Second group of SOLIDS parameters

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

SLD-PARM2

<-range><-----sld-parm2----->

.

(repeats until all operations of this type are covered)

.

END SLD-PARM2

Example

SLD-PARM2

<ILS >***

#	-	#	KEIM	JEIM	ACCSDP	REMSDP***
1		7	0.08	1.90	0.01	0.5

END SLD-PARM2

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<sld-parm2>	KEIM	4F10.0	0.0	0.0	none	complex	Both
	JEIM		none	none	none	complex	Both
	ACCSDP		0.0	0.0	none	tons/ac/day	Engl
			0.0	0.0	none	tonnes/ha/day	Metric
	REMSDP		0.0	0.0	1.0	/day	Both

Explanation

KEIM is the coefficient in the solids washoff equation.

JEIM is the exponent in the solids washoff equation.

ACCSDP is the rate at which solids accumulate on the land surface.

REMSDP is the fraction of solids storage which is removed each day when there is no runoff, for example, because of street sweeping.

If monthly values for the accumulation and unit removal rates are being supplied, values supplied for these variables in this table are not used by the program.

4.4(2).5.3 Table-type MON-SACCUM -- Monthly solids accumulation rates

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-SACCUM
```

```
<-range><-----mon-accum----->
```

```
. . . . .
```

```
(repeats until all operations of this type are covered)
```

```
. . . . .
```

```
END MON-SACCUM
```

```
*****
```

```
Example
```

```
*****
```

```
MON-SACCUM
```

```
<ILS > Monthly values for solids accumulation (tonnes/ha.day) ***
```

```
# - # JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC***
1   7 0.0 .12 .12 .24 .24 .56 .67 .56 .34 .34 .23 .12
```

```
END MON-SACCUM
```

```
*****
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-accum>	ACCSDM(12)	12F5.0	0.0	0.0	none	tons/ac/day	Engl
			0.0	0.0	none	tonnes/ha/day	Metr

Explanation

This table is only required if VASDFG = 1 in Table-type SLD-PARM1.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(2).5.4 Table-type MON-REMOV -- Monthly solids unit removal rates

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-REMOV
<-range><-----mon-remov----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-REMOV
```

```
*****
Example
*****
```

```
MON-REMOV
  <ILS > Monthly solids unit removal rate          ***
  # - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC***
  1   7   .05  .05  .07  .15  .15  .20  .20  .20  .20  .10  .05  .05
END MON-REMOV
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-remov>	REMSDM(12)	12F5.0	0.0	0.0	1.0	/day	Both

Explanation

This table is only required if VRSDFG = 1 in Table-type SLD-PARM1.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(2).5.5 Table-type SLD-STOR -- Initial solids storage

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
SLD-STOR
<-range><sld-stor>
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END SLD-STOR
```

```
*****
Example
*****
```

```
SLD-STOR
<ILS > Solids storage (tons/acre) ***
# - #          ***
1   7          0.2
END SLD-STOR
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<sld-stor>	SLDS	F10.0	0.0 0.0	0.0 0.0	none none	tons/ac tonnes/ha	Engl Metric

Explanation

SLDS is the initial storage of solids on the impervious surface.

4.4(2).6 IMPLND BLOCK -- Section IWTGAS input

```
*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
[Table-type IWT-PARM1]
[Table-type IWT-PARM2]           Tables in brackets [] are not
[Table-type MON-AWTF]           always required
[Table-type MON-BWTF]
[Table-type IWT-INIT]
```

Explanation

The exact format of each of the tables mentioned above is detailed in the documentation which follows.

4.4(2).6.1 Table-type IWT-PARM1 -- Flags for section IWTGAS

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

IWT-PARM1

<-range><iwtparm1>

.

(repeats until all operations of this type are covered)

.

END IWT-PARM1

Example

IWT-PARM1

<ILS > Flags for section IWTGAS***

- # WTFV CSNO ***

1 7 0 0

END IWT-PARM1

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<iwtparm1>	WTFVFG	2I5	0	0	1
	CSNOFG		0	0	1

Explanation

WTFVFG indicates whether or not the water temperature regression parameters (AWTF and BWTF) are allowed to vary throughout the year, and thus, whether or not Table-types MON-AWTF and MON-BWTF are expected.

If CSNOFG=1, the effects of snow accumulation and melt are being considered; if it is zero, they are not. If section IWATER is active, the value of CSNOFG supplied here is ignored because it was first supplied in the input for that section (Table-type IWAT-PARM1).

4.4(2).6.2 Table-type IWT-PARM2 -- Second group of IWTGAS parameters

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
IWT-PARM2
<-range><-----iwt-parm2----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END IWT-PARM2
```

```
*****
Example
*****
```

```
IWT-PARM2
  <ILS > Second group of IWTGAS parms***
    # - #      ELEV      AWTF      BWTF***
    1   7      1281.      40.0      0.8
END IWT-PARM2
```

```
*****
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<iwt-parm2>	ELEV	3F10.0	0.0	-1000.	30000.	ft	Engl
			0.0	-300.	9100.	m	Metric
	AWTF		32.	0.0	100.	DegF	Engl
			0.0	-18.	38.	DegC	Metr
	BWTF		1.0	0.001	2.0	DegF/F	Engl
			1.0	0.001	2.0	DegC/C	Metr

Explanation

ELEV is the elevation of the ILS above sea level; it is used to adjust saturation concentrations of dissolved gases in surface outflow.

AWTF is the surface water temperature when the air temperature is 32 deg F (0 deg C). It is the intercept of the surface water temperature regression equation.

BWTF is the slope of the surface water temperature regression equation.

4.4(2).6.3 Table-type MON-AWTF -- Monthly values for AWTF

```
*****
      1         2         3         4         5         6         7         8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-AWTF
<-range><-----mon-awtf----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-AWTF
```

```
*****
Example
*****
```

```
MON-AWTF
<ILS > Value of AWTF at start of each month (deg F)          ***
# - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC***
1   7  37.  38.  39.  40.  41.  42.  43.  44.  45.  44.  41.  40.
END MON-AWTF
```

```
*****
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-awtf>	AWTFM(12)	12F5.0	32. 0.	0. -18.	100. 38.	deg F deg C	Engl Metric

Explanation

This table is only required if WTFVFG = 1 in Table-type IWT-PARM1.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(2).6.4 Table-type MON-BWTF -- Monthly values for BWTF

```
*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
MON-BWTF
<-range><-----mon-bwtf----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END MON-BWTF
```

```
*****
Example
*****
```

```
MON-BWTF
<ILS > Value of BWTF at start of each month (deg F/F)      ***
# - #  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC***
1   7   .3   .3   .3   .4   .4   .5   .5   .5   .4   .4   .4   .3
END MON-BWTF
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<mon-bwtf>	BWTFM(12)	12F5.0	1.0 1.0	0.001 0.001	2.0 2.0	deg F/F deg C/C	Engl Metric

Explanation

This table is only required if WTFVFG = 1 in Table-type IWT-PARM1.

Note: The input monthly values apply to the first day of the month, and values for intermediate days are obtained by interpolating between successive monthly values.

4.4(2).6.5 Table-type IWT-INIT -- Initial conditions for section IWTGAS

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
IWT-INIT
<-range><-----iwt-init----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END IWT-INIT
```

```
*****
Example
*****
```

```
IWT-INIT
  <ILS >      SOTMP      SODOX      SOCO2***
  # - #        DegC      mg/l      mg C/l***
  1   7        16.
END IWT-INIT
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<iwt-init>	SOTMP	3F10.0	60.0	32.	100.	Deg F	Engl
			16.0	.01	38.0	Deg C	Metric
	SODOX		0.0	0.0	20.0	mg/l	Both
	SOCO2		0.0	0.0	1.0	mg C/l	Both

Explanation

These are the initial values for the temperature, dissolved oxygen concentration, and CO2 concentration of the surface runoff. The values given in this table do not affect anything in the simulation beyond the start of the first interval of the run. Therefore, in most simulations, this table can be omitted.

4.4(2).7 IMPLND BLOCK -- Section IQUAL input

```
*****
      1      2      3      4      5      6      7      8
123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
[Table-type NQUALS]
[Table-type IQL-AD-FLAGS]

      Table-type QUAL-PROPS      |
[Table-type QUAL-INPUT]         |
[Table-type MON-POTFW]          | repeat this group of tables for each
[Table-type MON-ACCUM]          | quality constituent
[Table-type MON-SQOLIM]         |
      ---
```

```
*****
```

Explanation

The exact format of each of the tables mentioned above is detailed in the documentation which follows or in the documentation for the PERLND module.

Tables enclosed in brackets [] are not always required; for example, because all the values can be defaulted.

4.4(2).7.1 Table-type NQUALS -- Total number of quality constituents simulated

This table is identical to the corresponding table for the PERLND module. See Section 4.4(1).8.1 (Module Section PQUAL) for documentation.

4.4(2).7.2 Table-type IQL-AD-FLAGS -- Atmospheric deposition flags for IQUAL

```
*****
      1         2         3         4         5         6         7         8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
Layout
*****
```

```
IQL-AD-FLAGS
<-range> <f><c> <f><c> <f><c> <f><c> <f><c> <f><c> <f><c> <f><c> <f><c> <f><c>
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END IQL-AD-FLAGS
```

```
*****
Example
*****
```

```
IQL-AD-FLAGS
<ILS >                      Atmospheric deposition flags ***
***      QUAL1  QUAL2  QUAL3  QUAL4  QUAL5  QUAL6  QUAL7  QUAL8  QUAL9  QAL10
#*** # <F><C> <F><C> <F><C> <F><C> <F><C> <F><C> <F><C> <F><C> <F><C> <F><C>
1      7  -1 10  -1 -1  11 12  13 -1   0  0   0 11   0 -1   0  0           -1  0
END IQL-AD-FLAGS
```

```
*****
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<f><c>	IQADFG(*)	(1X,2I3)	0	-1	none

Explanation

IQADFG is an array of flags indicating the source of atmospheric deposition data for QUALs. Each QUAL has two flags. The first is for dry or total deposition flux, and the second is for wet deposition concentration. The flag values indicate:

- 0 No deposition of this type is simulated
- 1 Deposition of this type is input as time series IQADFX or IQADCN
- >0 Deposition of this type is input in the MONTH-DATA table with the corresponding table ID number. (Refer to Section 4.11 for details)

Note: atmospheric deposition can only be specified for QUALOF's; it is an error to specify a non-zero flag value for a non-QUALOF.

4.4(2).7.3 Table-type QUAL-PROPS -- Identifiers and flags for a quality constituent

```
*****
      1          2          3          4          5          6          7          8
1234567890123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

```
QUAL-PROPS
<-range><-qualid--->      <qt><-----flags----->
. . . . .
(repeats until all operations of this type are covered)
. . . . .
END QUAL-PROPS
```

Example

```
QUAL-PROPS
  <ILS >   Identifiers and Flags          ***
  # - #    QUALID      QTID  QSD VPFW  QSO  VQO***
  1   7      B0D        kg    0    0    1    1
END QUAL-PROPS
```

Details

Symbol	Fortran name(s)	Format	Def	Min	Max
<qualid>	QUALID	3A4	none	none	none
<qt>	QTYID	A4	none	none	none
<flags>	QSDFG	4I5	0	0	1
	VPFWFG		0	0	1
	QSOFG		0	0	1
	VQOFG		0	0	1

Explanation

QUALID is a string of up to 10 characters which identifies the quality constituent.

QTYID is a string of up to 4 characters which identifies the units associated with this constituent (e.g., kg, # (for coliforms)). These are the units referred to as "qty" in subsequent tables (e.g., Table-type QUAL-INPUT).

If QSDFG is 1 then:

1. This constituent is a QUALSD (sediment associated).
2. If VPFWFG is 1, the washoff potency factor may vary throughout the year. Table-type MON-POTFW is expected.

If QSOFG is 1 then:

1. This constituent is a QUALOF (directly associated with overland flow).
2. If VQOFG is 1, the rate of accumulation and the limiting storage of QUALOF may vary throughout the year. Table-types MON-ACCUM and MON-SQOLIM are expected.

4.4(2).7.4 Table-type QUAL-INPUT -- Surface storage of qual and nonseasonal parameters

```
*****
1          2          3          4          5          6          7          8
123456789012345678901234567890123456789012345678901234567890
*****
```

Layout

QUAL-INPUT

<-range><-----qual-input----->

.

(repeats until all operations of this type are covered)

.

END QUAL-INPUT

Example

QUAL-INPUT

<ILS > Storage on surface and nonseasonal parameters***

#	-	#	SQO	POTFW	ACQOP	SQOLIM	WSQOP	***
1		7	1.21	.172	0.02	2.0	1.70	

END QUAL-INPUT

Details

Symbol	Fortran name(s)	Format	Def	Min	Max	Units	Unit system
<qual-input>	SQO	5F8.0	0.0	0.0	none	qty/ac	Engl
			0.0	0.0	none	qty/ha	Metric
	POTFW		0.0	0.0	none	qty/ton	Engl
			0.0	0.0	none	qty/tonne	Metric
	ACQOP		0.0	0.0	none	qty/ac/day	Engl
			0.0	0.0	none	qty/ha/day	Metric
	SQOLIM		0.000001	0.000001	none	qty/ac	Engl
			0.000002	0.000002	none	qty/ha	Metric
	WSQOP		1.64	0.01	none	in/hr	Engl
			41.7	0.25	none	mm/hr	Metric

Explanation

The following variable is relevant only if the constituent is a QUALSD:

1. POTFW, the washoff potency factor.

POTFW (washoff potency factor) is the ratio of constituent yield to sediment outflow.

The following variables are applicable only if the constituent is a QUALOF:

1. SQO, the initial storage of QUALOF on the surface of the ILS.
2. ACQOP, the rate of accumulation of QUALOF on the surface.
3. SQOLIM, the maximum storage of QUALOF on the surface.
4. WSQOP, the rate of surface runoff that will remove 90 percent of stored QUALOF per hour.

If monthly values are being supplied for any of these quantities, the value in this table is not relevant; instead, the system expects and uses values supplied in the corresponding monthly table (Table-types MON-POTFW, MON-ACCUM, MON-SQOLIM).

4.4(2).7.5 Table-type MON-POTFW -- Monthly washoff potency factor

This table is identical to the corresponding table in the PERLND module. See Section 4.4(1).8 for documentation.

4.4(2).7.6 Table-type MON-ACCUM -- Monthly accumulation rates of QUALOF

This table is identical to the corresponding table in the PERLND module. See Section 4.4(1).8 for documentation.

4.4(2).7.7 Table-type MON-SQOLIM -- Monthly limiting storage of QUALOF

This table is identical to the corresponding table in the PERLND module. See Section 4.4(1).8 for documentation.